



PRELIMINARY REPORT OF SEA & EIA TOOL FOR LANDSUPPORT PROJECT

Task 1.1

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Preliminary report of EIA and SEA tool for LANDSUPPORT project (Task 1.1)

1. Legislative introduction

The Environmental Impact Assessment (EIA) was introduced in Europe by Council Directive 85/337/EEC and subsequently updated with Directive 2014/52/EU.

The Strategic Environmental Assessment (SEA) was established by Directive 2001/42/EC “for integrating environmental considerations into the preparation and adoption of certain plans and programmes which are likely to have significant effects on the environment in the Member States because it ensures that such effects of implementing plans and programmes are taken into account during their preparation and before their adoption”. The main differences between the two instruments is evaluated here: the EIA is a procedure that aims to assess public and private projects, whereas the SEA is a process used at policy, planning and programming levels. Moreover, the latter is carried out *during* the preparation of a plan or programme and before its adoption or submission to the legislative procedure.

2. Procedural schemes and documental contents

The procedural schemes of both evaluations have many similarities and can be summarized as follows:

- Screening phase
- Elaboration of **Environmental Impact Assessment Report (EIA)** or **Environmental Report (SEA)** in which the impact that the project, plan or programme might have on the environment or on cultural heritage is described and evaluated. The work may be preceded by a phase of consultation between the proposer and the evaluating Authority during which the contents of the document are identified and defined (Scoping phase)
- Public consultation
- Evaluation of the adequacy of the report
- Final decision
- Monitoring

Table 1 shows the main contents required in the Environmental Impact Assessment Report (EIA) or Environmental Report (SEA):

EIA (Environmental Impact Assessment Report) text (partly rearranged) by <i>Dir. 2014/52/EU, ANNEX IV (Information for the environmental impact Assessment Report)</i>	SEA (Environmental Report) text (partly rearranged) by <i>Dir. 2001/42/CE, ANNEX I (Information referred to in Article 5)</i>
<p>1. Description of the project including location, physical characteristics of the project as a whole, the main characteristics of the operational phase, an estimate of expected residues, emissions and waste produced during the construction and operation phases;</p> <p>2. A description of reasonable alternatives (for example in terms of project design, technology, location, size and scale), which are relevant to</p>	<p>(a) an outline of the contents and main objectives of the plan or programme and relationship with other relevant plans and programmes;</p> <p>(b) the relevant aspects of the current state of the environment and the likely evolution thereof should the plan or programme not be im-</p>

<p>the proposed project and its specific characteristics and have been studied by the developer, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;</p> <p>3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof should the project not be implemented, in so much as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge;</p> <p>4. A description of the factors specified in Article 3 that are likely to be significantly affected by the project (population, human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage, including architectural and archaeological aspects, and landscape);</p> <p>5. A description of the likely significant effects of the project on the environment (resulting from construction, the use of natural resources, emissions, the risks to human health and cultural heritage, impact on climate etc.);</p> <p>6. A description of the forecasting methods or evidence used to identify and assess the significant effects on the environment, including details of difficulties encountered when gathering the required information and the main uncertainties involved;</p> <p>7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset and should cover both the construction and operational phases;</p> <p>8. A description of the expected significant adverse effects of the project on the environment due to the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned;</p> <p>9. A non-technical summary of the information provided under points 1 to 8;</p> <p>10. A reference list detailing the sources used for the descriptions and assessments included in</p>	<p>plemented;</p> <p>(c) the environmental characteristics of areas likely to be significantly affected;</p> <p>(d) any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of special environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;</p> <p>(e) the environmental protection objectives, established at international, Community or Member State level, that are relevant to the plan or programme and the way these objectives and any environmental considerations were taken into account during its preparation;</p> <p>(f) the likely significant effects on the environment, including aspects such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage (not forgetting architectural and archaeological heritage), and landscape, as well as the interrelationship between these factors;</p> <p>(g) the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects implementation of the plan or programme might have on the environment;</p> <p>(h) an outline of the reasons for selecting between the alternatives dealt with and a description of how this assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in gathering the required information;</p> <p>(i) a description of the measures envisaged concerning monitoring in accordance with Article 10;</p> <p>(j) a non-technical summary of the information provided under the above headings.</p>
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the report.

Table 1. Contents requested in EIA and SEA document

3. Landsupport goals

There is a range of software that can provide the editors of the EIA and SEA documents and the Authorities responsible for their assessment with spatial information and impact measurement, often in specific relation to the different activities of a company or a sub-fund (emissions from a landfill area, impacts deriving from quarrying, etc.). Such software can operate in a circumscribed territorial area affected by regional or local regulations, so meeting the needs of a specific legislative context, and is designed for the compilation of EIA and SEA documents. The LANDSUPPORT-DSS does not intend to replicate the already existing instruments but aims to support the experts and the Authorities involved in the EIA and SEA procedures by providing geospatial elements which may help obtain an organic and integrated vision of the territory, its physical characteristics and the interactions between the factors that compose it. This holistic approach assumes great relevance when analyzing the Soil-Plant-Atmosphere system. Moreover, with the “on-the-fly” elaboration from what-if modelling, it is possible to visualize real-time scenarios through simulations which may provide a more complete analysis of potential project, plan or programme alternatives.

4. Potential use of Landsupport

The first possible use of Landsupport refers to those documents which are concerned with the construction of the baseline scenario of the area affected by a project, plan or programme, on different scales depending on the purpose of the specific intervention, in order to provide a representation of the state of the territory under evaluation. The information obtained is used with the aim of identifying the sensitivity and criticality of the environmental context which is important also in the scoping phase. Table 2 shows the references to the baseline scenario included in the contents requested in the EIA and SEA documents:

Environmental Impact Assessment Report (EIA)	Environmental Report (SEA)
3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution there should be no implementation of the project, in so much as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge;	(b) the relevant aspects of the current state of the environment and the likely evolution thereof should there be no implementation of the plan or programme;
4. A description of the factors specified in Article 3 likely to be significantly affected by the project (population, human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage (including architectural and archaeological as-	(c) the environmental characteristics of the areas that are likely to be significantly affected;

pects), and landscape);	
	(d) any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a special environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;

Table 2. Extract from Table 1.

The relevant environmental components analyzed are:

- Atmosphere (air and climate)
- Water (hydrology and hydrogeology)
- Soil and subsoil
- Ecosystems, vegetation, flora and fauna
- Anthropic ecosystems and socio-economic aspects
- Landscape, cultural heritage and historical aspects

The Landsupport interface allows selection of the area under study by using administrative limits, cadastral data or by its being designed directly onto the geo-referenced map on the dashboard; by clicking on the "Environmental Features" button a pdf file (portable document format) will be automatically downloaded which will provide synthesized, quali-quantitative information obtained from analysis of the thematic maps and the time series present in the system. The data contained in the file includes geographical aspects (surface data, municipalities included in the selected area, average altitude, exposure, etc.) and climatic data, as well as information on geology, pedology, land use and any restrictions present in the selected territory. Table 3 shows the parameters that may be calculated by using Landsupport in relation to the main environmental components.

Environmental Features	Landsupport
Atmosphere	cumulative rainfall and monthly average, average temperature, average solar radiation
Water	hydrology and hydrogeology
Soil and subsoil	lithological typologies and their incidence, types of soils and their characteristics, incidence and surface, vulnerability to nitrates, hydrogeological risk
Ecosystems, vegetation, flora and fauna	land use, biodiversity indices
Anthropic ecosystems and socio-economic aspects	evolution of land take, agricultural SPRAWL indices, population data
Landscape, cultural heritage and historical aspects	landscape and conservation restrictions

Table 3. Landsupport parameters

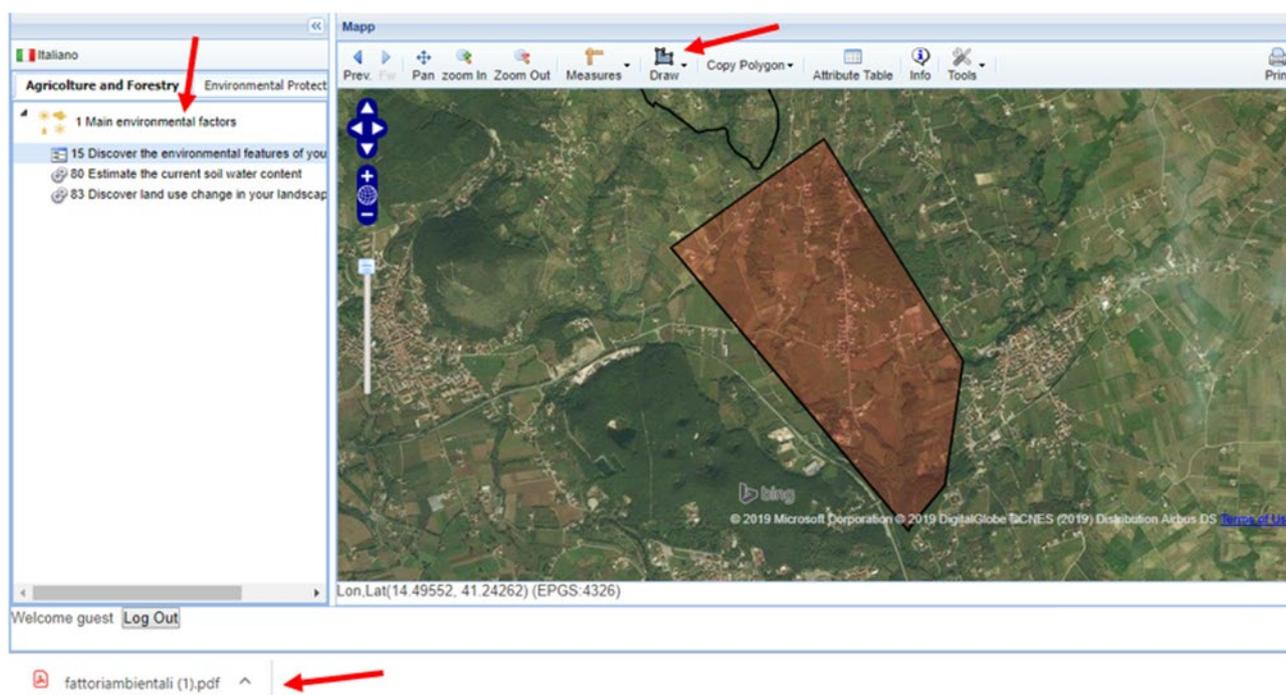


Figure 1 Snapshot of main features of EIA/SEA tool from LANDSUPPORT prototype platform

Main environmental features
Area of interest : DEMO1

Geographical features

Surface area:	216.5 [ha]
Municipality:	Castelnuovo (BN)
Coordinates of the center of the area:	41° 54' 10" N - 54° 31' 55" E

The landscape

Elevation (average):	120 [m s.l.m.]
Slope (average):	13 %
Aspect (average):	South-West (217)

The Climate

Annual rainfall:	Average : 1125.0 [mm]		
Annual Temperature:	Average : 15.1 °C	Min : -7.9 °C	Max : 29.6 °C
Rain (last recorded event):	Average : 6.0 [mm]		
Temperature (last recorded event):	Average : 11.8 °C	Min : 0.0 °C	Max : 23.6 °C

Geology

Calcareniti	91.6 [ha]	42.3 %
Igimbriti	66.7 [ha]	30.8 %
Sabbie e ghiaie di piano alluvionale	29.0 [ha]	13.4 %
Igimbriti	15.0 [ha]	6.9 %

Legal restrictions

No sites of European Importance for Conservation (SAC)

No sites concerning Special Protection Areas (SPA)

Legal restrictions (more)

Soil Use and Cover 1954/2011

Vigneti	61.8 [ha]	28.5 %
Vigneti consociati - Sistemi culturali complessi a netta dominanza di vigneti intercalati in minima misura da oliveti o altre colture		
	28.0 [ha]	12.9 %
Oliveti	21.7 [ha]	10.0 %
Bochi di tipo illirico-submediterraneo e prevalenza di querce caducifoglie con Quercus pubescens e/o Quercus cerris		
	16.8 [ha]	7.8 %
Bochi a prevalenza di castagno		
	16.5 [ha]	7.6 %
Vegetazione erbacea ed arborea in evoluzione - Elementi lineari del paesaggio inseriti nello spazio rurale		
	12.9 [ha]	5.9 %

Soils

Associazione dei suoli Patera, La Rocca	66.2 [ha]	30.6 %
Associazione dei suoli Masseria la Grotta, Pare Tonda	63.6 [ha]	29.4 %
Associazione dei suoli Masseria la Grotta	39.1 [ha]	18.1 %
Associazione dei suoli Masseria Marcellini	15.2 [ha]	7.0 %

Soil description

Figure 2 Example of report outputs from EIA/SEA tool of LANDSUPPORT prototype platform

The choice between project, plan or programme alternatives and their evaluation is more complex. Especially in Strategic Environmental Assessment, the "zero option" is often the only alternative considered as a consequence of the lack of an organic and perspective vision due to the complexity of factors making up the territory "system".

The what-if modelling allows the examination of the spatial data and environmental parameters which enable the visualization and evaluation of alternative scenarios; the

system allows the measurement and comparison of some of the effects produced as a result of the various alternatives considered.

Moreover, the difficulty in finding the information necessary to evaluate Ecosystem Services, as well as their complex quantification, is one consequence of a marked lack of an exhaustive, evaluable and comparable set of alternatives for an efficient environmental assessment.

In Table 4 are quoted the key elements occurring in the EIA and SEA directives referring to the need of evaluating different project (plan or program) alternatives:

Table 4. Extract from Table 1

Environmental Impact Assessment Report (EIA)	Environmental Report (SEA)
2. A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, as well as an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;	(h) an outline of the reasons for selecting the alternatives dealt with and a description of how the assessment was undertaken, including any difficulties (such as technical deficiencies or lack of know-how) encountered in gathering the required information;

By using models and specific inputs for each of the different selected areas, Landsupport allows calculation of the Ecosystem Service values in order to quantify and compare the effects of the various alternatives considered. This also applies for the vulnerability of the territory analyzed. Depending on the areas affected by the intervention and their location, the models will calculate, through the platform geospatial data, parameters, such as equivalent grain production loss, loss of biodiversity, loss of organic matter or loss of hydrological functions of the soil, in relation to historical and simulated time series. More specifically, the Ecosystem Services that can be assessed through Landsupport are:

Table 5. Ecosystem Services and Indicators according to ISPRA (2018)

Ecosystem Services	Indicators
Carbon sequestration	Potential loss of organic substance, above-ground carbon stock
Habitat quality	Biodiversity indices
Agricultural production	Potential loss of equivalent wheat production
Forest biomass production	Above-ground biomass
Protection against soil erosion	Interactive estimate of potential soil erosion
Water availability	
Regulation of the hydrological regime	Loss of soil hydrological functions

In the following demonstrative example, the effects of a new urban development are assessed by hypothesizing the 100% soil impermeabilization of two selected areas with the same shape and the same surface, but different geographical locations:

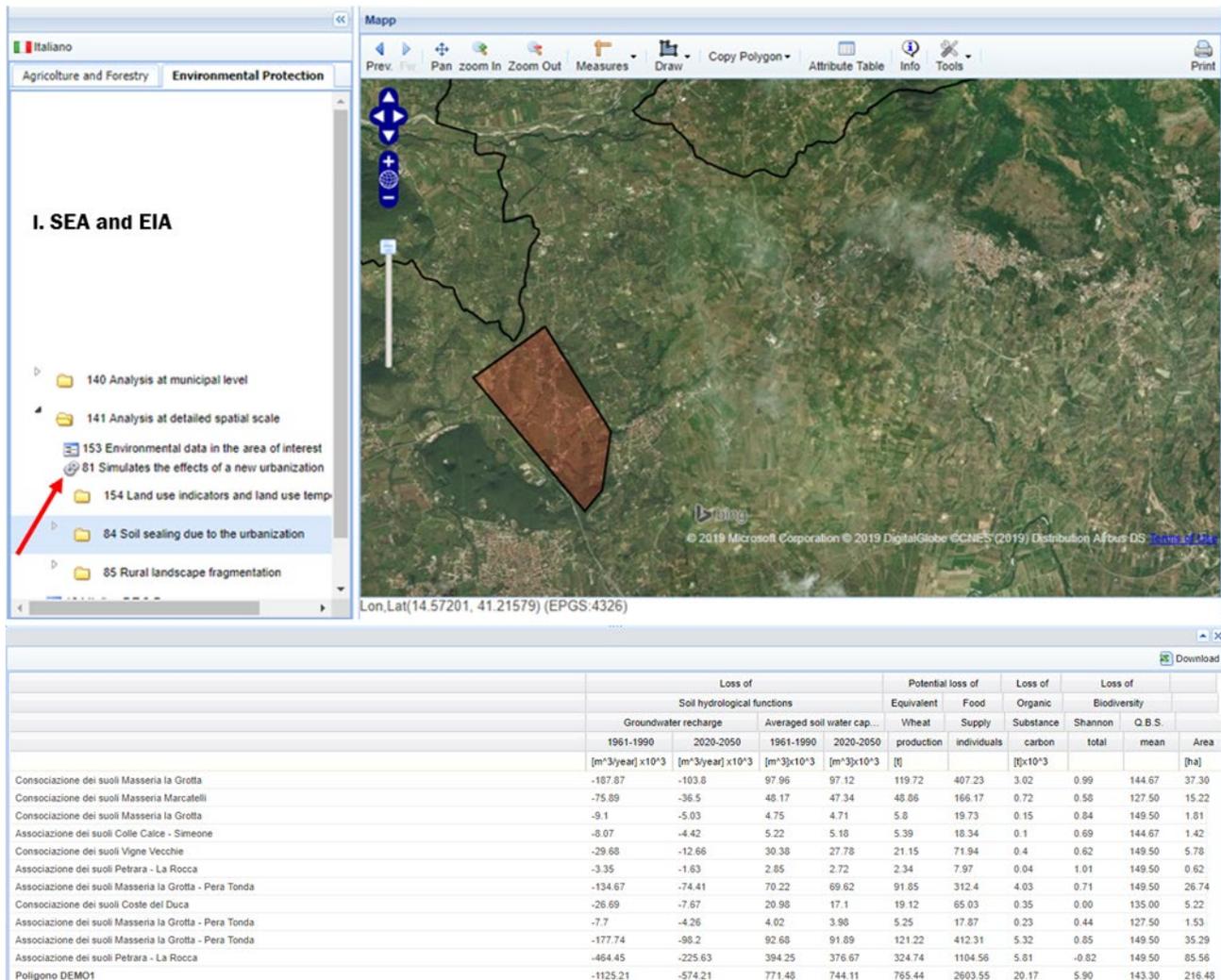


Figure 3 Simulation of the new urbanization effects of Alternative 1.

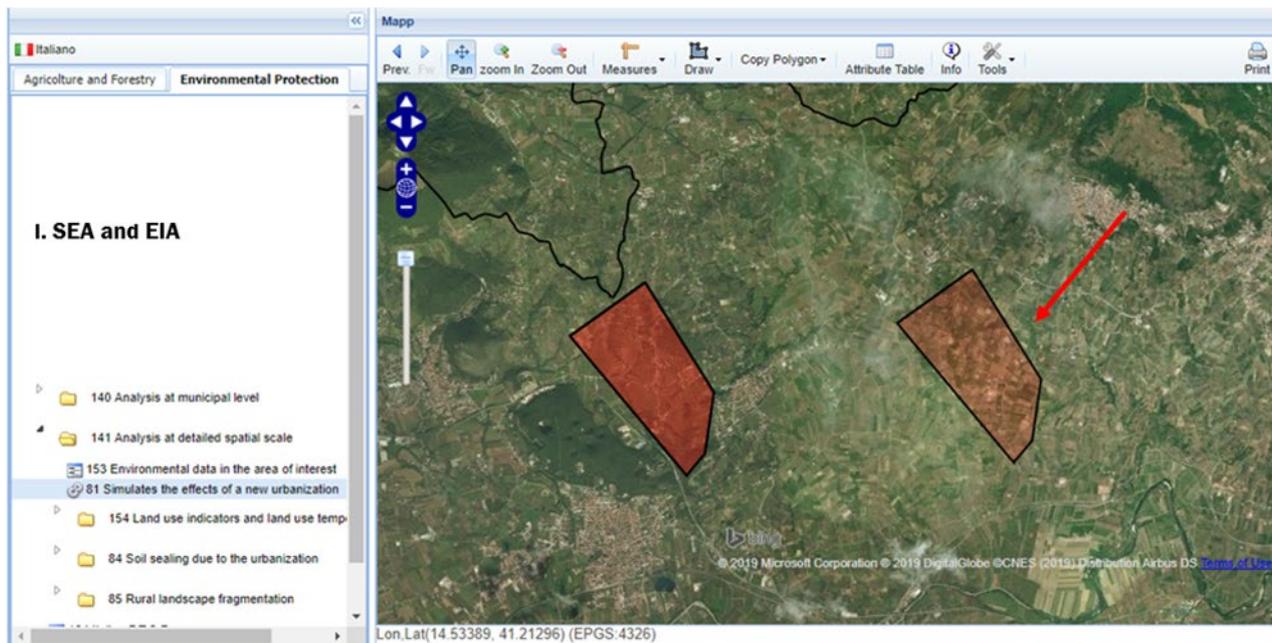


Figure 3 Simulation of the new urbanization effects of Alternative 2, part 1

	Loss of				Potential loss of		Loss of	Loss of	Area [ha]	
	Soil hydrological functions				Equivalent	Food	Organic	Biodiversity		
	Groundwater recharge		Averaged soil water cap...		Wheat	Supply	Substance	Shannon		Q.B.S.
	1961-1990	2020-2050	1961-1990	2020-2050	production	individuals	carbon	total		mean
	[m ³ /year] x10 ³	[m ³ /year] x10 ³	[m ³]/x10 ³	[m ³]/x10 ³	[t]		[t]x10 ³			
Consociazione dei suoli Padulo dello Oro	-24.85	-15.01	24.19	22.72	18.43	62.7	0.9	0.63	120.50	5.04
Consociazione dei suoli Taverna Starze	-143.17	-71.96	122.98	118.05	97.15	330.46	2.39	0.33	120.50	26.54
Associazione dei suoli La Cerasa - Toppo Verzianni	-302.41	-191.5	256.14	253.53	238.76	812.11	6.51	0.76	120.50	62.91
Consociazione dei suoli Candro	-88.61	-26	95.45	93.58	0	0	0.54	1.02	120.50	16.11
Consociazione dei suoli Pennine	-88.66	-54.45	82.2	80.83	0	0	2.31	0.67	120.50	17.30
Consociazione dei suoli Padulo dello Oro	-83.4	-50.39	81.2	76.25	61.87	210.46	3.03	0.58	120.50	16.90
Consociazione dei suoli Padulo dello Oro	-58.07	-35.09	56.53	53.09	43.08	146.54	2.11	0.54	120.50	11.77
Consociazione dei suoli Pennine	-150.12	-82.19	139.18	136.87	0	0	3.91	0.68	120.50	29.29
Associazione dei suoli Codacchio - Monaci	-165.5	-103.62	73.78	74.4	105.25	357.98	0.44	0.74	120.50	30.64
Poligono DEMO2	-1104.79	-640.21	931.65	910.12	564.54	1920.25	22.14	5.94	120.50	216.49

Figure 4 Simulation of the new urbanization effects of Alternative 2, part 2

The values relating to the different project hypotheses, presented in a table and exportable in Excel, allow an immediate qualitative and quantitative comparison of some of the expected effects, which is useful for measuring the loss of Ecosystem Services. The results will validate the choice made or will allow the creation of new alternatives which are more efficient in relation to environmental aspects. In addition, through the basic webGIS functions and the territorial themes contained in the platform, it is possible to know about further elements which might be of use for the evaluation of alternatives, such as distance from residential areas, distance from protected areas, road network, etc. There are also numerous graphic applications that allow the results obtained to be integrated, so providing an immediate representation of landscape integrity and its evolution over the years, of interest for such thematic areas as the land use change matrix, the time-based interactive mapping of land use, interactive mapping of rural land fragmentation and agricultural sprawl index.

The main advantages of the DSS in the environmental assessment are evident in terms of the possibility to obtain a more objective evaluation of the parameters relating to the physical territory and the visual presentation of complex data in order to foster communication and understanding among the interested parties. However, Landsupport, like Decision Support Systems in general, cannot be considered to be an exhaustive tool or to provide definitive answers, but, rather, a means to facilitate users in making decisions that take into account as many factors, and their interactions, as possible. Moreover, it should also be remembered that the accuracy of the results obtained by the models is dependent upon the accuracy, quality and detail of the starting data.

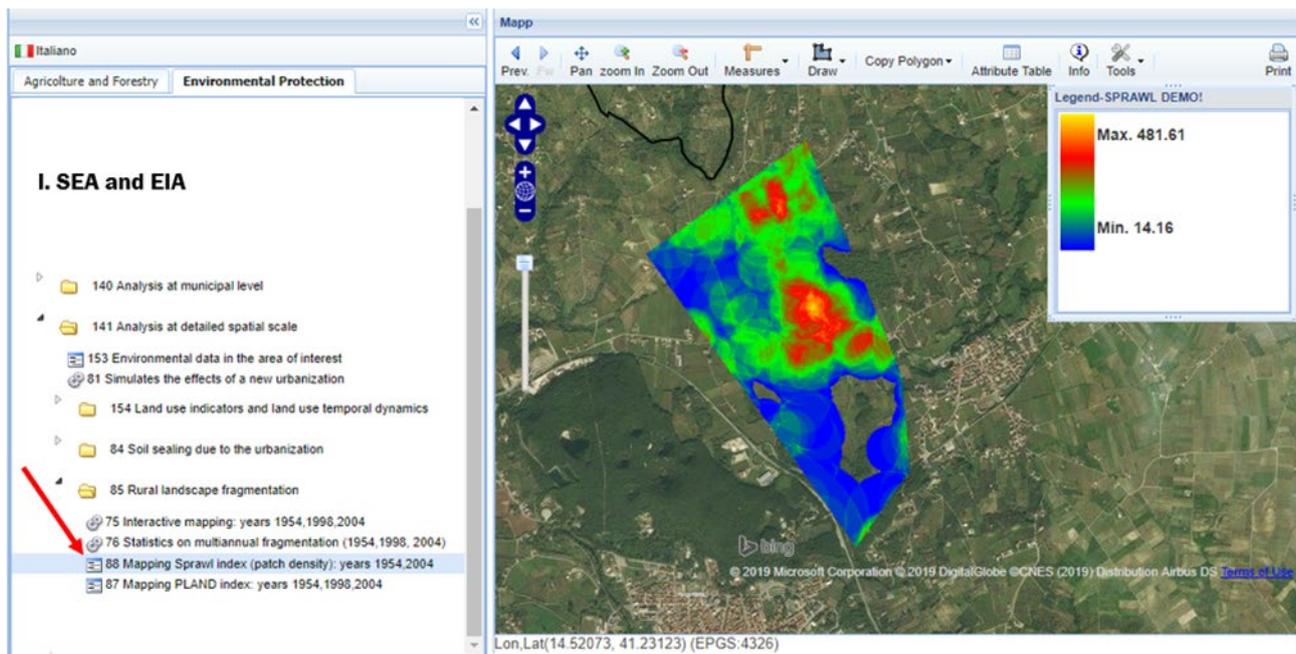


Figure 5 Mapping of agricultural SPRAWL index