B.10 Software for assessment and quantification of ecosystem services

Part 2

WebGIS Manual

Making Good Natura
LIFE+11 ENV/IT/000168

The project "Making Public Goods Provision the Core Business of Natura 2000" (project no. LIFE+11 ENV/IT/000168, CUP B81H12000580004) is cofinanced by the European fund LIFE+. It also enjoys funds provided by the Italian Environment and Agriculture Ministries.

The project is coordinated by:
Consorzio Universitario per la Ricerca Socioeconomica e per l'Ambiente (CURSA)
Via Palermo 37, I-00184 Rome
www.lifemgn-serviziecosistemici.eu

Report of action B.10:

Software for assessment and quantification of ecosystem services
Part 2: WebGIS Manual

Report compiled by:
Uta Schirpke, Claudio De Marco

Translation: Helen Ampt

Accademia Europea di Bolzano (EURAC)
Istituto per l'Ambiente Alpino
Viale Druso 1, I-39100 Bolzano
www.eurac.edu

© Bolzano, June 2015

Citation: Schirpke, U., De Marco, C. (2015) Software for assessment and quantification of ecosystem services. Part 2: WebGIS Manual. Report of the project Making Good Natura (LIFE+11 ENV/IT/000168), EURAC research, Bolzano, p. 20.

Project partners:

Index

Index of tables

Index of figures

1 Introduction

The LIFE+ project Making Good Natura (MGN) provides free simple access to the wealth of cartographic information it developed. It is a tool for communicating and sharing geospatial data with other users. Geographic or alphanumerical data can be found and images downloaded from the same interface using the search tool of WebGIS and a simple browser. The WebGIS system is a useful platform for local government, providing much environmental information about administrative areas, and also for citizens, providing them with details about their area.

The platform shows:

- **How to view one or more themes**
- **How to obtain information on visualised areas**
- **How to search by predefined questions**
- **How to save and print images**

The WebGIS system can be accessed in two ways:

- directly at: http://lifemgn.eurac.edu/

- from the LIFE+ MGN project website, clicking the "WebGIS" icon at the top of the home page.

2   Definitions of ecosystem services

2.1   Provisioning services

Provisioning services provide true goods such as food, water, timber, fibres, fuel and other primary materials, as well as genetic material and ornamental species.

Fresh water
Underground water, rainwater and surface water for domestic, industrial and agricultural use

Permanent and annual crops
Plants cultivated for food

Forage, pasture
Grassland for pasture and/or hay production for herbivores (mainly sheep, goats and cattle) and generally also for wild animals (such as deer)

Mushrooms, berries, non-woody products
Edible plant and non-plant species, such as mushrooms and berries, available to gather in largely forest areas

Raw materials (wood, fibres, etc.)
Wood available for harvest from forests for uses such as timber and firewood

Medicinal plants
Plants containing active substances useful for therapies or production of medicines

Genetic resources
Genes and genetic information useful for animal husbandry, crop improvement and biotechnology

Faunistic resources
Hunting and fishing provide food, skins and trophies, and may be recreational or commercial, or to manage/control species.

2.2 Regulation services

These ecosystem services regulate climate, air quality, water quality, soil formation, pollination and waste assimilation, as well as mitigating natural risks such as erosion and invasive species.

Biological control
Natural control of parasites and diseases transmitted by vectors (e.g. birds, bats, wasps, frogs, fungi) that attack plants, animals and persons
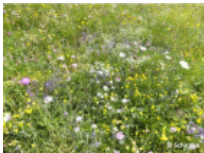
Habitat for biodiversity
Supply of environments with food, water and shelter, essential for the survival of animals. Ecosystems provide different habitats essential for the life cycle of species. Habitats that host a large number of species are genetically diverse and are known as *biodiversity hotspots*.
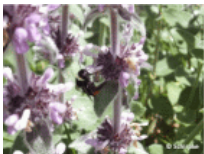
Pollination
Pollination is the main service provided by insects and is essential for the development of fruit, vegetables and seeds.
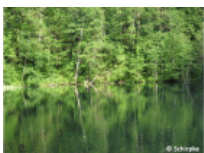
Flood mitigation
Wetlands absorb water and forests reduce surface run-off, buffering the effects of extreme events and preventing floods.
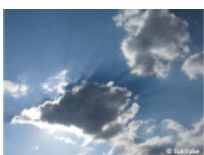
Erosion protection
Plant cover conserves soil (e.g. trees stabilise slopes and prevent leaching and erosion)

Water purification
Ecosystems filter and decompose organic residues and contaminants.

Air purification
Vegetation regulates air quality by filtering harmful airborne substances.

Water recharge
Ecosystems regulate surface flow of water, promoting recharge of aquifers and increasing water availability.

Carbon sequestration
Trees and plants capture and store greenhouse gases: as they grow, plants remove carbon dioxide from the atmosphere and store it in their tissues. Forest ecosystems are therefore carbon reserves.

2.3 Cultural services

Cultural services include immaterial benefits such as heritage, cultural identity, spiritual and intellectual enrichment, as well as aesthetic and recreational values.

Aesthetic value
Humans perceive beauty in the physical characteristics of nature.

Recreational value
Ecosystems offer possibilities for recreation and leisure.

Cultural value (inspiration for art, culture, education and the spirit)
Existential, aesthetic, spiritual and religious value is ascribed to ecosystems, landscapes, animals and plants.

3   Themes

The information in WebGIS is organised in groups of themes, each of which has various layers of information (e.g. administrative borders, Natura 2000 network, land cover) and corresponding specific data (Table 1). The **general cartography** provides general geographic information on all of Italy, both cognitive and descriptive. It therefore makes it possible to have both detailed and general (overall) knowledge of an area, providing a basic vehicle for visualising thematic results of the LIFE+ MGN project. MGN cartography (Figure 1) shows the results of analysis conducted in the framework of the project, divided into two main thematic areas:

1. Supply of ecosystem services
   - the ecosystem services considered (see Figure 2) were **quantified** in the **21 LIFE+ MGN pilot sites** and the results are reported in table form, since not all of them can be represented graphically on a map (layer 'LIFE+ MGN pilot sites' in Theme 3).
   - the supply of ecosystem services was **evaluated qualitatively** on a scale from 0 to 3, based on land cover (CORINE 2006), over the entire Italian **Natura 2000** network. With respect to the whole area of a site, the evaluation corresponds to a mean, weighted according to the areas of the various land covers present in the site (each cover has a different capacity to supply various services) and the results for all ecosystem services are shown in table form in the layers 'SCI', 'SPA' and 'SPA/SCI' of Theme 3.
   - on the other hand, Themes 4-6 map **supply capacity** for each service on the basis of single covers, represented as grades of colour, for the **entire Natura 2000 network of Italy**.
2. Potential beneficiaries
   This complex evaluation was only conducted for the services identified for the LIFE+ MGN pilot sites. Thus, the **areas of provenance of beneficiaries or the areas of enjoyment of the services** (Themes 7-9) can be visualised on a map.
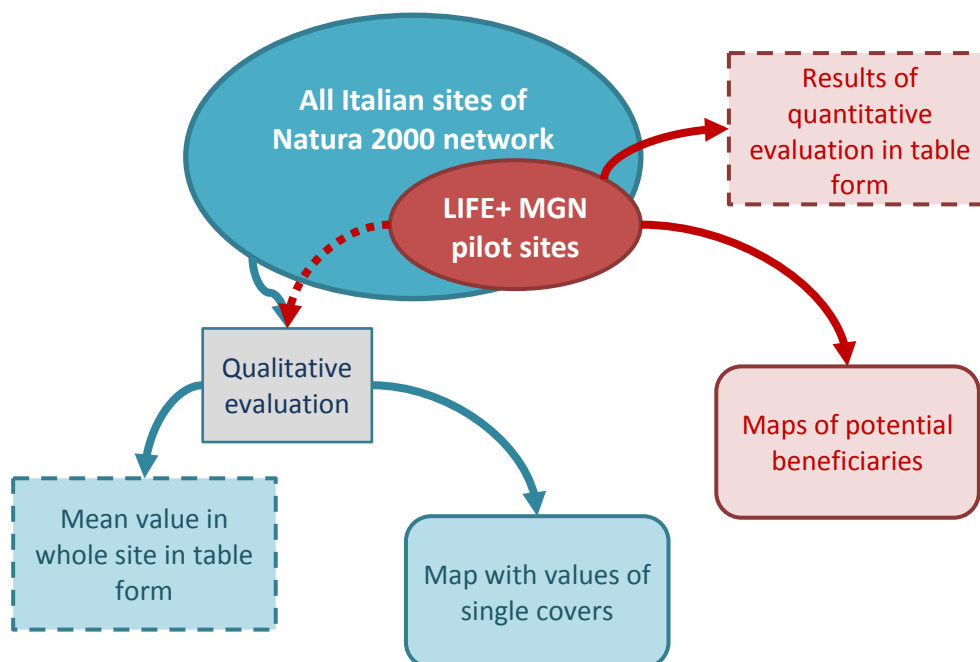
Figure 1: MGN cartography.

Table 1: Themes present in WebGIS

	Theme	Layer	Attributes	Description	Source
1.	Administrative borders	National borders Regional borders Provincial borders Municipal borders			ISTAT, 2011
2.	Nomenclature	Region names Province names Municipality names			ISTAT, 2011
3.	Natura 2000 network	LIFE+ MGN pilot sites	Site name Site code ES value	Results of quantification (supply, demand, monetary value) of selected ES (Figure 2). For details see report of Actions B4-9.	EEA, 2013a
		Sites of Community Importance (SCI)	Site name Site code ES value (all services)	Results of qualitative evaluation of potential supply in relation to cover areas (CORINE 2006) by site.[1] For details see report of Action A2.4.	
		Special Protection Area (SPA)			
		SPA/SCI			
		Biogeographic regions			EEA, 2013b
4.	Provisioning services	See section 2.1	Site name Site code CLC 2006 code ES value	Qualitative evaluation of potential supply in relation to land cover (CORINE 2006). For details see report of Action A2.4.	EEA, 2013c
5.	Regulation services	See section 2.2			
6.	Cultural ecosystem services	See section 2.3			
7.	Potential beneficiaries – provisioning services	See section 2.1			
8.	Potential beneficiaries – regulation services	See section 2.2	Number of beneficiaries	Potential beneficiaries for pilot sites[2] For method see report of Action A2.3	
9.	Potential beneficiaries – cultural services	See section 2.3			
10.	Land cover	LIFE+ MGN habitat pilot sites	Site name Site code Habitat		Regional partners
		Corine Land Cover 2006			EEA, 2013c
11.	Orthophoto	Orthofoto 2006			National Geoportal

ES: ecosystem service
CLC: CORINE land cover

---

[1] Evaluation scale: 3-high, 2-medium, 1-low, 0-not significant

[2] Potential beneficiaries are groups of persons or individuals who enjoy goods and services through active or passive consumption or through simply appreciating the existence of those servcies. If there are no beneficiaries, the natural elements or processes cease to be ecosystem services.

Figure 2: Ecosystem services selected for application of the MGN model in LIFE+ MGN pilot sites.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	RL			ERSAF									RS			PNCVD			PNP		PNSSS
	IT2040401	IT20A0402	IT20B0501	IT2020301	IT2020002	IT2070022	IT2070021	IT2070303	IT2040601	IT2040019	IT2040020	IT2070402	ITA020007	ITA020008	ITA060006	IT8050055	IT8050025	IT8050006	IT9310014	IT9310008	IT4090006
F1																					
F2	█							█						█							█
F3	█	█																█			█
F4			█									█									
F5								█								█	█				
F6																					
F7						█												█			
F8												█	█	█			█		█		█
R1				█		█	█									█					
R2																					
R3	█				█		█		█	█	█										
R4																					
R5										█	█					█					
R6		█	█		█																
R7																					
R8																					
R9																			█		
C1		█			█				█			█								█	
C2			█	█		█	█		█	█	█		█			█	█	█		█	
C3				█				█												█	

F1-Permanent and annual crops, F2-Forage, pasture, F3-Faunistic resources, F4-Raw materials, F5-Mushrooms, F6-Medicinal plants, F7-Genetic resources, F8-Fresh water, R1-Carbon sequestration, R2-Air purification, R3-Water recharge, R4-Water purification, R5-Erosion protection, R6-Flood mitigation, R7-Pollination, R8-Biological control, R9-Habitat for biodiversity, C1-Aesthetic value, C2-Recreational value, C3-Cultural value.

4 Map interface

A window with five elements appears on launching the application (Figure 3):

(1) Main window
The main window shows the map; the first image to appear is a map of Italy. By selecting levels, different maps and themes can be viewed.

(2) Toolbar
The toolbar contains navigation tools.

(3) Table of contents
The table of contents contains tools for viewing and searching under three tabs: levels, legend and search.

(4) Reference map
The red rectangle in the lower right indicates the area currently viewed in the main window. The size of the reference map can be modified by clicking the two hot keys below it to view the maximum extension of the map or the current view.

(5) Data bar
Data on the scale of visualisation (in metres), the projection and the coordinates of the cursor in the predefined reference system or in WGS84 latitude-longitude coordinates are shown in the lower left (data bar).

Figure 3: Elements of the map interface.
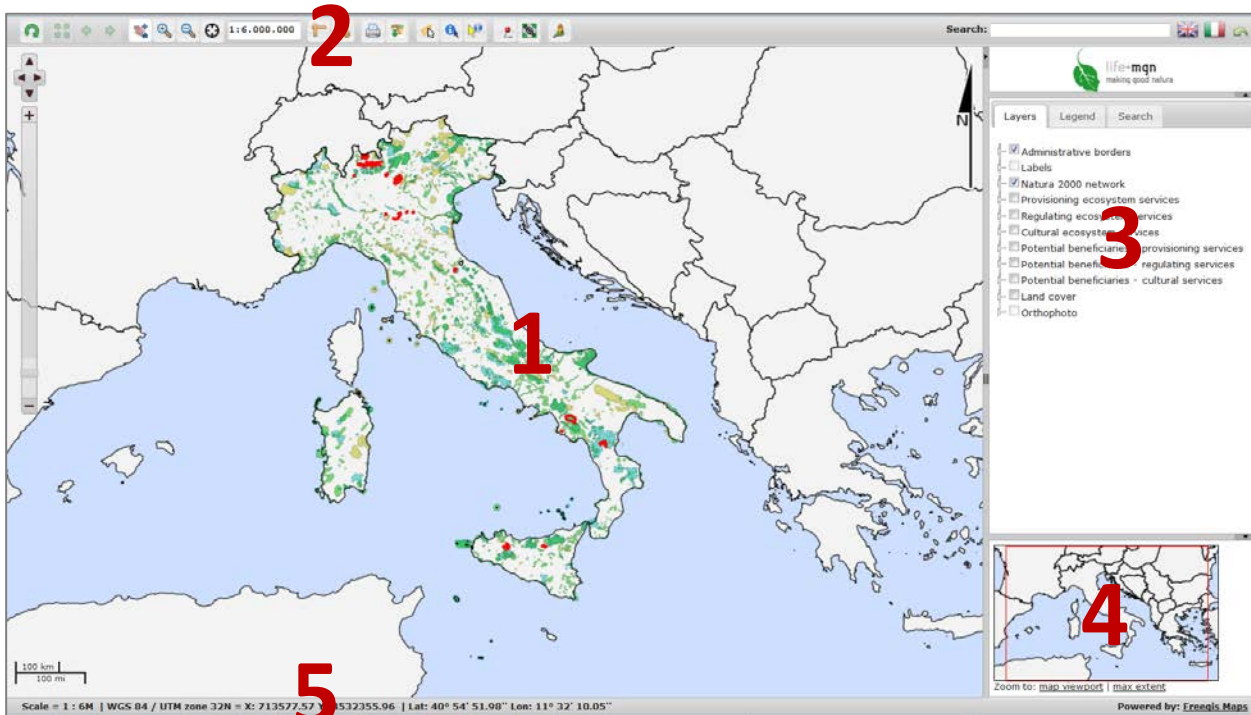
5 How to view one or more themes

Data can be visualised by choosing themes and area of interest. Certain themes can be visualised at all scales of representation, whereas others can only be viewed in certain intervals of scale: in such cases the checkbox cannot be clicked. This is because certain themes are not legible at certain scales: for example the administrative borders of municipalities are not indicated at scales greater than 1:50 000. The name of the layer is shown in grey when the data cannot be viewed at the current scale.

For simpler use, groups of themes may be open or closed. Clicking the symbol ⊞ opens the corresponding group and clicking ⊟ closes it.

Levels

To access the layers of the different themes, click the tab "Levels" and select the appropriate checkbox. The information layer is accessed by clicking the icon 𝒊 and the transparency/opacity of the layer is modified by clicking the tool icon 🔧. When the map is closed, the modifications are lost.

Note: certain themes can only be viewed at certain scales in order to avoid an excess of information that makes the image incomprehensible.
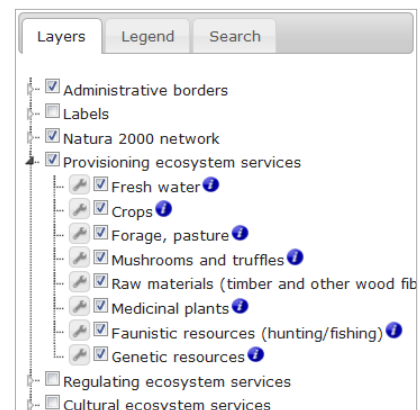
Legend

The layers have their own legends of colours and symbols. Legends are viewed by clicking the "Legend" tab in the table of contents. The legends of all the layers checked for viewing on the map are shown. If a layer is deactivated the legend does not appear. Next to the legend there is a slide bar for viewing all the themes.
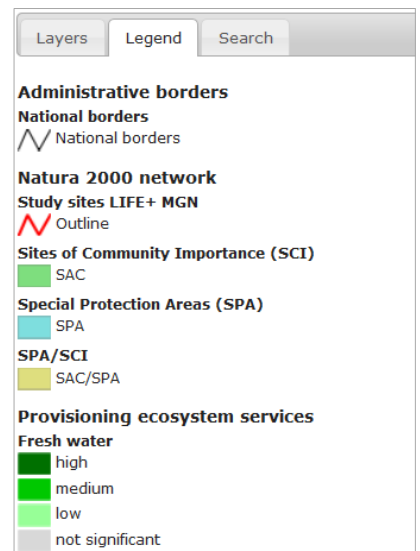
Example

View the qualitative evaluation of the ecosystem service "Fresh water".

Click the tab "Levels" in the table of contents and check the appropriate ecosystem service under "Provisioning services". In the main window a map appears showing areas with different capacity to supply the service in different colours, according to land cover (CORINE 2006). Potential supply of the ecosystem service is viewed opening the "Legend" tab.

Figure 4: How to select an ecosystem service, map and corresponding legend

6 How to obtain information on visualised areas

Objects on the map can be questioned interactively to obtain associated information using the information tools in the toolbar. If multiple layers are active (e.g. provisioning services and potential beneficiaries), the information of the two themes is shown in separate tables in the table of contents.

The toolbar shows two information icons:

	Info to obtain information about objects on the map, click or check the rectangle. The results are shown to the right of the map.
	Tooltip Information is obtained by activating this tool and placing the cursor on the element in question. Clicking the tool, a configuration panel opens: - choose whether or not close tooltip automatically; - indicate the layer about which information is desired. Move the cursor on the map to coincide with the object in question. The information is retrieved once the cursor is stationary for at least one second.

Example

To view ecosystem services quantified in a pilot site

Click "Levels" in the table of contents and select the theme Natura 2000 network. Then activate the information tool "Info" [icon] in the toolbar, drag it to the site of interest and left click. The "Data" tab opens in the table of contents; it shows the ecosystem services quantified by the project for the site. To enlarge, click [icon]. The data can be viewed in a table that opens in the main window, or may be downloaded as an Excel (.xls) file by clicking [icon].

Figure 5: Table of results in the main window accessed from the "Data" tab.

7 How to search by predefined questions

WebGIS offers the possibility of searching for areas of interest and viewing the land area identified. Besides the general position tools (zoom, pan), searches for areas of interest can be conducted by theme (e.g. pilot sites, MGN, habitat) using the guided search tool. The search, selection and information tools are only available for layers that can be searched or about which information is available.

Search
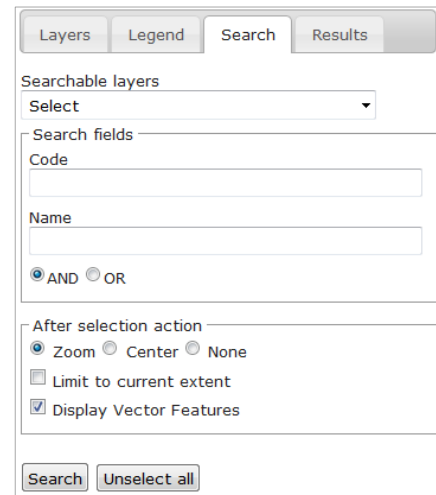
Through the "Search" tab in the table of contents, it is possible to select from the following search themes:

- LIFE+ MGN pilot sites
- Natura 2000 areas throughout Italy (SCI; SPA and SCI/SPA)
- Community habitats in pilot sites

After selecting the search theme, left click the empty field to see a drop down menu with the values in the WebGIS database (the values can be scrolled with the lateral scroll bar).

You can choose whether the search must meet all the search criteria selected (default) or at least one of them, and indicate what you wish to do after this selection:
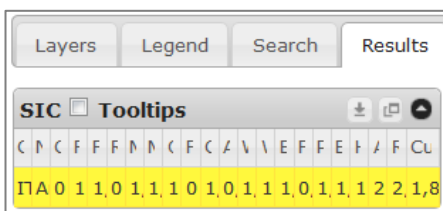
- viewing options: current view, zoom (default), centre, none
- whether (default) or not to view results on map.
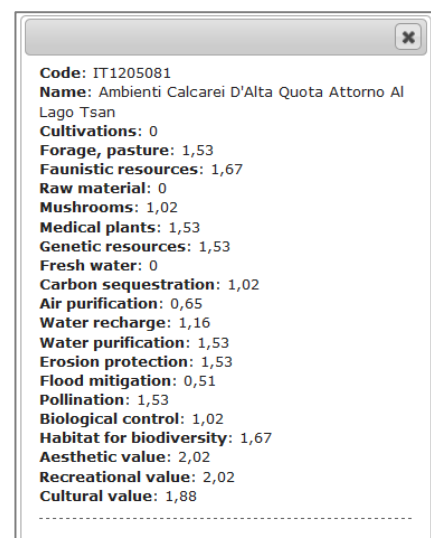
Search results

After a map search, the results appear in the "Data" tab and/or on the map. Passing the cursor over the results table, the corresponding object appears on the map. Alternatively you can click on the highlighted point to show the corresponding row in the results table. With the Tooltips checkbox checked, when you move the cursor over the list, a dialog box with corresponding information appears on the map.

The icon is for magnifying the results table.

The icon is for downloading the results table as a Microsoft Excel (.xls) file.

Example

Search a LIFE+ MGN pilot site

Click the "Search" tab in the table of contents and select the search theme "LIFE+ MGN pilot sites". Left click the empty field "Code" or "Name" to see a drop-down menu with the codes and/or names of the sites (these can be scrolled using the lateral scroll bar) and find the desired site. Then indicate whether the search must meet both criteria (default) or at least one, and click "Search".

Figure 6: How to enter the search in the "Search" tab and what appears on the map

8   How to save and print images

The image in the main window can be saved and/or printed using the buttons in the toolbar.

Print

This tool is for printing the map in HTML or PDF format.

When you click the "Print" button 🖨 in the toolbar, a dialog box opens that allows you to:
- Enter a title and date
- Choose whether to include the legend of the information layers viewed
- Choose paper orientation (horizontal or vertical) and the format (e.g. A4)
- Set a scale (the default scale is that of the map) and select a part of the map to print.

Save image

This tool is for downloading a georeferenced image (.tif) of what is visualised on the map.

When you click the "Download image" button 📥 in the toolbar, a dialog box opens that allows you to set a scale (the default scale is that of the map visualised) and select a part of the map to save.
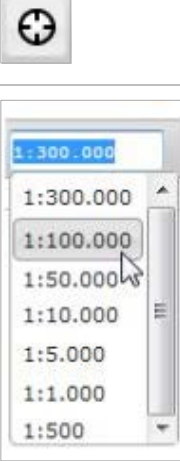
Example

Download the image of the ecosystem service "fresh water" in the site IT2070402 "Alto Garda Bresciano"

After finding the site in question (see section 7 "Search by predefined questions") and requesting information about the ecosystem service *fresh water* (see section 5 "View one or more themes"), click the button "Download image" 📥 in the toolbar and select the scale of the image, then click "Download".

9 Toolbar

|	
	Reload Click the button to reload the map, maintaining the current view.
	Zoom extension This tool becomes active after at least one zoom or pan operation. Its purpose is to return the view to the maximum extension of the map.
	Previous view This tool becomes active after at least one zoom or pan operation. Its purpose is to return to the previous view.
	Next view This tool becomes active after using the *Previous view* tool. Its purpose is to proceed to the next view/s, until the last zoom or pan effected.
	Pan This tool is for shifting the view on the map. Left-drag the map to the desired position. Drop to regenerate the map in the new position.
	Zoom-in This tool is for increasing the scale and hence detail of the map. It has two modes: - Click on the point to zoom in on. After an instant the scale doubles with the point at the centre of the map. - Click on the map and left-drag a rectangle on the area to magnify. Drop to regenerate the map with zoom on the selected area.
	Zoom-out This tool is for reducing scale. It has only one mode, which is the same as for simple magnification, described above.
	Zoom in present position
	Scale of visualisation This tool is for seeing and managing the zoom scale of the map visualisation. Click on the scale to select the text and open a drop-down menu, from which you can select a predefined scale or type a preferred scale in its place. Enter the typed scale as a whole number, e.g. 1000. When either of these operations is done, the map reloads at the selected scale. The new scale appears in the toolbar window.
	Measure length This tool is for measuring a distance on the map. Click one end of the polyline or segment

	that you wish to measure. Move the cursor and click again. The length is indicated in the information bar. With each further click, the total length of the polyline and that of the last piece are shown.
	Measure area This tool is for measuring an area on the map. Proceed as for length and at the end of the procedure double click. The area appears in the information bar.
	Print This tool is for printing the map in HTML or PDF format. Click on the tool to open a dialog box with the options: - Enter a title - Choose paper orientation (horizontal or vertical) - Choose paper size (e.g. A4) - Enter a date - Set a scale (the default scale is the current scale of the map).
	Download image This tool is for downloading a georeferenced image of everything visualised on the map.
	Select Click the tool to open a dialog box with the following options: - *Type of geometry*: refers to the shape of the field selected on the map (point, box/rectangle, polygon, circle). - *Levels*: to indicate what it is desired to obtain information on (all active levels, a chosen level). - *Action after selection*: to choose how to the selection is to appear on the map (zoom to optimal viewing scale, centre view on object, maintain current scale without changing view). - *Cancel selection*: to unselect a selection.
	Info This tool is for obtaining information about objects on the map. Click or select with a rectangle. The results appear to the right of the map.
	Tooltip This tool can be activated and dragged with the cursor onto an element to obtain information about it. Click on the tool to open a configuration panel for: - choosing not to automatically close tooltips - indicating the layer about which information is required. Move the cursor on the map over the object about which information is desired. The request for information is launched when the cursor is stationary for at least a second.

	Annotation This tool is for pasting notes with text on the map. They remain while the map is open and can be printed. Click on the tool to open a configuration panel for: - creating or cancelling notes - selecting the type of geometry to draw (lines, polygons, freehand and point). - entering text. Move the cursor to draw the geometric figure in the appropriate place. Once the figure has been digitised, if the option "add text" has been selected a window for the text opens. Click "Save" to save the note in the temporary memory of the map and to add it as a layer; click "Cancel" to eliminate the note. Saving enables the note to be printed.
	Street View This tool is for defining the position and direction of vision of Google Street View directly on the map. Click on the point of view, indicate the direction and double click.
	Help This tool opens a window with a brief manual of the basic navigation tools.

10 References

EEA (2013a) Natura 2000 data - the European network of protected sites. http://www.eea.europa.eu/data-and-maps/data/natura-3

EEA (2013b) Biogeographical regions. http://www.eea.europa.eu/data-and-maps/data/biogeographical-regions-europe#tab-gis-data

EEA (2013c) Corine Land Cover 2006 seamless vector data. http://www.eea.europa.eu/data-and-maps/data/clc-2006-vector-data-version-3#tab-gis-data

ISTAT (2011) www.istat.it/it/archivio/104317#accordions

National Geoportal. WMS services. http://www.pcn.minambiente.it/PCNDYN/catalogowms.jsp?lan=it