Annex 27

IMPLEMENTING THE WEB BASED SDSS SOFTWARE AND HARDWARE SYSTEM

The WS-DSS_rel1

SUMMARY

1 OVERALL DESCRIPTION

The main objective of this group of actions is to build a new Web-based Spatial Decision Supporting System (WS-DSS). The WS-DSS is a system designed to aid the decision-making process for semi-structured problems that have spatial components and that can be queried through the web. Such systems have been applied to only few environmental land surface applications in the world (e.g. Miller et al., 2007; De and Bezuglov, 2006, Rao et al. 2007).

The WS-DSS will provide data sharing, visualization of geospatial information and spatial decision support services for environmental planning and management.

Agricultural managers, policy makers and local authorities heavily depend on geospatial data, However, even today, spatial data and geographic information are under-utilized by *local* administrations as a central resource for improving economic productivity, decision-making, and delivery of services and improving farming activities.

The specific aim of the WS-DSS is to support decision makers in implementing some EU regulations and directives. The DSS contains the expert knowledge and necessary rules for selecting feasible measures to reach the application of the directives. Furthermore it comprises rules that predict the impacts after implementing the measures. The DSS is not developed to deliver detailed planning of measures. It rather supports the decision maker in finding the right measure and to identify implementation priorities based on the current situation. It helps to get an overview about the required measures in a selected area. In particular it will focus on: Environment (action 5.1) and Agriculture (action 5.2).

An existing system cannot support the foreseen level of complexity and the integration of existing models. Moreover, as explained before, there are only few prototype systems that have been designed to address very specific issues. They are lacking of the required project flexibility including the implementation of the following issues: (i) monitoring environmental data (assimilation); (ii) the bottom-up contribution from stakeholders and (iii) the integration of environmental simulation modelling within a S-DSS which enables the evaluation of alternate management scenarios. So far, (iv) there are very limited experience of the combination of S-DSS on a web based GIS (Rao et al. 2007).

The main functions of the WS DSS are:

- To display empirical data collected in regions of interest, giving stakeholders shared knowledge of the situation;
- To provide science-based models, demonstrating projected consequences of various actions;

- To allow stakeholders to see tradeoffs and set priorities;
- To automatically search for management strategies that improve the implementing of EU directive and regulation.

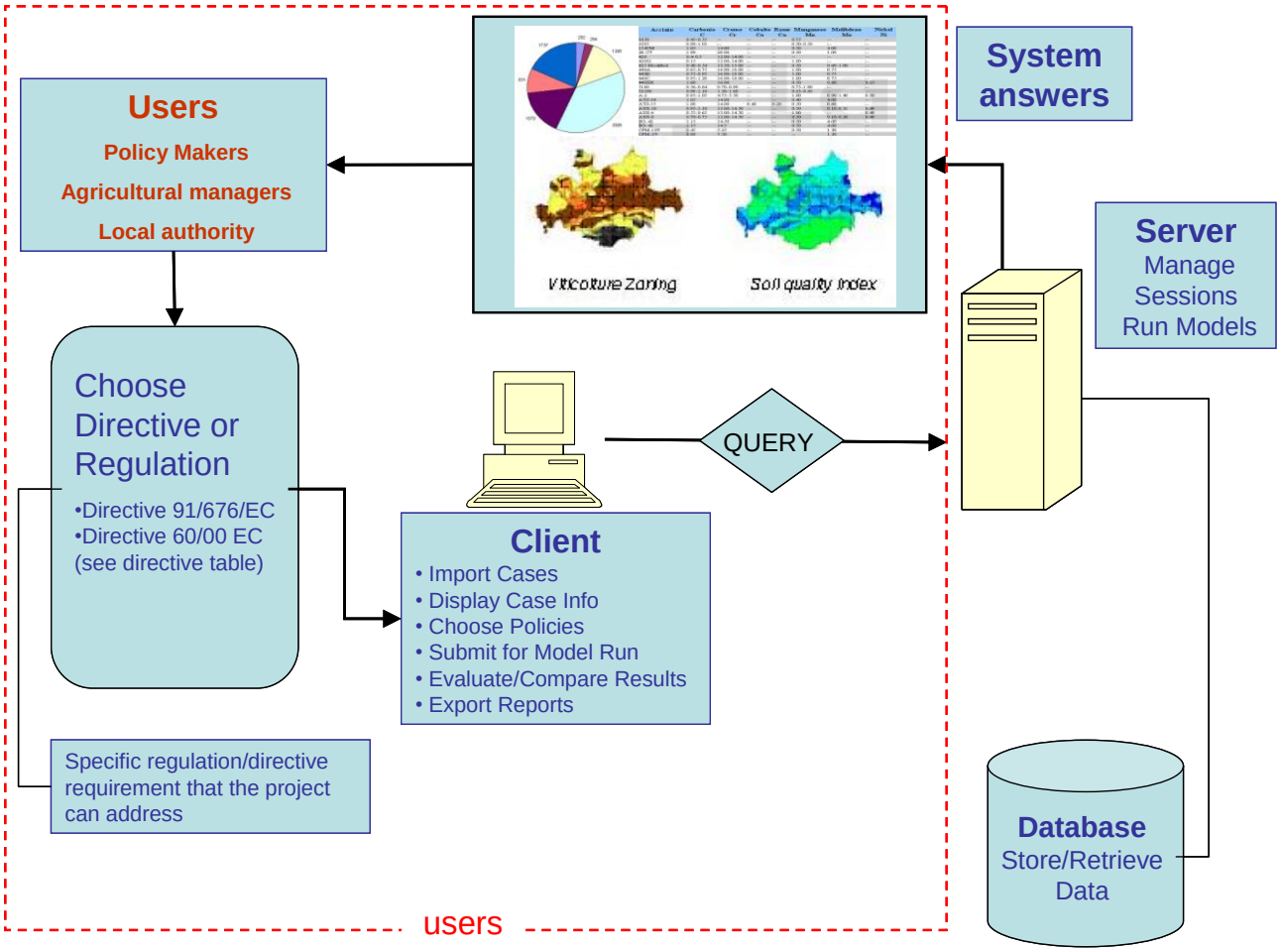


figure 1.1 – How the systems work

2 INCEPTION AND OBJECTIVES

Spatial decision support systems comprise a range of technical components, such as models and data, coupled with complex interfaces and processes. An understanding of these issues is essential for the development of successful systems, but often requisites are ambiguous or tools fail to meet reasonable expectations of reusability. By collating existing knowledge on spatial decision support the SDSS aims to provide the community with a means of locating information about resources.

Traditional approaches to web-based data management and search could not guarantee high quality results nor control the relationships between data.

In brief the main characteristics of a spatial decision problems are:

- a large number of decision alternatives,
- the outcomes or consequences of the decision alternatives are spatially variable,
- each alternative is evaluated on the basis of multiple criteria,
- some of the criteria may be qualitative while others may be quantitative,
- there is typically more than one decision maker (or interest group) involved in the decision-making process,
- the decision makers have different preferences with respect to the relative importance of evaluation criteria and decision consequences,
- the decisions are often surrounded by uncertainty.

Simon (1960) suggests that any decision-making process can be structured into three major phases:

- intelligence - is there a problem or an opportunity for change?
- design - what are the decision alternatives?
- choice - which alternative is best?

GISystems can provide support required in each of the three phases of decision-making.

Intelligence	**the intelligence phase involves searching or scanning the environment for conditions calling for decisions;**
	this phase requires an exploratory analysis of the decision situation;
	GIS can play a vital role at the initial stage of spatial decision-making;
	the system can help in coordinating decision situation analysis through its ability to integrate and explore data and information from a wide range of sources;
	GIS can effectively present information in a comprehensive form to the decision makers.
Design	the design phase involves inventing, developing, and analyzing a set of possible decision alternatives for the problem identified in the intelligence phase;
	a formal model is typically used to support a decision maker in generating the set of alternatives;
	while an increasing number of GISystems are described as systems for supporting the process of designing and evaluating spatial decision alternatives, most commercially available GIS lack the kinds of spatial analysis and modeling required by decision makers;
	the capabilities of GIS for generating a set of alternative decisions are mainly based on the spatial relationship principles of connectivity, contiguity, proximity and the overlay methods;
	in current GIS environments, models for generating decision alternatives operate in the background, detached from users insights and qualifications.
Choice	the choice phase involves selecting a particular decision alternative from those available;
	each alternative is evaluated and analyzed in relation to others in terms of a prespecified decision rule;
	the decision rules are used to rank the alternatives under consideration;
	the ranking depends upon the decision maker's preferences with respect to the importance of the evaluation criteria;
	critical for use of GIS in the choice phase is the capability of incorporating the decision maker's preferences into the decision-making process;
	in general, GISystems do not provide a mechanism for flexible incorporation of the decision maker's preferences into the decision-making process.

The methodological approach to build a robustness WS-DSS may be divided into the following steps. The first step consists in gathering multi-thematic data representing principal constraints identified by the project actors. These data may be derived from existing spatial database (analogical and numeric) or may be produced specifically for the study. For example, remote sensing data, field surveying and GPS technologies constitute multi-source data acquisition. Studies, statistics and expertise reports describing

the management problem represent knowledge and information that are generally combined with spatial data in order to elaborate spatialized evaluation models that will help the analyst in the formulation and the resolution of the problem.

3 SDSS COMPONENTS AND CONSTRUCTION

The first phase consisted in identifying the appropriate hardware architecture and free open source technologies for the management and processing of spatial information. It was, therefore, defined a Open Source" technology stack " for the management and publication of geographic and environmental according to the OGC and INSPIRE Directive.

3.1 SYSTEM ARCHITECTURE

The logical architecture of the Web Based Spatial DSS is a 3-tier architecture. It is a client–server architecture in which the presentation, the application processing, and the data management are logically separate processes. This architecture has 3 essential components:

1. Presentation tier, is the topmost level of the application; it displays the information related to the services; it communicates with other tiers by outputting results to the browser/client tier and to all other tiers in the network.
2. Business logic tier (application Server), the logic tier is pulled out from the presentation tier and, as its own layer, it controls an application's functionality by performing detailed processing.
3. Data tier, it consists of database servers; here information is stored and retrieved; this tier keeps data neutral and independent from application servers or business logic. Giving data its own tier also improves scalability and performance.

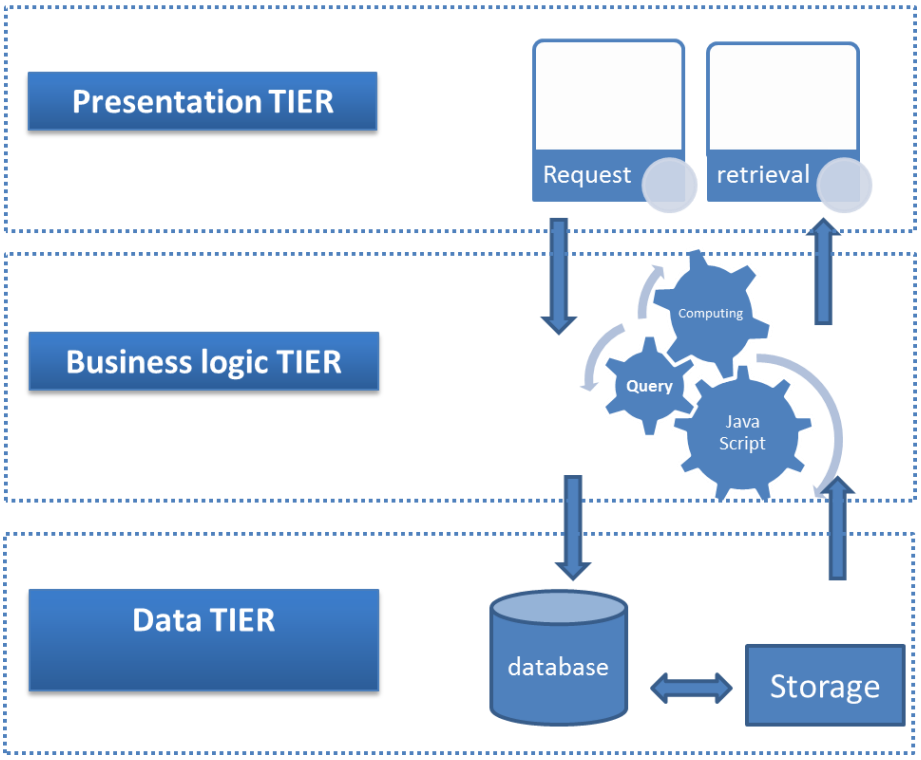


figure 3.1 – System Architecture

The main advantages, disadvantages and related performances of 3-Tier solution are shown in table below.

Advantages	Disadvantages
Development Issues: • Complex application rules easy to implement in application server • Business logic off-loaded from database server and client, which improves performance • Changes to business logic automatically enforced by server – changes require only new application server software to be installed • Application server logic is portable to other database server platforms by virtue of the application software	Development Issues: • More complex structure • More difficult to setup and maintain
Performance: • Superior performance for medium to high volume environments	Performance: • The physical separation of application servers (containing business logic functions) and database servers (containing databases) may moderately affect performance.

3.2 TECHNICAL IMPLEMENTATION

3.2.1 WEB CLIENT

Technologies used for the development of the web client in the WEB based Spatial Decision support Systems is based on AJAX (Asynchronous JavaScript and XML). AJAX is a new paradigm for developing Web applications, and is ultimately made of a set of existing software technologies. The difference between classic Web applications and AJAX Web applications is all in the way they interact with the server. A classic Web application submits forms to receive pages; an AJAX application submits data to receive data.

In short, AJAX delivers effective results in terms of user experience and opens up a whole world of opportunities for creative developers and architects. It pushes a new approach to building Web applications with a new programming paradigm and a new set of tools; and you have to start designing applications accordingly.

With AJAX Technologies, the web browser is not a *thin client* but it becomes in a *"thick client",* because a fraction of the business logic is into the web browser in JavaScript applet. JavaScript applet provides logic functionality to the client. is the most popular language for Ajax programming due to its inclusion in and compatibility with the majority of modern web browsers.

The main javascript frameworks used to displaying and inquiry the geodata is OpenLayers and jQuery.

OPENLAYERS is an open source (provided under a modified BSD license) JavaScript library for displaying map data in web browsers. It provides an API for building rich web-based geographic applications similar to Google Maps and Bing Maps. The library includes components from the Rico JavaScript library and the Prototype JavaScript Framework.

JQUERY is a fast and concise JavaScript Library that simplifies HTML document traversing, event handling, animating, and Ajax interactions for rapid web development. jQuery is designed to change the way that software engeeniers write JavaScripts.

On the web client is implemented the presentation tier and a fraction of the business logic tier developed in the javascript code.

In short, the following technologies are implemented on the client-side:

- HTML
- Javascript: scripting web application

- KML: is an XML notation for expressing geographic annotation and visualization within Internet-based
- OpenLayer: JavaScript Library for manipulating geographical objects;
- JQuery: JavaScript Library
- Interaction Client/Server Side: AJAX: Asynchronous JavaScript And XML

3.2.2 SERVER SIDE

On the server Side the followed technologies are implemented:

PHP

It is a general-purpose server-side scripting language originally designed for Web development to produce dynamic Web pages. It is one of the first developed server-side scripting languages to be embedded into an HTML source document, rather than calling an external file to process data

APACHE HTTP SERVER, commonly referred to as Apache, is web server software notable for playing a key role in the initial growth of the World Wide Web. In 2009 it became the first web server software to surpass the 100 million website milestone. Typically Apache is run on a Unix-like operating system.

POSTGRESQL

PostgreSQL is a powerful, open source object-relational database system. An enterprise class database, PostgreSQL boasts sophisticated features such as Multi-Version Concurrency Control (MVCC), point in time recovery, tablespaces, asynchronous replication, nested transactions (savepoints), online/hot backups, a sophisticated query planner/optimizer, and write ahead logging for fault tolerance. It supports international character sets, multibyte character encodings, Unicode, and it is locale-aware for sorting, case-sensitivity, and formatting. It is highly scalable both in the sheer quantity of data it can manage and in the number of concurrent users it can accommodate. There are active PostgreSQL systems in production environments that manage in excess of 4 terabytes of data.

POSTGIS

PostGIS adds support for geographic objects to the PostgreSQL object-relational database. In effect, PostGIS "spatially enables" the PostgreSQL server, allowing it to be used as a backend spatial database for geographic information systems (GIS), much like ESRI's SDE or Oracle's Spatial extension. PostGIS follows the OpenGIS "Simple Features Specification for SQL" and has been certified as compliant with the "Types and Functions" profile.

GEOSERVER

GeoServer is an open source software server written in Java that allows users to share and edit geospatial data. Designed for interoperability, it publishes data from any major spatial data source using open standards.

FPDF

FPDF is a PHP class which allows to generate PDF files with pure PHP.

C++ PROGRAMS

The decision to use Apache + PHP + Server RDBMS PosgreSQL allows complete portability of the system on both Linux / UNIX and Microsoft machine.

The development of the system has required the implementation of new functionalities to meet project and users demands.

Based on the current state of art of the vector data elaboration, Postgis conducts the main vector analysis. Postgis shows also new interesting characteristic for data extraction from one or more vectors layers (such as intersections and overlaps) and massive processing of statistic raster data.

A very new approach has been used to process raster data combining original C++ code and postgis functionality. Accessing to raster data (reading and writing) is carried out by GDAL library which abstracts the access data in various formats, while accessing vector data has been carried out by the pqxx (it is C + + library for accessing PostgreSQL databases) and Postgis for potential manipulation of vector data.

A notable example is a massive and very fast ZonalAttribute operation on raster data (mean statistical values extraction / variance / minimum / maximum /-pixel count).

This allows the analysis of large number of a raster files with polygon shape file masking (both optional), where the determination of pixels position (inside or outside the polygon) is made by postgis. Using postgis with a single query the system decides what are the segments (and thus the pixels) of a raster line belonging to a polygon. The ZonalAttribute is a recurrent algorithm when you want to extract statistical data from a raster.

Part of the supervision of the algorithms implemented on the vector and raster formats are, instead, delegated to PHP WEB server (data preparation, activation of the tools, analysis and presentation of results).

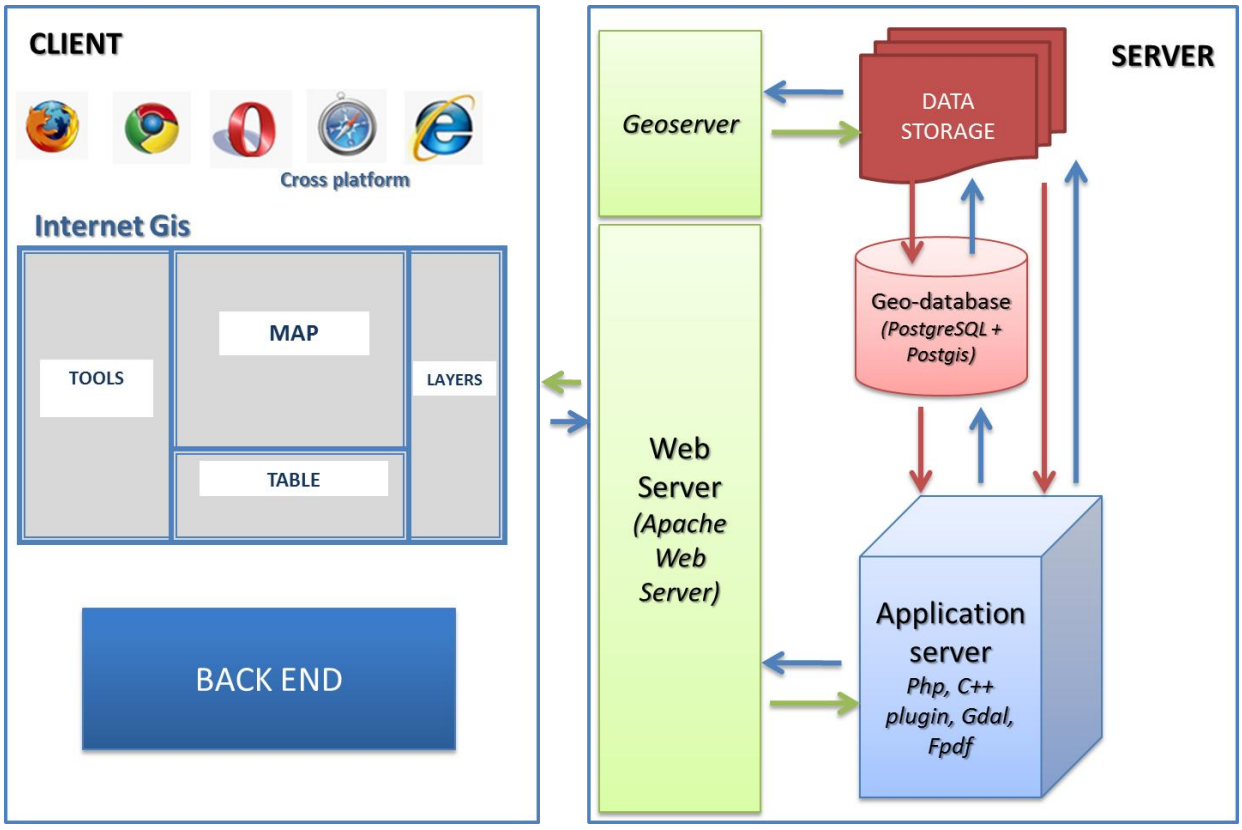


figure 3.2 – Technical implementation

4 THE SYSTEMS AT WORK

4.1 OVERVIEW OF USER INTERFACE

The access to the SOILCONSWEB WEB SPATIAL DECISION SUPPORT SYSTEMS is available at the following link: www.lanconsultingweb.eu, where the user finds the button to "*start DSS*" .

The user interface window has been organised into three main frames, designed to maximize the accessibility to all features of the system. The frames position and dimensions have been chosen to emphasize the objective of each functionality and to provide the user with the best performance and usability.

The first frame includes the *TOOLS* sections, divided in a list of themes (left in the figure below) and a bar of GIS TOOLS (top centre). The second frame (centre window) is the *MAP* section with the *TABLET,* showing the results of tools processing, the geographic data and their attributes. The third frame (right) is the *LAYERS* section in which GIS and elaboration results can be selected to be shown in the central (*MAP*) area.

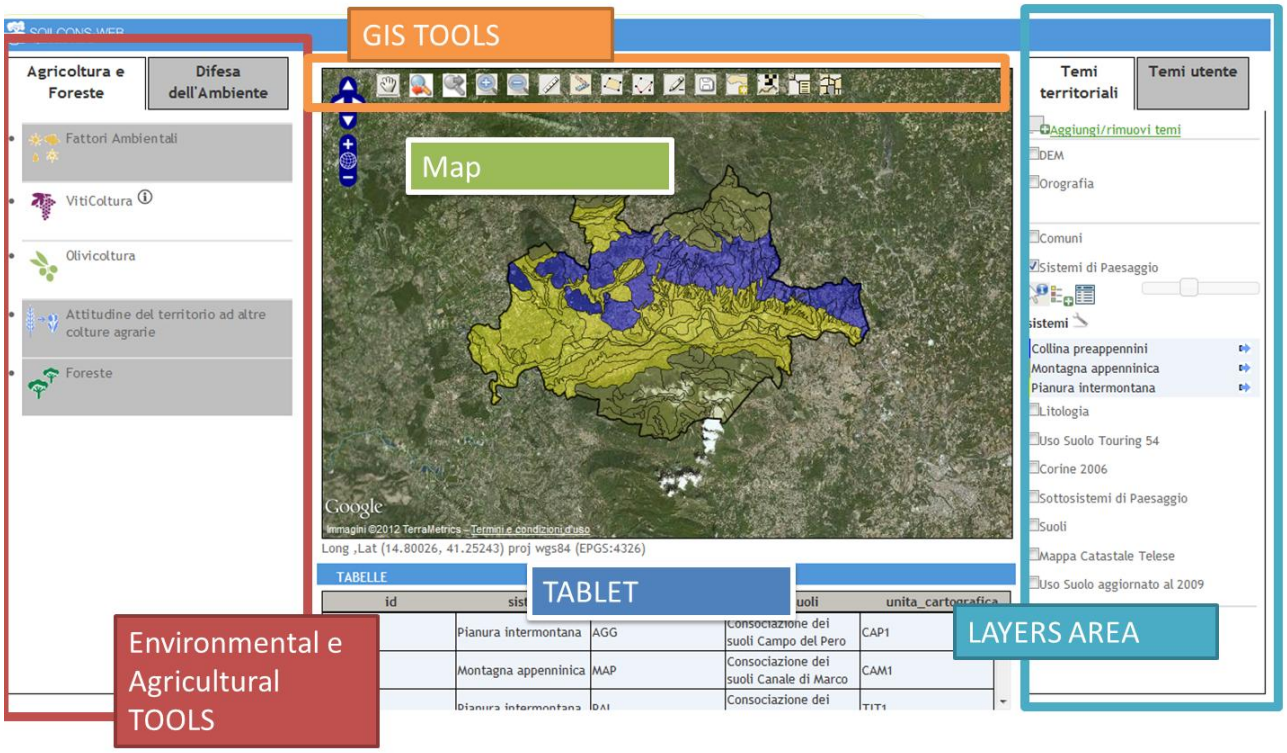


figure 4.1 - User interface

The main section of the SDS-System is the *TOOLS* section. All interactive tools are made available in this frame. Tools are designed to allow the user to extract information with respect to their specific area or theme of interest (see *MAP* section – advance tools selection).

figure 4.2 – Agricultural Tools

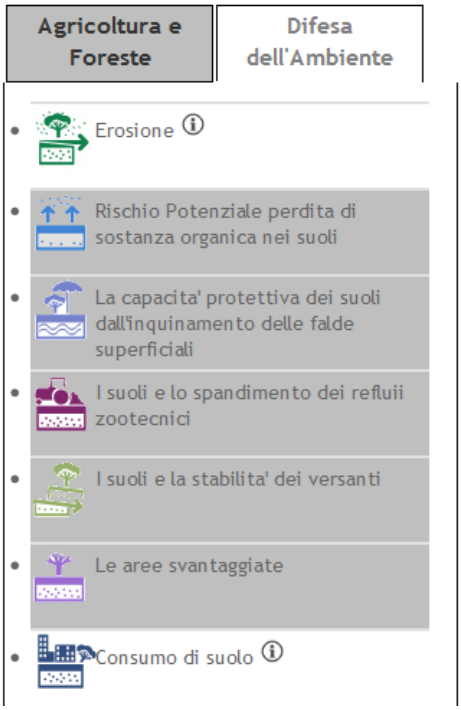


figure 4.3 – Environmental Tools

The available elaborations are grouped in two categories of themes (organized in tabs for each sub-theme): agriculture and environment. By selecting a given theme, a list of options is shown and a specified tool dialog box will open to guide the user through the model input choice.

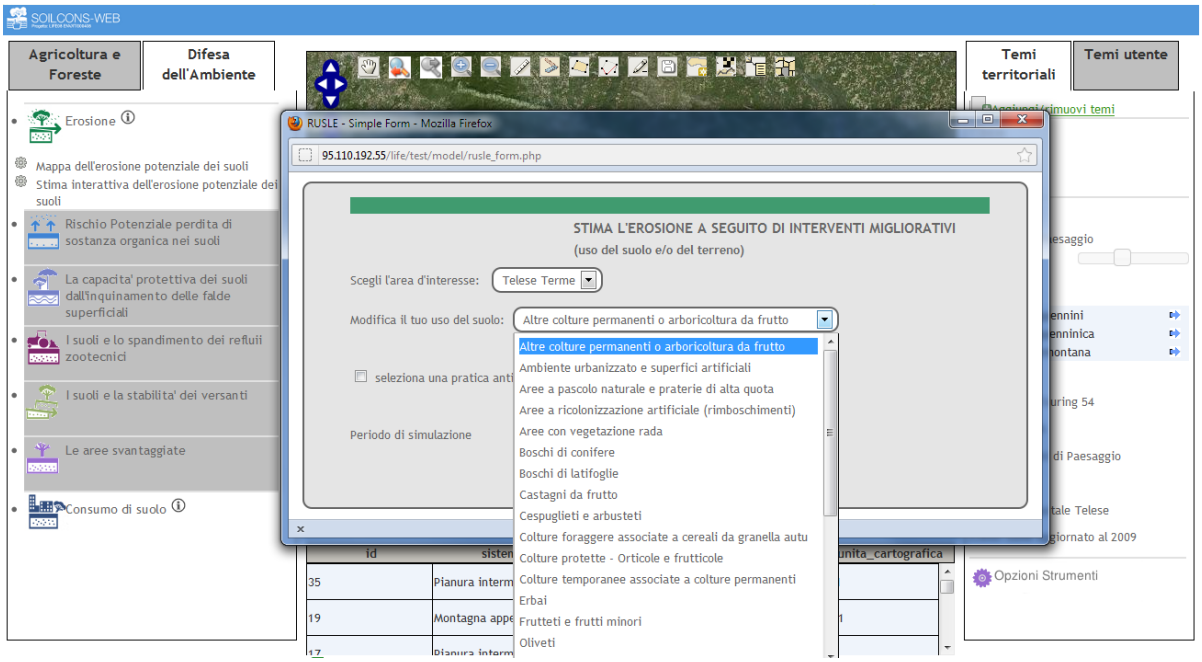


figure 4.4 – RUSLE dialog form

The results of each model elaboration is made available in the *DATA* area. Selected results are shown in *MAP* and *TABLE* areas. In the Map frame, the map of the area of interest is displayed. Buttons are available in the top of the frame, the user can navigate the data similarly to a gis desktop (pan, zoom, previous and next zoom the mouse wheel can also be used for these operations); base layer is Google satellite map.

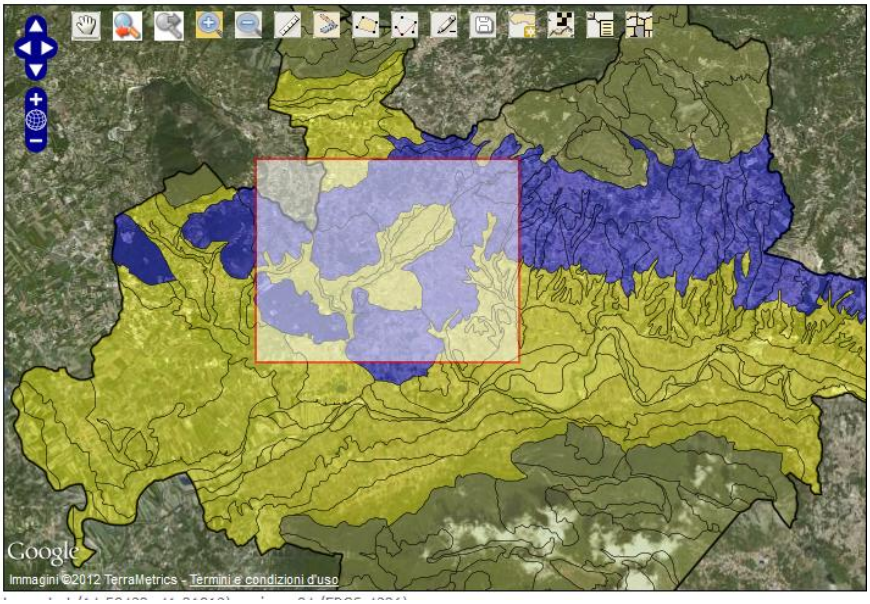


figure 4.5 – Zooming tool

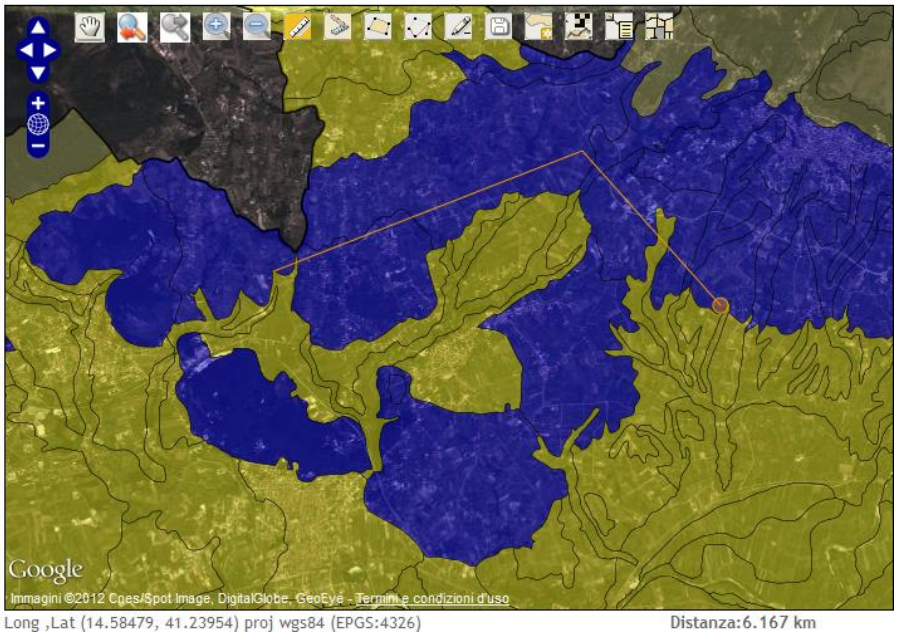


figure 4.6 – Inquiry tool

The LAYERS area is divided into two tabs, the first tab (public themes tab) contains the territorial themes which can be added from remote server, the second tab (User themes Tab) displays the user calculation and user made layers. Clicking on the "aggiungi/rimuovi temi" button on public themes tab you can add/remove public layes. Navigate to the layer form, the user can add map layers. The Metadata prepared according to Inspire Directive are displayed by clicking on information button.

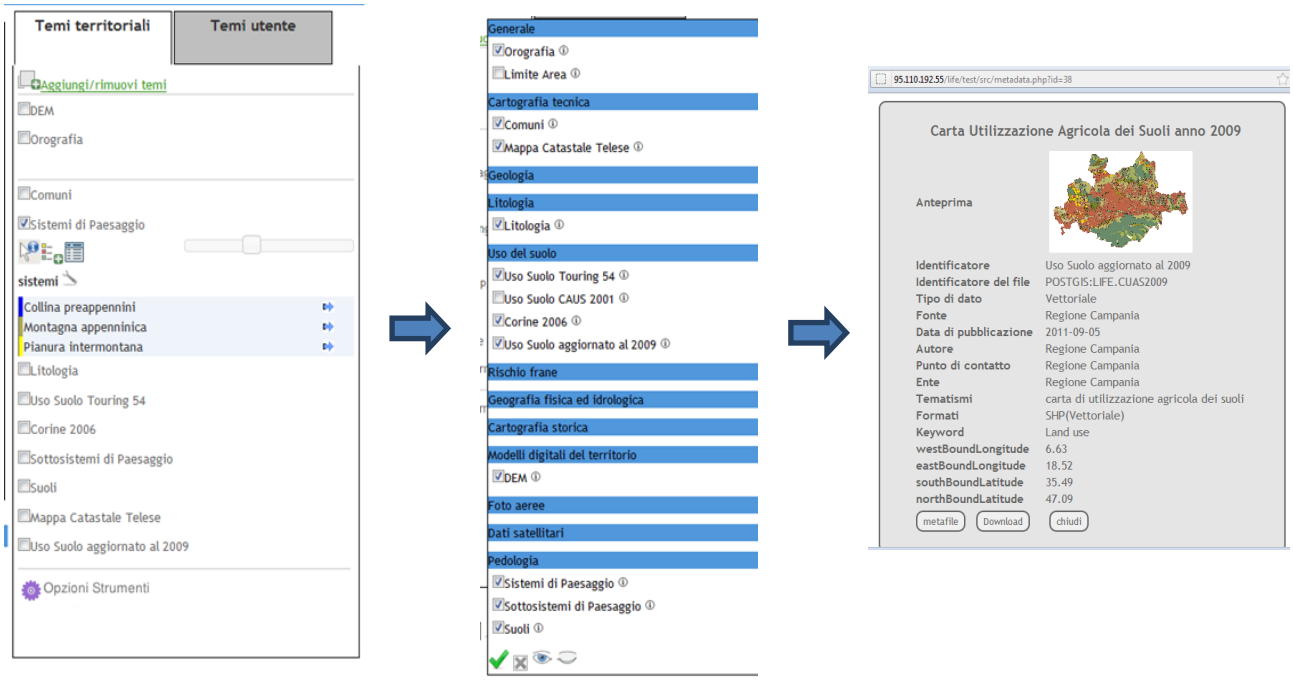


figure 4.7 – Public themes tab

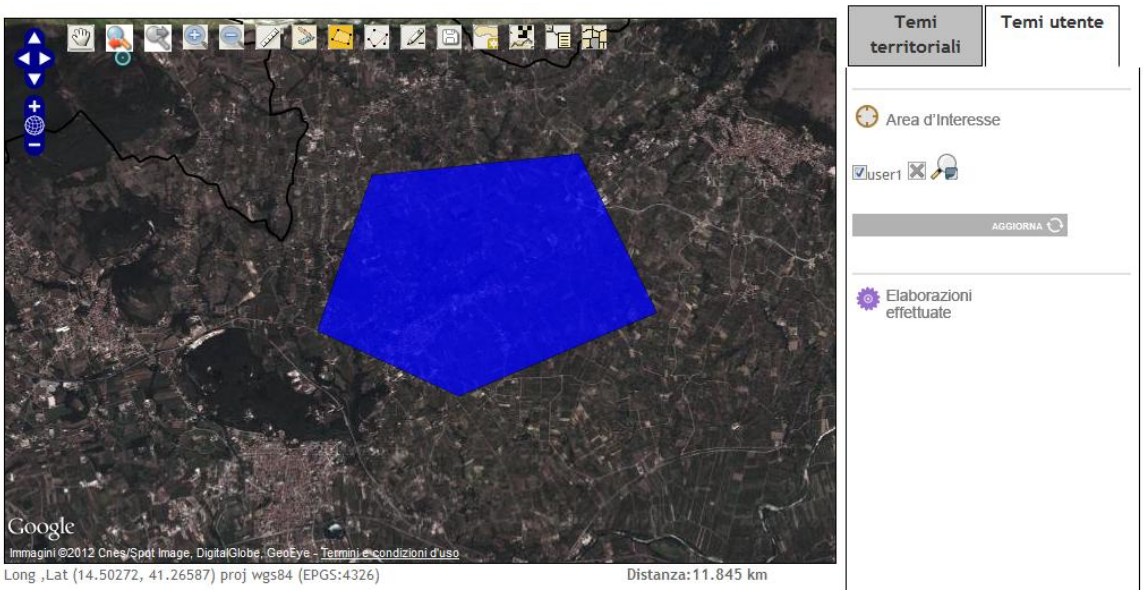


figure 4.8 – User themes tab

Tablet displays the data joined to each feature in the displayed map.

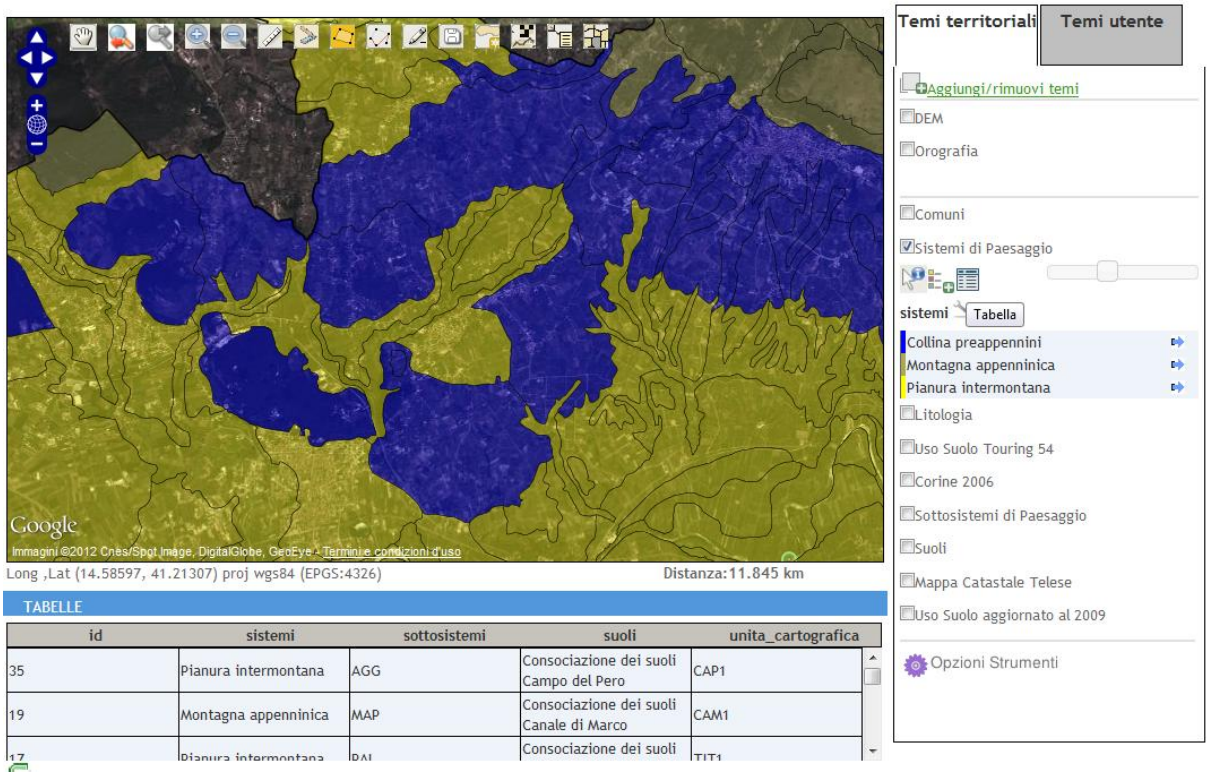


figure 4.9 – Layer Table

Statistical and GIS query tools (zonal statistic, query builder) have been implemented for general purpose. In the top part of the Map frame advanced tools are positioned for drawing polygons (user interest area), searching location, calculate statistics on raster data and build query on shape area.

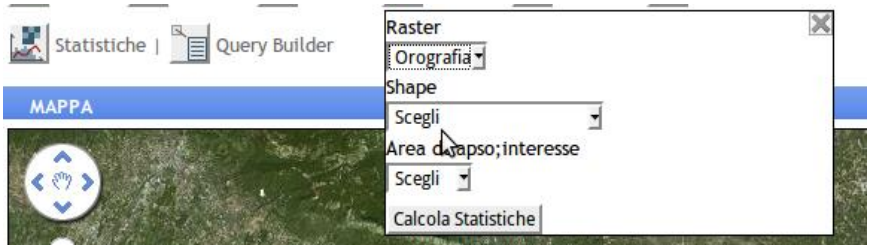
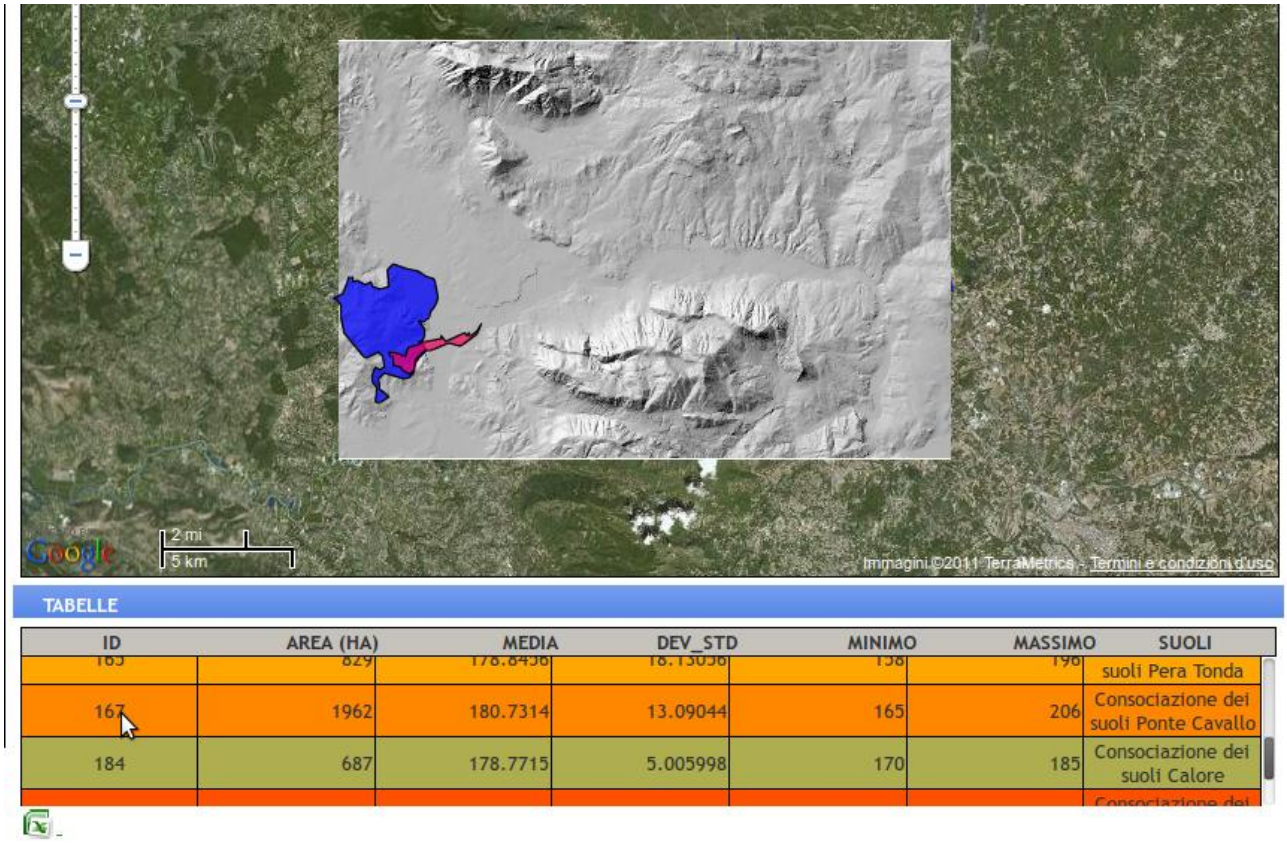


figure 4.10 – Zonal Statistic dialog form

The results of statistics and query builder will be shown in de *TABLE* area.



ID	AREA (HA)	MEDIA	DEV_STD	MINIMO	MASSIMO	SUOLI
165	829	178.8456	18.13056	138	196	suoli Pera Tonda
167	1962	180.7314	13.09044	165	206	Consociazione dei suoli Ponte Cavallo
184	687	178.7715	5.005998	170	185	Consociazione dei suoli Calore

figure 4.11 – Zonal Statistic results

4.2 USER AT WORK

4.2.1 NAVIGATION PANEL

The navigation panel enables users to zoom in their area of interest. Apart from using the pan  and zoom-in  / zoom-out  icons on the toolbar with the mouse, navigating can also be done with the mouse wheel and the arrow keys.

While digitizing you can press the mouse wheel to pan inside of the main window and you can roll the mouse wheel to zoom in and out on the map. For zooming place the mouse cursor inside the map area and roll it forward (away from you) to zoom in and backwards (towards you) to zoom out. The mouse cursor position will be the centre of the zoomed area of interest.

Panning the Map during digitizing is possible with the arrow keys. Place the mouse cursor inside the map area and click on the right arrow key to pan east, left arrow key to pan west, up arrow key to pan north and down arrow key to pan south.

The previous extent button  allow you to return to the extent you had before zooming in or out. The next extent button  allows you to jump forward an extent (after you have used the previous extent button). This is a sort of “undo” button in regard to navigation.

4.2.2 MEASURING DISTANCES AND AREA

The measure tool  allows to draw a line, or a series of connected lines, to roughly measure the Euclidean distance between points. Click on it and then click on your map at the starting point. Move your cursor to your end point, or next point, repeating until you are done. Double click to finish.

You can also calculate Area using the tool shaped like a polygon  . Simply draw a polygon and double click to finish.

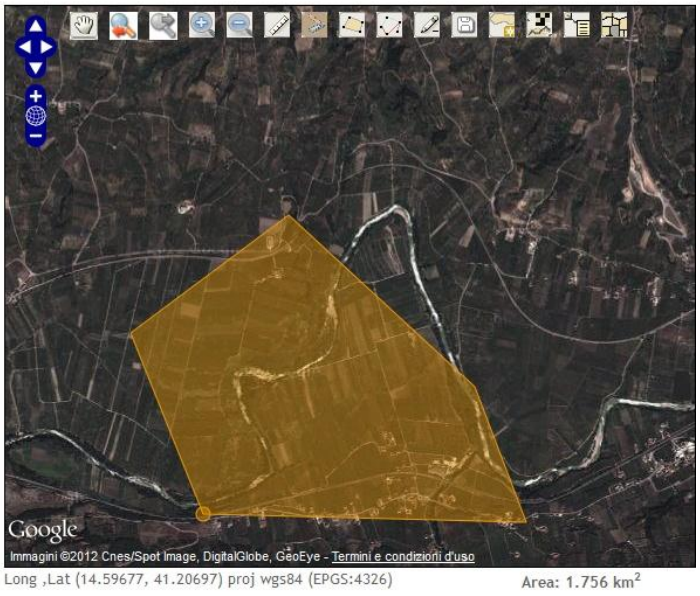


figure 4.12 – Measuring tools

4.2.3 DRAWING YOUR INTEREST AREA

CREATE AREA OF INTEREST FROM SCRATCH

The editing buttons  enable users to draw polygons and set their area of interest. User can draw boundaries of new polygons in order to limit area to perform analysis. The new polygons are stored in the remote database. By pressing the "draw"  button and moving the mouse, the cursor on the map becomes an "o". Clicking (once) on a point on the map, the user adds the vertices of the polygon; a double click on the last vertexes needed to close the polygon. Modify the drawn polygons is very easy: the user has to press the "Modify" button  and dragging on the vertices or it can be completely removed by pressing the "delete" button  . Finally, it is possible to save the area of interest through the save button  . Pops up dialog form permit to save the name of area of interest and additional information.

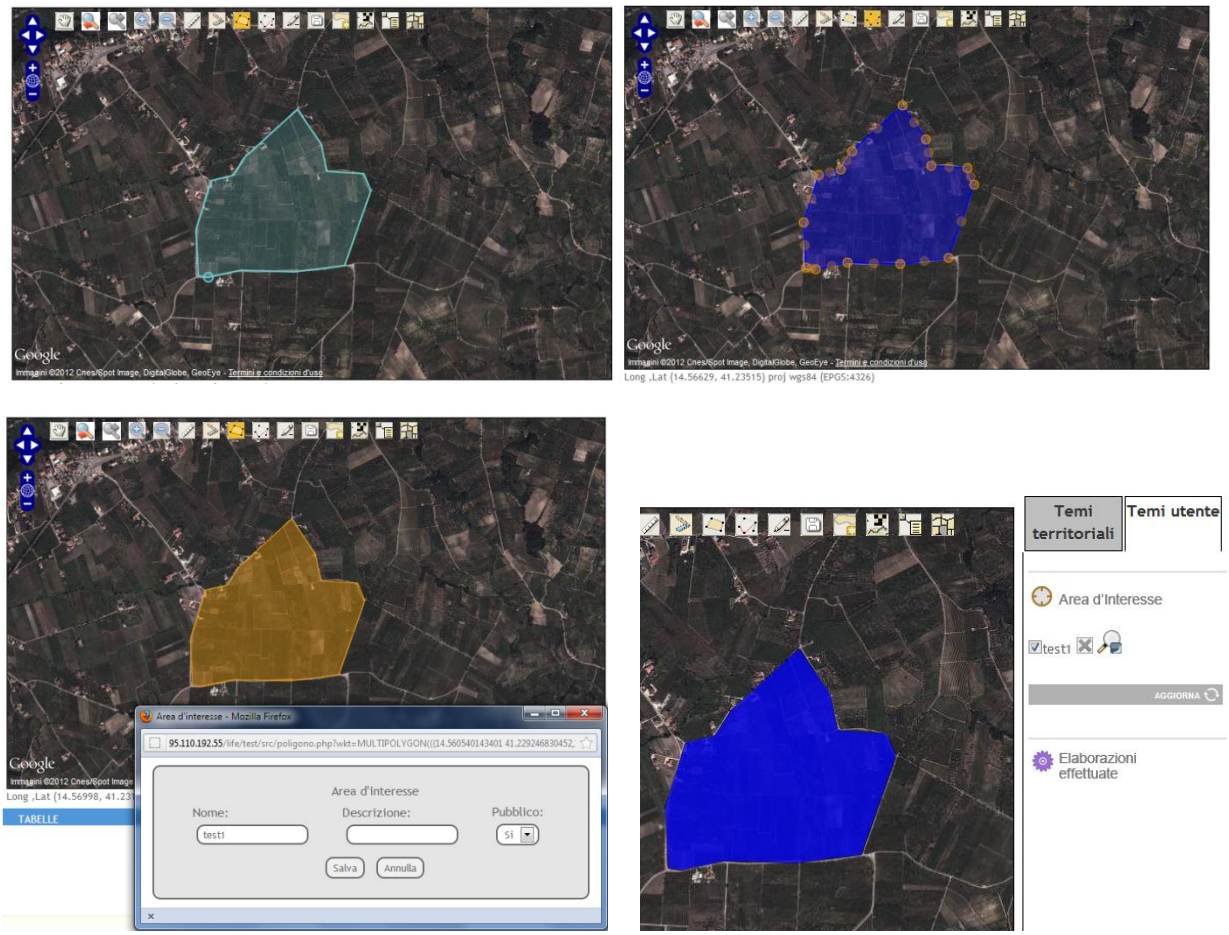


figure 4.13 – Editing area of interest.

SETTING SNAPPING TOLERANCE

Snapping tolerance is the distance used to search for the closest vertex and/or segment you are trying to connect when you set a new vertex or move an existing vertex. If you aren't within the snap tolerance, the system will leave the vertex where you release the mouse button, instead of snapping it to an existing vertex and/or

segment. The snapping tolerance setting affects all tools which work with tolerance. The snapping options are available in the tool option (Opzioni Strumenti).

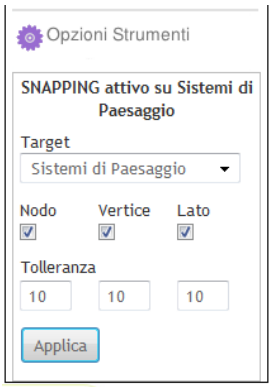


figure 4.14 – Snapping panel.

To set the snapping tolerance on available layer click on the tool option menu and choice the target layer, the snapping type (vertex, edge or endpoint) and map tolerance. Then click on "Applica" and start the editing session. If snapping is on you can read "SNAPPING ATTIVO".

CREATE AREA OF INTEREST FROM COMUNI BOUNDARY LAYER

You can create a new area of interest based on "Comuni" boundary layer by clicking on "seleziona Comune" and selecting available "Comune" from the list.

figure 4.15 – Create "Comuni" boundary layer dialog form.

CREATE AREA OF INTEREST FROM CADASTRAL DATALAYER

You can create a new area of interest based on cadastral data layer by clicking on "seleziona dati catastali" and selecting available parcels from the list.

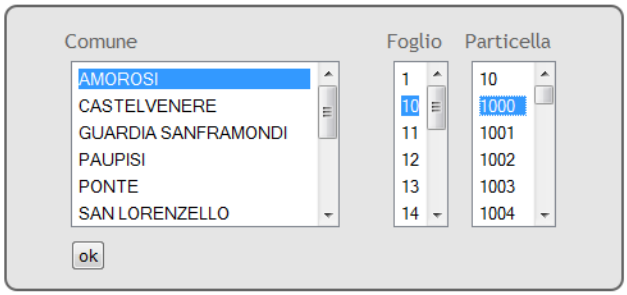


figure 4.16 – Create Parcels boundary layer dialog form.

4.2.4 QUERY BUILDER

The Query builder button  opens the Query Builder and allows you to define a subset of a layer using a SQL-like WHERE clause, display the result in the main window. For example, if you have a Comuni (towns) layer with a population field you could select the town by entering ISTAT code in the SQL box of the query builder. The Fields, Values and Operators sections help the user to construct the SQL-like. Once a given selection is made, the relevant features will be highlighted on the map.

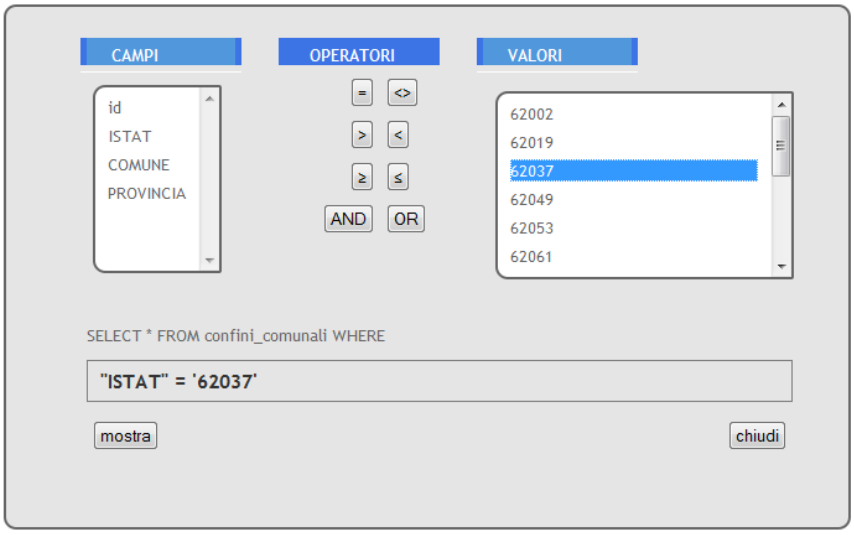


figure 4.17 – Query builder dialog form.

4.2.5 MAP LEGEND

The map legend area lists all the layers in the project. The checkbox in each legend entry can be used to show or hide the layer. Each layer in a map can have the opacity of that layer individually set from zero opacity to 100 percent opaque. Layers that are partially transparent will allow objects, labels and pixels from layers underneath them to be partially visible. Interactive setting of opacity can be performed by moving a slider bar.

Classification feature by color: categorized renderer is used to render all features from a layer, using a gratuated defined symbol, which color reflects the value of a selected feature's attribute. The Style tab allows you to select the attribute used for rendering.

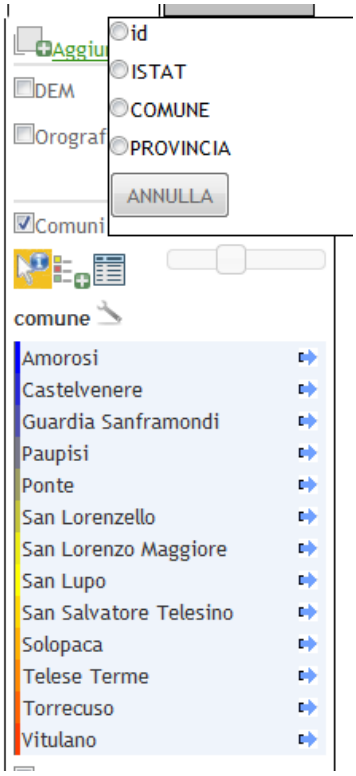
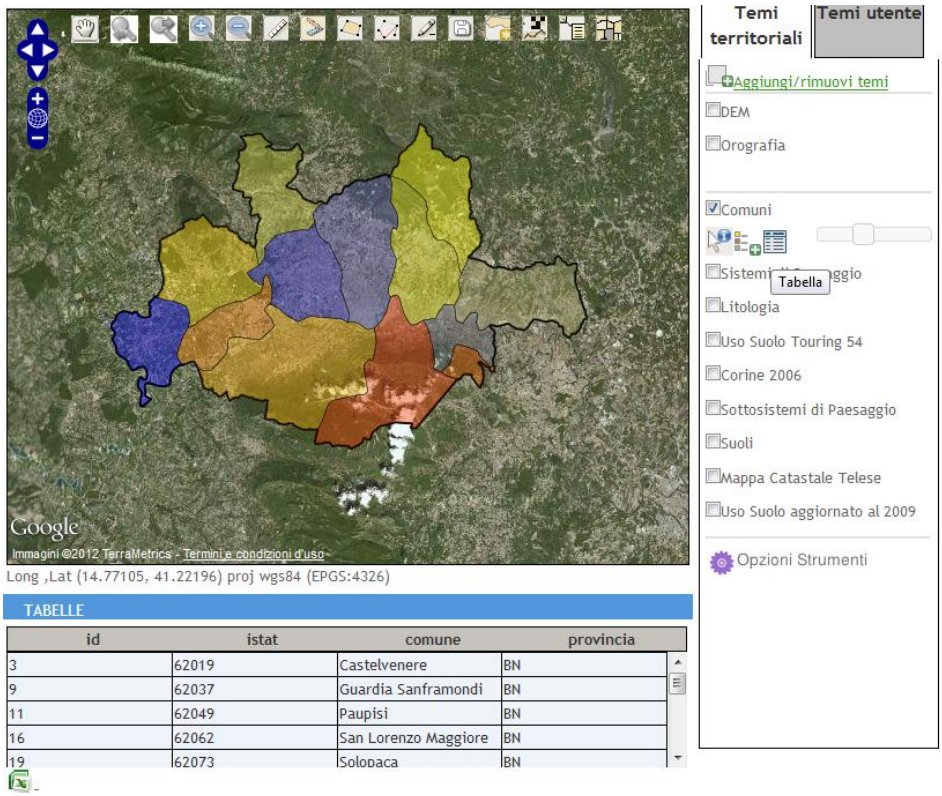


figure 4.18 – Rendering options of map legend.

4.2.6 WORKING WITH TABLES

Every layer has an attribute table associated with it. You can open the table by clicking on the layer table icon  .

The table will have as many rows, or records, as it does map features.. There can be any number of columns (fields). The first columns is standard: ID, the feature Id, the rest of the fields will vary. In most cases, there will also be a column that identifies each map feature with a unique name, such as a census tract number or neighborhood name. There may be additional fields identifying attributes of the map feature. You can also highlight a feature on the map by clicking on a row in the table. This way, you can find a specific place on your map.



id	istat	comune	provincia
3	62019	Castelvenere	BN
9	62037	Guardia Sanframondi	BN
11	62049	Paupisi	BN
16	62062	San Lorenzo Maggiore	BN
19	62073	Solopaca	BN

figure 4.19 – Table associated to a layer.

EXPORTING TABLES

To export table in xls format go to the export button  and "Export."

4.2.7 IDENTIFYING ATTRIBUTES OF FEATURES

The map layers features have attributes stored in a table. You can access this information in several different ways. Using the identify  tool associated to the layer, click on a map feature in the map display. An "identify results"box will display all of the information known about that feature. Notice the layers dropdown menu.

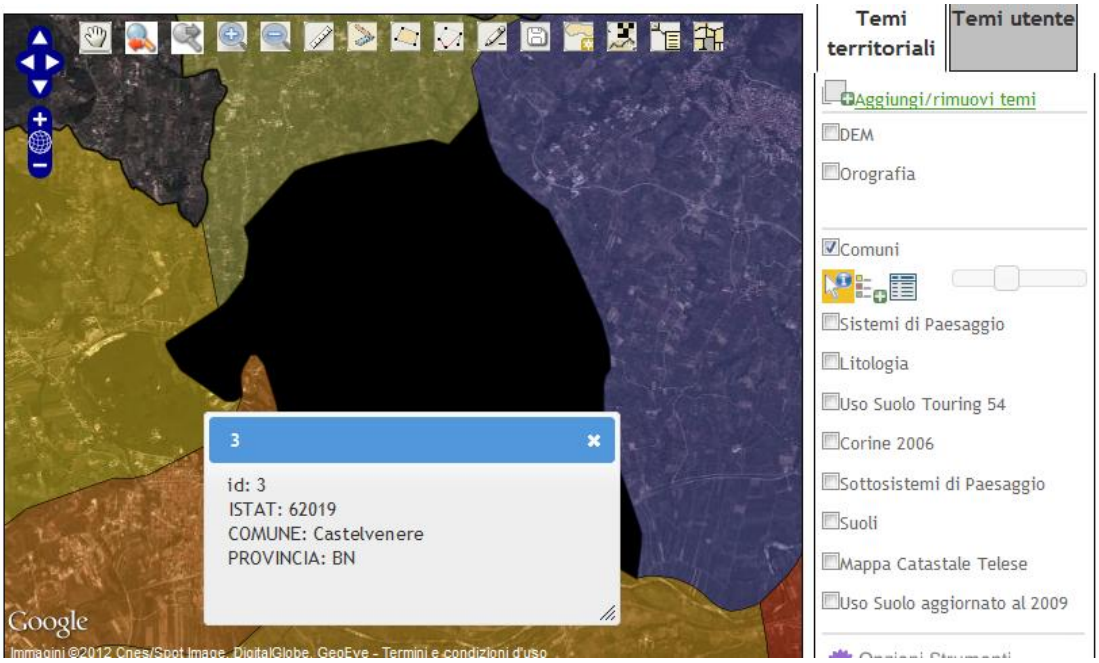


figure 4.20 – Identify attribute layer.

5 IMPLEMENTED TOOLS

5.1 DIFESA DELL'AMBIENTE

5.1.1 EROSIONE (EROSION)

5.1.1.1 MAPPA DELL'EROSIONE POTENZIALE DEI SUOLI (POTENTIAL EROSION SOIL MAP)

DESCRIPTION

The model evaluates potential erosion according to RUSLE model.

INPUT DATA

- area of interest;
- land cover CUAS 2009;

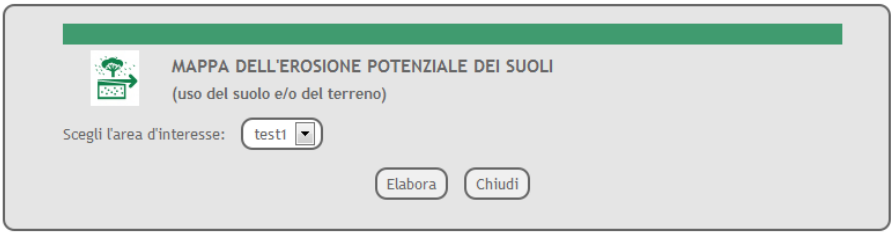
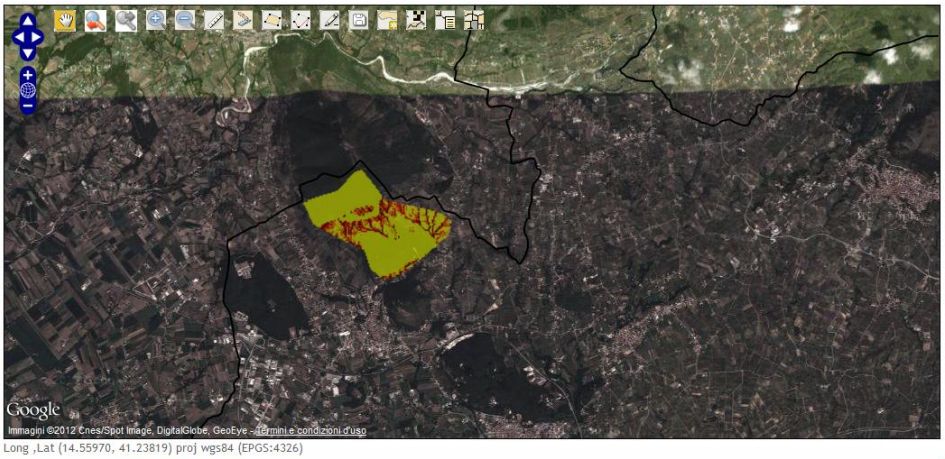


figure 5.1 - Potential erosion dialog form

OUTPUT DATA

- raster data of erosion effects;
- CONSUMPTION for the AOI for the chosen period
- table sheet which shows soil erosion (mean) value per land cover (stored in database);
- PDF report.



id	area(ha)	media(t/ha/anno)	minimo(t/ha/anno)	massimo(t/ha/anno)
1	202.5	0.6	0.0	28.3

figure 5.2 - Raster map and data sheet of potential erosion effects

SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

id	area (ha)	media (t/ha/anno)	dev_std (t/ha/anno)	minimo (t/ha/anno)	massimo (t/ha/anno)
1	202.5	0.6	2.6	0.0	28.3

figure 5.3 – Generated PDF Report

5.1.1.2 STIMA INTERATTIVA DELL'EROSIONE POTENZIALE DEI SUOLI – RUSLE. (INTERACTIVE POTENTIAL EROSION EVALUTATION)

DESCRIPTION

The model evaluates potential erosion according to RUSLE model.

INPUT DATA

- area of interest;
- land cover CUAS 2009 (the user can change land cover to obtain a new scenario simulation);
- anti-erosion practices (optional).
- Simulation Period

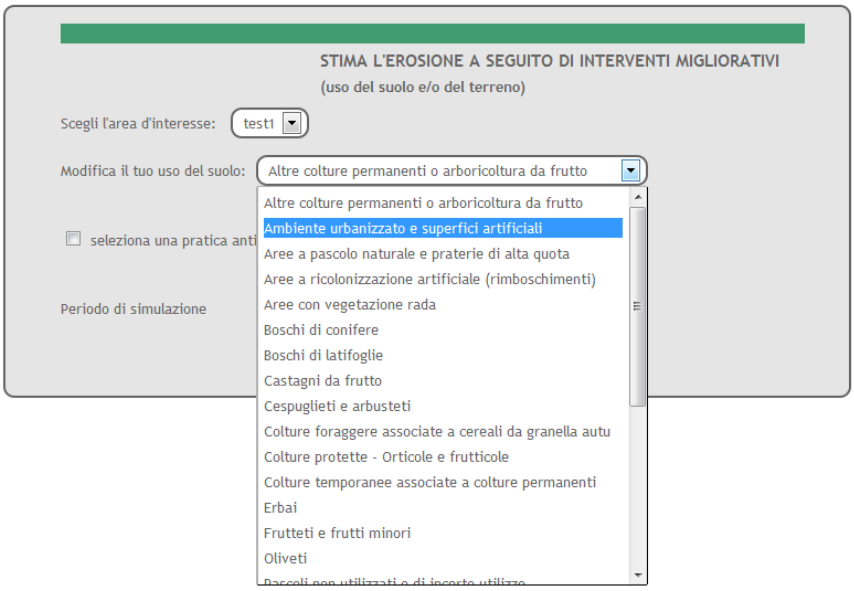
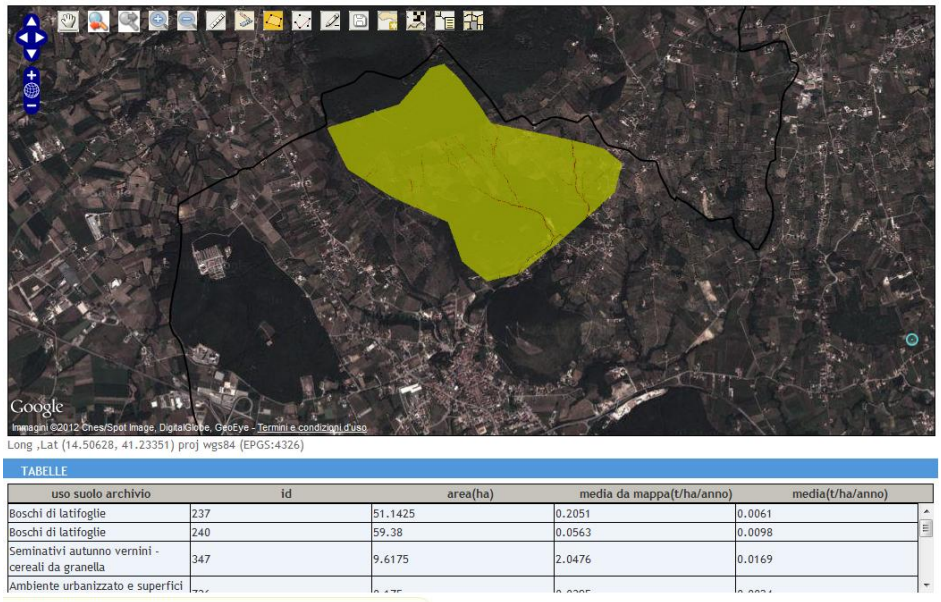


figure 5.4 - Interactive potential erosion dialog form

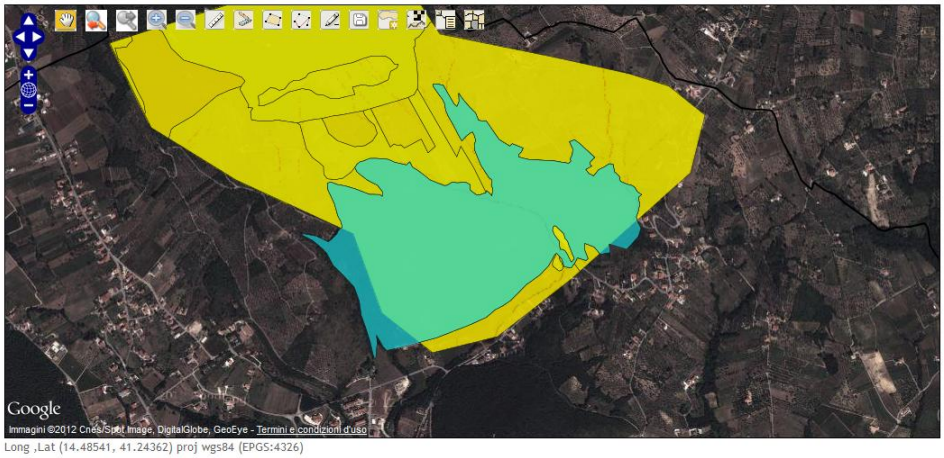
OUTPUT DATA

- raster data of erosion effects;
- vector data of erosion effects mean value with respect to soil use in database;
- table sheet shows soil erosion (mean) value per land cover (stored in database) and variation according to user scenario;
- PDF report.



uso suolo archivio	id	area(ha)	media da mappa(t/ha/anno)	media(t/ha/anno)
Boschi di latifoglie	237	51.1425	0.2051	0.0061
Boschi di latifoglie	240	59.38	0.0563	0.0098
Seminativi autunno vernini - cereali da granella	347	9.6175	2.0476	0.0169
Ambiente urbanizzato e superfici				

figure 5.5 - raster data of erosion effects

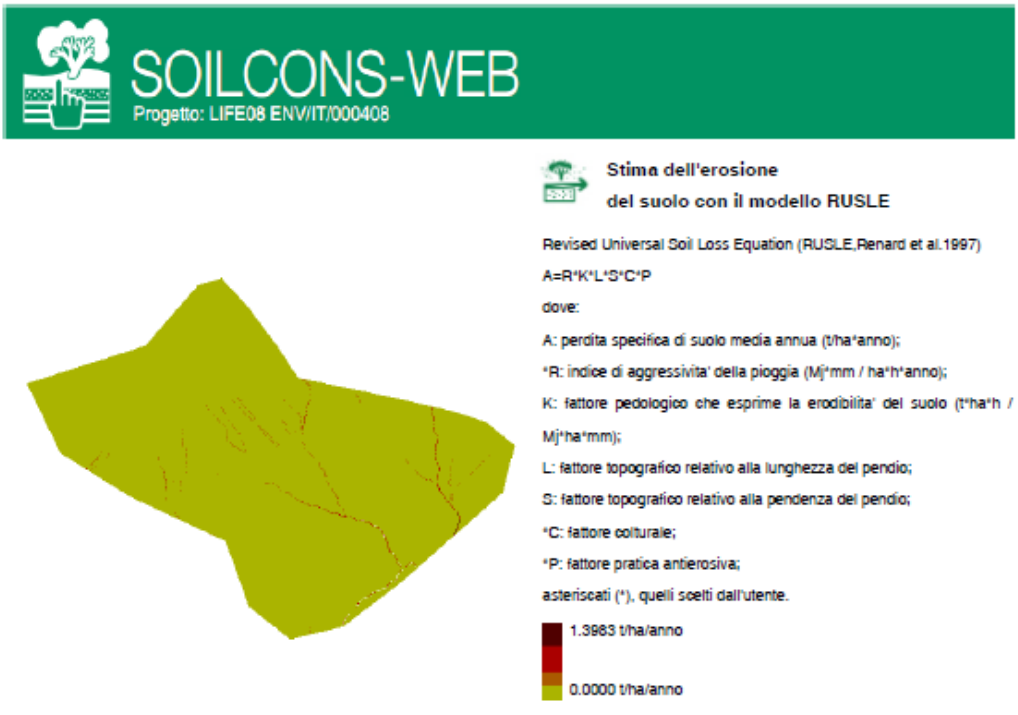


Long ,Lat (14.48541, 41.24362) proj wgs84 (EPGS:4326)

TABELLE

uso suolo archivio	id	area(ha)	media da mappa(t/ha/anno)	media(t/ha/anno)
Boschi di latifoglie	237	51.1425	0.2051	0.0061
Boschi di latifoglie	240	59.38	0.0563	0.0098
Seminativi autunno vernini - cereali da granella	347	9.6175	2.0476	0.0169
Ambiente urbanizzato e superfici				

figure 5.6 - Vector data of erosion and data sheet of mean value.



INFORMAZIONI SULLA SIMULAZIONE

Estensione della superficie: 202.47(ha)

Parametri della simulazione:

Periodo simulato: Da: 2010-1-1 A: 2010-12-31

Uso suolo (parametro C): Ambiente urbanizzato e superfici artificiali

Sistemazioni agrarie (parametro K):

figure 5.7 – Generated PDF Report

5.1.2 CONSUMO DI SUOLO (CONSUMPTION OF THE SOIL)

5.1.2.1 CONSUMO DEL TERRITORIO RURALE DA URBANIZZAZIONE: MAPPATURA INTERATTIVA PER GLI ANNI 1954, 1998, 2004 (RURAL LAND CONSUMPTION: INTERACTIVE MAPPING FOR THE YEARS 1954, 1998, 2004)

DESCRIPTION

The model evaluates consumption and urbanization of rural area.

INPUT DATA

- area of interest;
- initial year (1954, 1998 or 2004);
- end year (1954, 1998 or 2004);

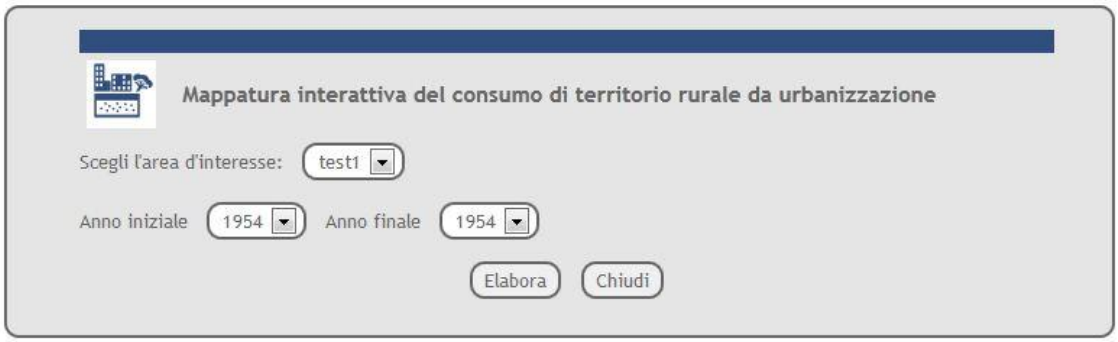


figure 5.8 – Rural Land Consumption dialog form

OUTPUT DATA

- vector data of erosion effects;
- table sheet which shows consumption of rural land (mean), stored in database;
- PDF report.

Long ,Lat (14.52641, 41.21149) proj wgs84 (EPGS:4326)

TABELLE

area persa [ha]	area recuperata [ha]
41.35	0.74

figure 5.9 – Consumption Rural Land Vector data and data sheet of mean value.

SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

Consumo di Suolo
Area d'interesse: Telese Terme

Aspetti Geografici

Superficie:	**995.8 [ha]**
Comune:	**Telese Terme (BN)**
Coordinate del centroide:	**41° 12' 30" N - 14° 30' 37" E**

Statistiche

Descrizione	Anno 1954 (ha)	Anno 1998 (ha)	Variazione (ha)	Variazione (%)
Territorio Non Urbanizzato	967.97	927.34	-40.63	-4
Territorio non urbanizzato suddiviso in classi di capacita' d'uso*				
Classe I	0	0	0	0
Classe II	0	0	0	0
Classe III	737.34	702.21	-35.13	-5
Classe IV	124.9	119.94	-4.96	-4
Classe V	68.78	68.58	-0.2	-0
Classe VI	36.95	36.61	-0.34	-1

figure 5.10 – Generated PDF Report

5.1.2.2 FRAMMENTAZIONE DEL TERRITORIO RURALE ED APERTO: MAPPATURA INTERATTIVA PER GLI ANNI 1954, 1998, 2004 (RURAL LAND CONSUMPTION: INTERACTIVE MAPPING FOR THE YEARS 1954, 1998, 2004)

DESCRIPTION

The model evaluates spatial integrity of rural.

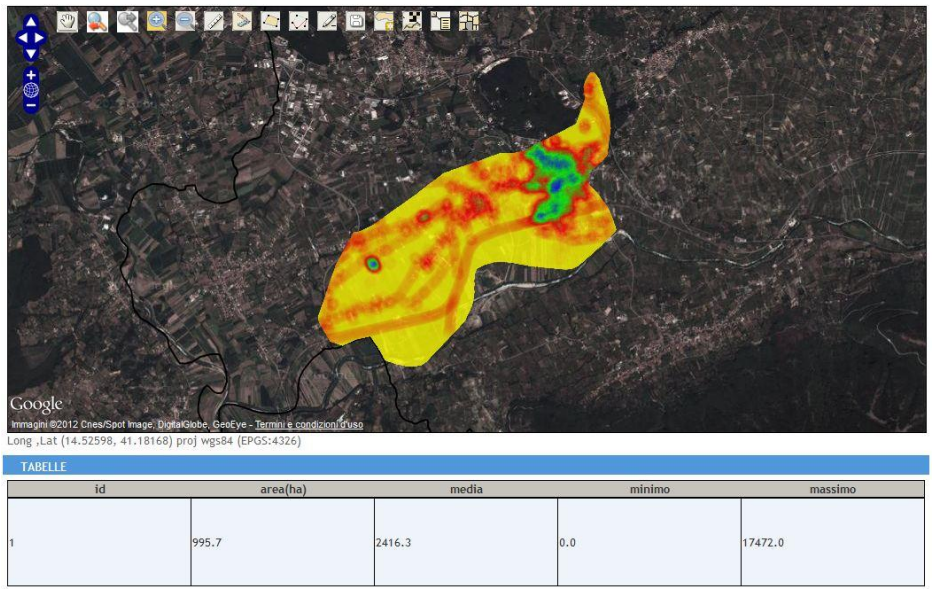
INPUT DATA

- area of interest;
- initial year (1954, 1998 or 2004);
- range of calculation: short (100m) or medium (800m);

figure 5.11 – Iterative spatial mapping of the rural integrity dialog form

OUTPUT DATA

- Raster data of fragmentation interactive for the selected year to range calculation;
- table sheet which shows fragmentation (area [ha],mean,min,max), stored in database;
- PDF report.



id	area(ha)	media	minimo	massimo
1	995.7	2416.3	0.0	17472.0

figure 5.12 – Raster data consumption of rural land and data sheet of mean value.

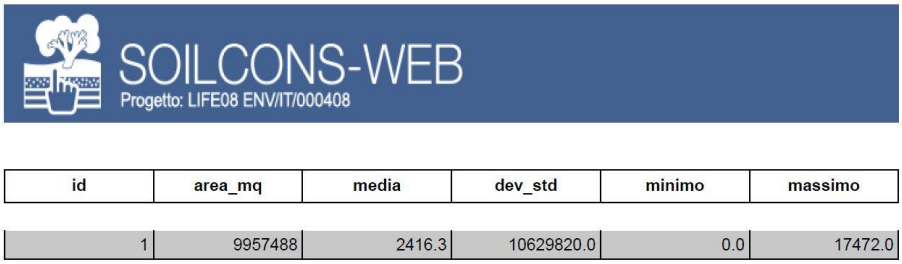


figure 5.13 – Generated PDF Report

5.1.2.3 STATISTICHE PLURIENNALI SULLA FRAMMENTAZIONE (ANNI 1954, 1998, 2004) (MULTI-FRAGMENTATION STATISTICS (YEARS 1954, 1998, 2004))

DESCRIPTION

The model evaluates Statistics on the multi-fragmentation based on the years 1954, 1998, 2004.

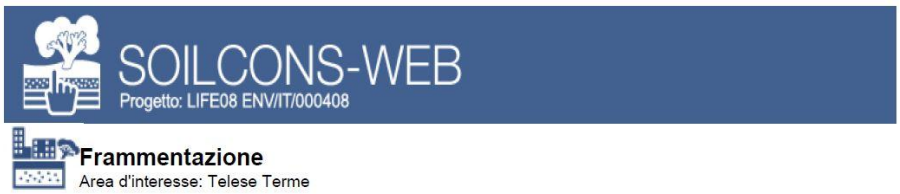
INPUT DATA

- area of interest;
- start year (1954, 1998 or 2004);
- end year (1954, 1998 or 2004);

figure 5.14 – Statistics on the multi-fragmentation dialog form

OUTPUT DATA

- PDF report.



Frammentazione del territorio rurale	Anno 1954	Anno 2004	Variazione	Variazione %
in un raggio di 100m (media)	855	2380	+1525	+178
in un raggio di 100m (dev. std)	1714.6	3255.8	+1541.2	+90
in un raggio di 800m (media)	49200	139000	+89800	+183
in un raggio di 800m (dev. std)	42661.5	103440.8	+60779.3	+142

figure 5.15 – Generated PDF Report

5.2 AGRICOLTURA E FORESTE

5.2.1 VITICOLTURA (VITICULTURE)

5.2.1.1 L'ETICHETTA DEL TUO "TERROIR" (THE LABEL OF YOUR "TERROIR")

DESCRIPTION

The model define and map some environmental factors (eg soil and hydraulic properties of soils, climate, exposure, solar radiation, etc..) that are very important to obtain high quality grapes (if you point to the production of wine): information on the specific "terroir" can be profitably used to the labeling of wine.

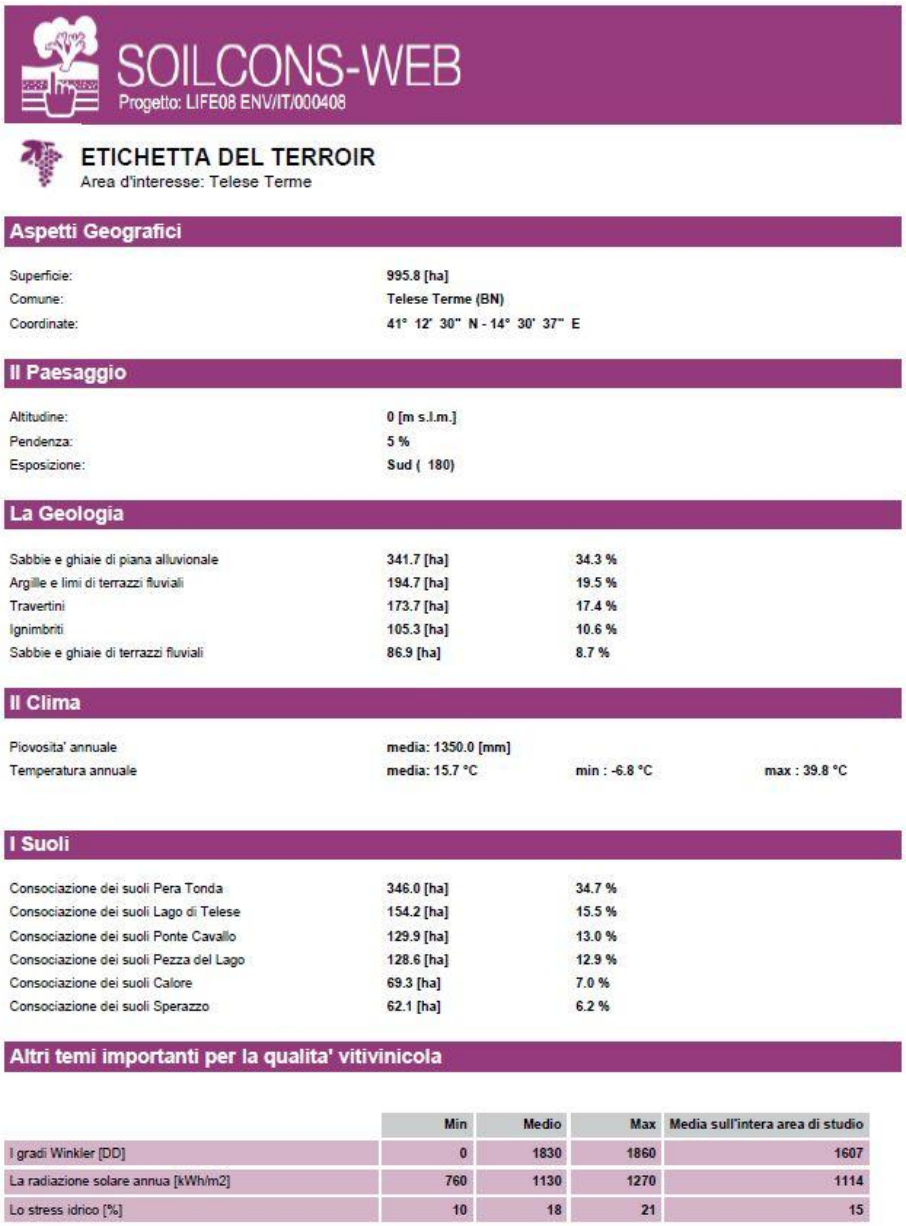
INPUT DATA

- area of interest;

figure 5.16 – information on the specific "terroir" dialog form

OUTPUT DATA

- PDF report.



SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

ETICHETTA DEL TERROIR
Area d'interesse: Telese Terme

Aspetti Geografici

Superficie:	995.8 [ha]
Comune:	Telese Terme (BN)
Coordinate:	41° 12' 30" N - 14° 30' 37" E

Il Paesaggio

Altitudine:	0 [m s.l.m.]
Pendenza:	5 %
Esposizione:	Sud (180)

La Geologia

Sabbie e ghiaie di piana alluvionale	341.7 [ha]	34.3 %
Argille e limi di terrazzi fluviali	194.7 [ha]	19.5 %
Travertini	173.7 [ha]	17.4 %
Ignimbriti	105.3 [ha]	10.6 %
Sabbie e ghiaie di terrazzi fluviali	86.9 [ha]	8.7 %

Il Clima

Piovosita' annuale	media: 1350.0 [mm]		
Temperatura annuale	media: 15.7 °C	min : -6.8 °C	max : 39.8 °C

I Suoli

Consociazione dei suoli Pera Tonda	346.0 [ha]	34.7 %
Consociazione dei suoli Lago di Telese	154.2 [ha]	15.5 %
Consociazione dei suoli Ponte Cavallo	129.9 [ha]	13.0 %
Consociazione dei suoli Pezza del Lago	128.6 [ha]	12.9 %
Consociazione dei suoli Calore	69.3 [ha]	7.0 %
Consociazione dei suoli Sperazzo	62.1 [ha]	6.2 %

Altri temi importanti per la qualita' vitivinicola

	Min	Medio	Max	Media sull'intera area di studio
I gradi Winkler [DD]	0	1830	1860	1607
La radiazione solare annua [kWh/m2]	760	1130	1270	1114
Lo stress idrico [%]	10	18	21	15

figure 5.17 – Generated PDF Report

5.2.1.2 I SUOLI DEL TUO "TERROIR" (SOILS OF TERROIR)

DESCRIPTION

The model evaluates the distribution of soils in the "terroir".

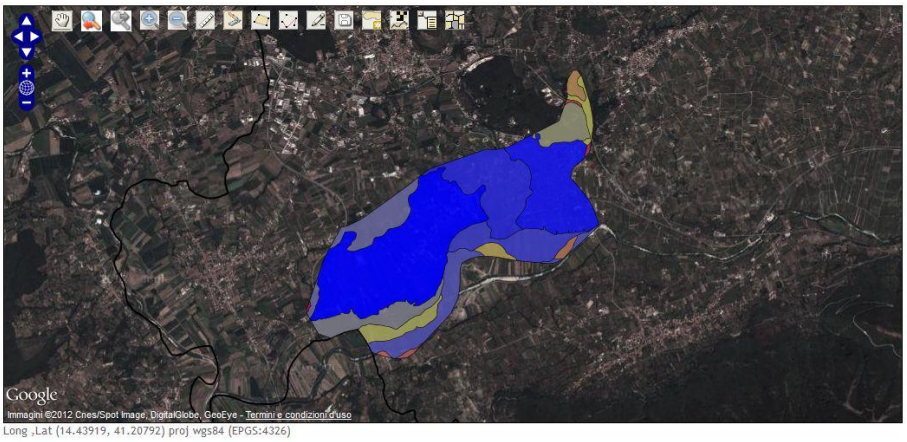
INPUT DATA

- area of interest;

figure 5.18 –Soils of "terroir" dialog form

OUTPUT DATA

- Vector data of the distribution of soils in the "terroir" in the area of interest;
- table sheet which shows the distribution of soils in the "terroir", stored in database;
- PDF report.

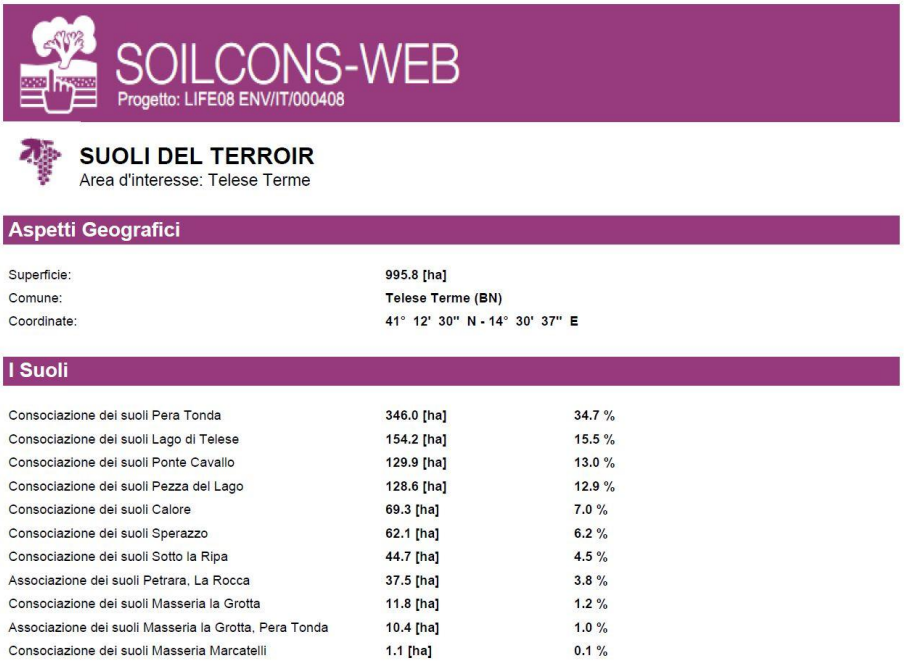


Long ,Lat (14.43919, 41.20792) proj wgs84 (EPGS:4326)

TABELLE

id	suolo	area(ha)
133	Consociazione dei suoli Pera Tonda	345.51
121	Consociazione dei suoli Lago di Telese	154.24
65	Consociazione dei suoli Pezza del Lago	128.63
153	Consociazione dei suoli Ponte Cavallo	71.96
118	Consociazione dei suoli Calore	69.28

figure 5.19 – Vector data of the distribution of soils in the "terroir" and data sheet of soil type with relative area.



SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

SUOLI DEL TERROIR
Area d'interesse: Telese Terme

Aspetti Geografici

Superficie:	995.8 [ha]
Comune:	Telese Terme (BN)
Coordinate:	41° 12' 30" N - 14° 30' 37" E

I Suoli

Consociazione dei suoli Pera Tonda	346.0 [ha]	34.7 %
Consociazione dei suoli Lago di Telese	154.2 [ha]	15.5 %
Consociazione dei suoli Ponte Cavallo	129.9 [ha]	13.0 %
Consociazione dei suoli Pezza del Lago	128.6 [ha]	12.9 %
Consociazione dei suoli Calore	69.3 [ha]	7.0 %
Consociazione dei suoli Sperazzo	62.1 [ha]	6.2 %
Consociazione dei suoli Sotto la Ripa	44.7 [ha]	4.5 %
Associazione dei suoli Petrara, La Rocca	37.5 [ha]	3.8 %
Consociazione dei suoli Masseria la Grotta	11.8 [ha]	1.2 %
Associazione dei suoli Masseria la Grotta, Pera Tonda	10.4 [ha]	1.0 %
Consociazione dei suoli Masseria Marcatelli	1.1 [ha]	0.1 %

figure 5.20 – Generated PDF Report

5.2.1.3 MAPPATURA DEI GRADI WINKLER (WINKLER DEGREES MAPPING).

DESCRIPTION

The model evaluates the degrees winkler

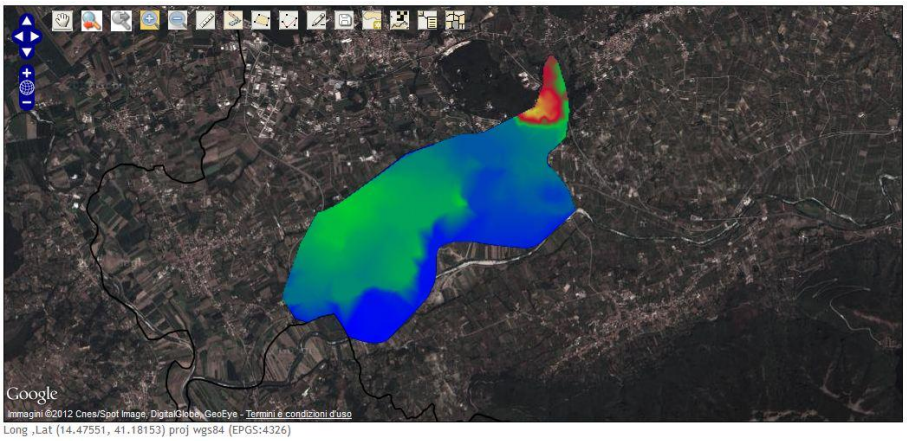
INPUT DATA

- area of interest;

figure 5.21 – The mapping of the Winkler degrees dialog form

OUTPUT DATA

- Raster data of the winkler degrees in the area of interest;
- table sheet which shows the distribution of soils in the "terroir", stored in database;
- PDF report.



Long ,Lat (14.47551, 41.18153) proj wgs84 (EPGS:4326)

TABELLE

id	area(ha)	media	minimo	massimo
1	995.8	1839.4	1747.8	1863.3

figure 5.22 – Raster data of the distribution of the winkler degree and data sheet of statistics.

SOILCONS-WEB

Progetto: LIFE08 ENV/IT/000408

Mappatura dei gradi Winkler Telese Terme

INFORMAZIONI SULLA SIMULAZIONE

Area d'nteresse: Telese Terme

Estensione della superficie: 995.8 [ha]

id	area_mq	media	dev_std	minimo	massimo
1	9957600	1839.4	249.9	1747.8	1863.3

figure 5.23 – Generated PDF Report

5.2.1.4 MAPPATURA DELLO STRESS IDRICO POTENZIALE DEI SUOLI (POTENTIAL SOIL MOISTURE STRESS MAPPING).

DESCRIPTION

The model evaluates the mapping potential soil moisture stress

INPUT DATA

- area of interest;

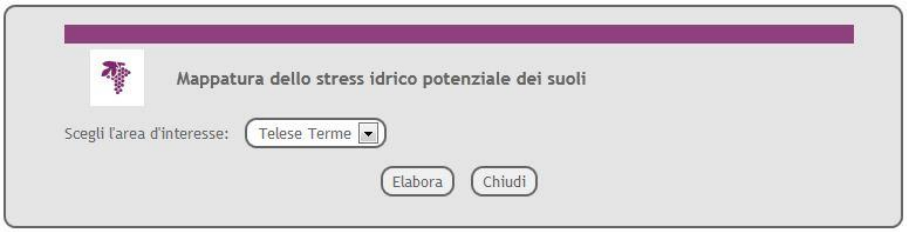
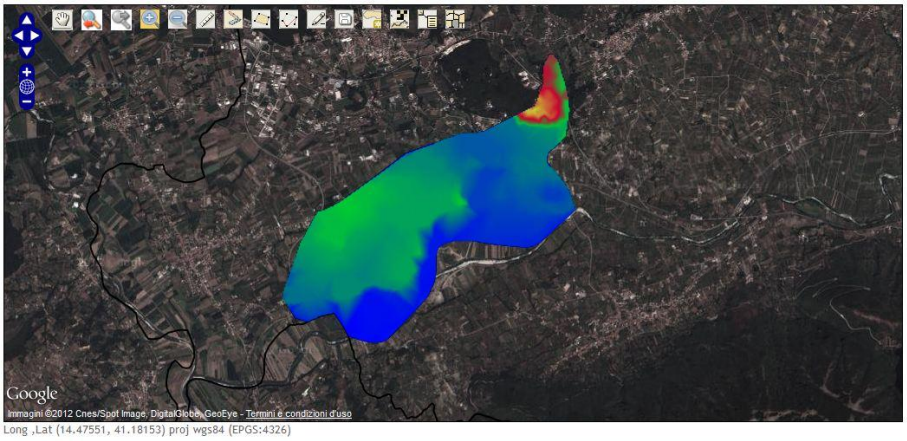


figure 5.24 – The mapping potential soil moisture stress dialog form

OUTPUT DATA

- Raster data of the potential soil moisture stress in the area of interest;
- table sheet which shows statistics potential soil moisture stress stored in database;
- PDF report.



TABELLE

id	area(ha)	media	minimo	massimo
1	995.8	1839.4	1747.8	1863.3

figure 5.25 – Raster data of the distribution of the potential soil moisture stress and data sheet of statistics.

SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

Mappatura dello stress idrico potenziale dei suoli Telese Terme

INFORMAZIONI SULLA SIMULAZIONE

Area d'nteresse: Telese Terme

Estensione della superficie: 995.8 [ha]

id	area (ha)	media (%)	dev_std (%)	minimo (%)	massimo (%)
1	995.6	17.5	10.3	10.0	21.0

figure 5.26 – Generated PDF Report

5.2.1.5 MAPPATURA DELLA RADIAZIONE SOLARE POTENZIALE (THE POTENTIAL SOLAR RADIATION MAPPING).

DESCRIPTION

The model evaluates the Mapping of the potential solar radiation

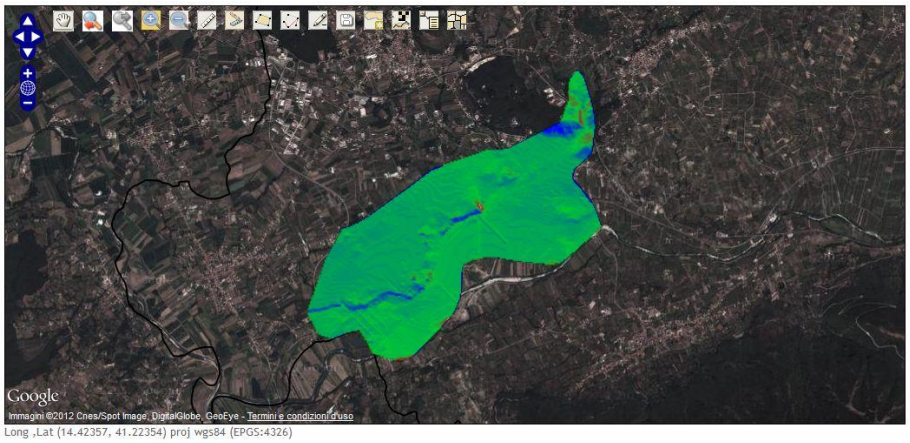
INPUT DATA

- area of interest;

figure 5.27 – The mapping of the solar radiation potential dialog form

OUTPUT DATA

- Raster data of the potential solar radiation in the area of interest;
- table sheet which shows statistics of the potential solar radiation stored in database;
- PDF report.



TABELLE

id	area(ha)	media(kwh/m^2)	minimo(kwh/m^2)	massimo(kwh/m^2)
1	995.8	1126.0	760.4	1266.1

figure 5.28 – Raster data of the distribution of potential solar radiation and data sheet of statistics.

id	area_mq	media	dev_std (KWh/m^2)	minimo (KWh/m^2)	massimo (KWh/m^2)
1	9957600	1126.0	513289.3	760.4	1266.1

figure 5.29 – Generated PDF Report

5.2.2 OLIVICOLTURA (OLIVE GROWING)

5.2.2.1 I SUOLI DEL TUO TERRITORIO OLIVICOLO (THE SOILS OF OLIVE LAND)

DESCRIPTION

The model evaluates the soils of your olive land.

INPUT DATA

- area of interest;

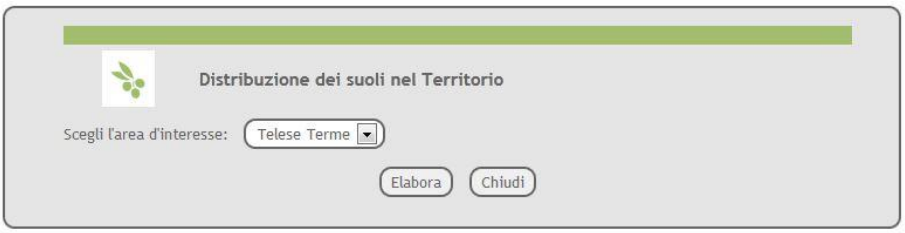
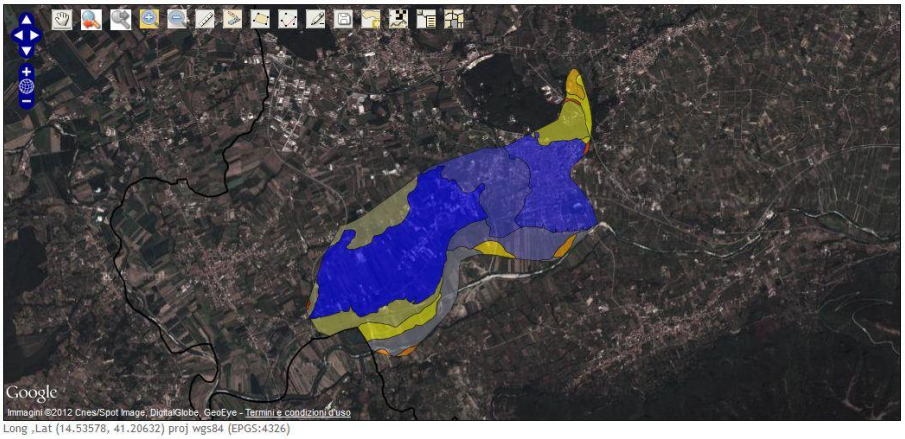


figure 5.30 – The soils of your land olive dialog form

OUTPUT DATA

- Vector data of the distribution of soils in the "terroir" of the area of interest;
- table sheet which shows statistics of the distribution of soils of your olive land (area [ha],mean,min,max), stored in database;
- PDF report.



Long ,Lat (14.53578, 41.20632) proj wgs84 (EPGS:4326)

TABELLE

id	suolo	area(ha)
133	Consociazione dei suoli Pera Tonda	345.51
121	Consociazione dei suoli Lago di Telese	154.24
65	Consociazione dei suoli Pezza del Lago	128.63
153	Consociazione dei suoli Ponte Cavallo	71.96
118	Consociazione dei suoli Calore	69.28

figure 5.31 – Vector data of the distribution of The soils of your olive land and data sheet of soil type with relative area.

SOILCONS-WEB
Progetto: LIFE08 ENV/IT/000408

Suoli del territorio olivicolo
Area d'interesse: Telese Terme

Aspetti Geografici

Superficie:	**995.8 [ha]**
Comune:	**Telese Terme (BN)**
Coordinate:	**41° 12' 30" N - 14° 30' 37" E**

I Suoli

Consociazione dei suoli Pera Tonda	**346.0 [ha]**	**34.7 %**
Consociazione dei suoli Lago di Telese	**154.2 [ha]**	**15.5 %**
Consociazione dei suoli Ponte Cavallo	**129.9 [ha]**	**13.0 %**
Consociazione dei suoli Pezza del Lago	**128.6 [ha]**	**12.9 %**
Consociazione dei suoli Calore	**69.3 [ha]**	**7.0 %**
Consociazione dei suoli Sperazzo	**62.1 [ha]**	**6.2 %**
Consociazione dei suoli Sotto la Ripa	**44.7 [ha]**	**4.5 %**
Associazione dei suoli Petrara, La Rocca	**37.5 [ha]**	**3.8 %**
Consociazione dei suoli Masseria la Grotta	**11.8 [ha]**	**1.2 %**
Associazione dei suoli Masseria la Grotta, Pera Tonda	**10.4 [ha]**	**1.0 %**
Consociazione dei suoli Masseria Marcatelli	**1.1 [ha]**	**0.1 %**

figure 5.32 – Generated PDF Report

5.2.2.2 MAPPATURA DELLA RADIAZIONE SOLARE POTENZIALE (SOLAR RADIATION POTENTIAL MAPPING).

DESCRIPTION

The model evaluates the potential solar radiation

INPUT DATA

- area of interest;

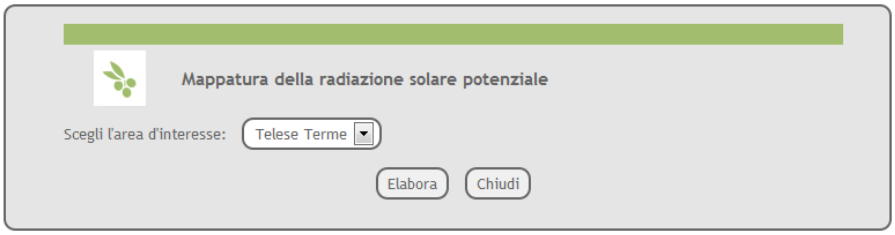
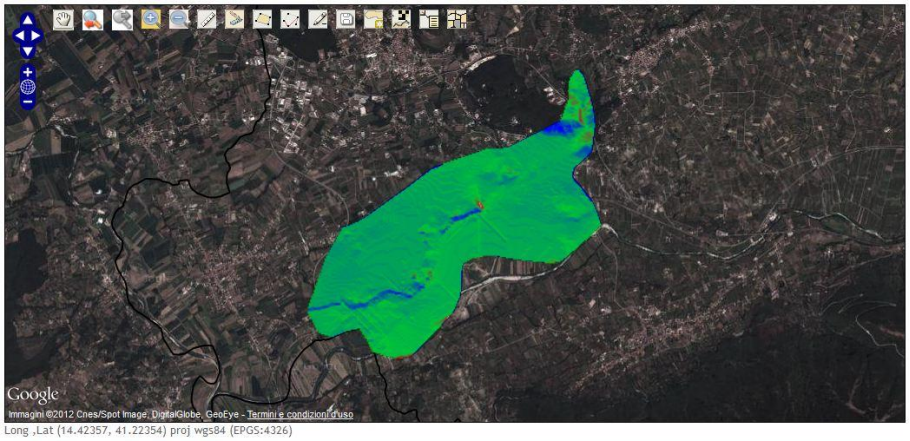


figure 5.33 – The mapping of the solar radiation potential dialog form

OUTPUT DATA

- Raster data of the potential solar radiation in the area of interest;
- table sheet which shows statistics of the potential solar radiation stored in database;
- PDF report.



id	area(ha)	media(kwh/m^2)	minimo(kwh/m^2)	massimo(kwh/m^2)
1	995.8	1126.0	760.4	1266.1

figure 5.34 – Raster data of the distribution of potential solar radiation and data sheet of statistics.

id	area_mq	media	dev_std (KWh/m^2)	minimo (KWh/m^2)	massimo (KWh/m^2)
1	9957600	1126.0	513289.3	760.4	1266.1

figure 5.35 – Generated PDF Report

6 BACK-END

A back-end interface is under development for registered users. This interface will enable users to manage data stored in the system:

- add/remove data (raster or vector);
- modify vector aspect in visualization;
- add metadata according to INSPIRE directive.

Nome	Pubblico	Tipo	Posizione	Campo di classificazione	Gruppo	Campi visibili	default
Uso Suolo CUAS 2009	true	2	cuas2009clip	label	4	null	true
DEM	true	3	DTM_20metri/dem	0	8	null	true
Sistemi di Paesaggio	true	2	life_suoli	sistemi	11	id,sistemi,sottosistemi, suoli,unita_cartografica	true
Comuni	true	2	confini_comunali	COMUNE	1	null	true
Litologia	true	2	carta_litologica	LITOLOGIA	3	null	true
Pedologia	true	2	carta_pedologica	SISTEMA	3	null	false
Uso Suolo Touring 54	true	2	uso_suolo1954_touring	ususuolo54	4	null	true
Uso Suolo CAUS 2001	true	2	cuas2001clip	CLASSE	4	null	true
Corine 2006	true	2	corine_cover_06	uso	4	null	true
Limite Area	true	2	limite_life	SUOLI	0	null	true
Orografia	true	3	OrografiaTerritorio/hillshade	0	0	null	true
Sottosistemi di Paesaggio	true	2	life_suoli	sottosistemi	11	id,sistemi,sottosistemi, suoli,unita_cartografica	true
Suoli	true	2	life_suoli	suoli	11	id,sistemi,sottosistemi, suoli,unita_cartografica	true
R Factor	true	3	r_factor/r	0	0	null	false
K Factor	true	3	k_factor/k	0	0	null	false
LS Factor	true	3	ls_factor/ls	0	0	null	false
C Factor	true	3	c_factor/c	0	0	null	false
Rusle	true	3	rusle/rusle	0	0	null	false
Psequence	true	6	rain/rain_cum_h24-%Y%m%d_00-idw2-160.asc	0	0	null	false
winkler	true	3	rusle/rusle	0	0	null	false
solare	true	3	rusle/rusle	0	0	null	false

figure 6.1 – back-end

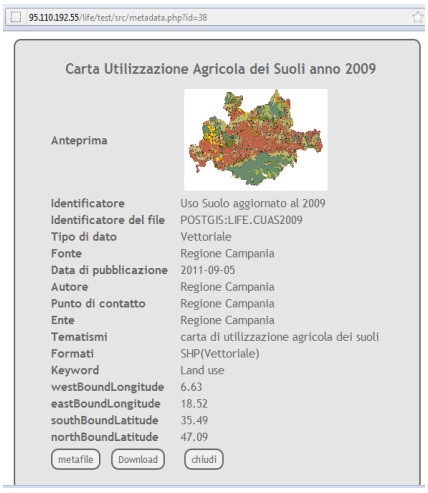


figure 6.2 – Displaying layer metadata stored in the systems

The storage of the ancillary information associated to each GIS data can be achieved according to UE directives (INSPIRE), only if all GIS DATA have a linked a metadata file.

As indicated in Art. 5, Member States shall ensure that metadata are created for the spatial data sets and services corresponding to the themes listed in Annexes I, II and III, and that those metadata are kept up to date. The creation and maintenance of metadata related to a series of spatial datasets, to spatial datasets, or to services related to such spatial datasets meet these requirements. These Implementing Rules do not require the documentation of individual spatial objects or attributes. As indicated in the Directive (Article 4-2) in case where multiple copies of the same spatial dataset are held by or on behalf of various public authorities, the Directive, and therefore these Implementing Rules, apply only to the reference version of the spatial dataset (i.e. that copy of a multiple-copied dataset which must be published under the conditions of the INSPIRE Directive) These Implementing Rules include the minimum set of metadata elements required to comply to Directive 2007/2/EC, and in particular to Articles 5 and 11 thereof.

This procedure track DATA and simplify manipulation in collaborative work.

Metadata are stored with the data in GIS DATA BASE and updated with their modification.

Ref.	Metadata elements	Multiplicity	Condition	Reason for inclusion
2.2.1.1	Resource title	1		Required by relevant European standards
2.2.1.2	Abstract	1		Required by relevant European standards
2.2.1.3	Resource type	1		As the Directive applies to both spatial datasets and spatial data services, this metadata element is necessary to identify the type of resource.
2.2.1.4	Resource Locator	0..*	Mandatory if a URL is available to obtain more information on the resource, and/or access related services.	Necessary link to additional information making it possible to inventory, and use the resources (Art 3-6)
2.2.1.5	Unique resource identifier	1		Unique Spatial Object Identifier (Art 8-2 (a))
2.2.1.7	Resource language	0..*	Mandatory if the resource includes textual information	Directive recognises the importance of multi-linguality (Art 8-2 (c))
2.2.2.1	Topic category	1..*		Classification of spatial data (Art. 11-2 (b))
2.2.3	Keyword	1..*		Keywords describing a resource (Art. 11-2 (a))
2.2.4.1	Geographic bounding box	1..*		Geographical location; (Art. 11-2 (e))
2.2.5	Temporal reference	1..*		Temporal domain; (Art 8-2 (d))
2.2.6.1	Lineage	1		Quality and validity of spatial data; (Art. 5-2 (c) and 11-2 (c))
2.2.6.2	Spatial resolution	0..*	Mandatory for datasets and dataset series if a unique equivalent scale or resolution distance can be specified	Contributes to assessment of Quality and Validity (Art. 5-2 (c) and 11-2 (c))
2.2.7	Conformity	1..*		The conformity of spatial data sets with the Implementing Rules referred to in Article 7(1); (Art. 5-2 (a) and Art. 11-2 (d))
2.2.8	Conditions for access and use	1..*		Conditions applying to access to, and use of, spatial data sets and services and where applicable, corresponding fees (Art. 5-2 (b) and 11-2 (f)).
2.2.9	Limitations on public access	1..*		Limitations on public access and the reasons for such limitations (Art. 5-2 (e))
2.2.10	Responsible organisation	1..*		Public authorities responsible for the establishment, management, maintenance and distribution of spatial data sets and services; (Art. 5-2 (d) and 11-2 (g))
2.2.11.1	Metadata point of contact	1..*		Required by relevant European standards
2.2.11.2	Metadata date	1		Art 5-1 requires that metadata are kept up to date
2.2.11.3	Metadata language	1		Directive recognises the importance of multi-linguality (Art 8-2 (c))

figure 6.3 – INSPIRE metadata for spatial data sets

7 HARDWARE SPECIFICATION

Two hardware platform are working:

- A developing platform located in ARIESPACE srl has the followed configuration: Intel Core i7-2600 3.40GHz; 3942MB Ram; Hd: 2x1 TB Raid 1.
- A dedicating server testing platform on ARUBA service which has the followed configuration: Intel Xeon 1.87GHz; 4047MB Ram; Hd: 2x500 GB Raid 1. The capabilities of testing platform is upgradable by contract with the server provider to better fitting to the needed of the test users.