



CD-ETA
Interreg Europe



European Union
European Regional
Development Fund

Digitization of Natural Heritage

Framework, Methodology, Standards, Best Practices

Margherita Azzari
Associate Professor
University of Florence

Franca Fauci
P. R. Manager
Foundation for Research and Innovation

Valencia and Alzira, Valencia Region - Spain

31st January, 1st and 2nd February 2017

Digitization of Natural Heritage Framework



What is Natural Heritage?

Natural heritage refers to the total sum of the elements of biodiversity, including flora, fauna and ecosystem types, together with associated geological structures and formations (geodiversity). Heritage is that which is inherited from past generations, maintained in the present, and bestowed upon future generations.

According to the UNESCO World Heritage Convention (1972) Natural Heritage includes:

- **natural features** consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view;
- **geological and physiographical formations** and precisely delineated areas which constitute the **habitat of threatened species of animals and plants** of outstanding universal value from the point of view of science or conservation;
- **natural sites** or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

To be included in the World Heritage List a feature, site or area must be of outstanding universal value.

What is Natural Heritage?

The Italian law (Codice Urbani, art 142) protects:

- a) its coastline (up to 300 meters from the shore line);
- b) territories bordering lakes (300 meters from the shore line);
- c) rivers, streams, waterways;
- d) mountains (the Alps: over 1,600 meters above sea level; the Apennines and the Islands: 1,200 meters above sea level);
- e) glaciers and glacial cirques;
- f) parks, national or regional reserves, and buffers outside parks;
- g) forests and woodlands;
- h) areas assigned to agricultural universities and encumbered by civic uses;
- i) wetlands;
- l) volcanoes.

Furthermore, it also protects landscape heritage (Codice Urbani, art 136):

- a) things that have traits of considerable natural beauty or geological singularity;
- b) villas, gardens and parks which are distinguished by their uncommon beauty;
- c) properties having aesthetic or traditional value;
- d) scenic landscapes or viewpoints accessible to the public, from which one can enjoy the sight of these attractions.

What is Natural Heritage?

The definition of natural heritage given in the Convention is based on a "naturalistic" vision of protected areas as "nature sanctuaries" which began in the USA. According to this point of view, vast areas remained almost "intact", completely lacking in any human presence or alterations and so will be preserved for future generations because their high environmental value.

This concept can be easily applied in America, Africa and Oceania, but with greater difficulty in Europe and in Italy, where the whole territory is the result of process of human transformation.

However, the definitions of the original text of the Convention have been then integrated (Operational guidelines) with other categories:

- **Mixed Cultural and Natural Heritage** (if a site satisfy a part or the whole of the definitions of both cultural and natural heritage laid out in Articles 1 and 2 of the Convention)
- **Cultural landscapes** are cultural properties and represent the "combined works of nature and of man" designated in Article 1 of the Convention. They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal.

What is Natural Heritage?

Cultural heritage should be kept distinct from the concept of landscape (or natural/environmental) heritage. Although similar in ratio, in the Urbani Code they are considered separately both in terms of notion and in terms of legal systems.

It is therefore essential to be aware of the different definitions of natural heritage as intended in the existing legislation at the local, national, and international levels; because, from these, derive obligations that can also affect natural heritage digitization activities. It is also equally important to reach a shared definition as the basis for the definition of standards.

Last but not least, one of the consequences of digitization is the evolution of a new type of rights. The reason for this is because digitization is a cross between institutional and interdisciplinary processes. It combines institutions, technology labs, and policy makers/managers, whose legal concerns are very different.

State of Art

In the last few years considerable attention has been devoted by the European Institutions to projects promoting the increase, use, sharing and distribution of data concerning European natural heritage and landscapes in multidisciplinary approaches.

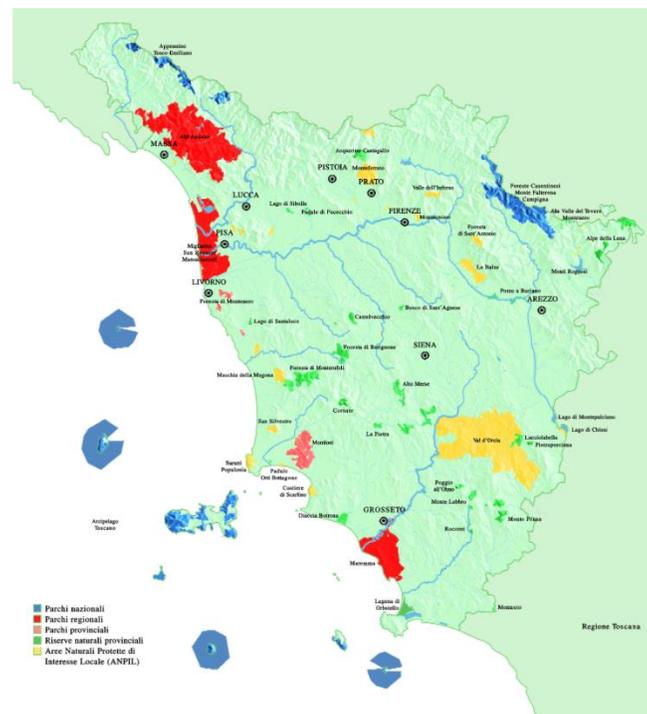
The most relevant EU-funded projects for the general frame of this project are:

- CHeriScape project (www.cheriscape.ugent.be/): a landscape-focused network.
- HERCULES (www.hercules-landscapes.eu/): tools for understanding, managing and protecting landscape functions and values.
- CULT-RURAL (cultrural.prismanet.gr/): promotion of a Cultural Area Common to European Rural Communities.

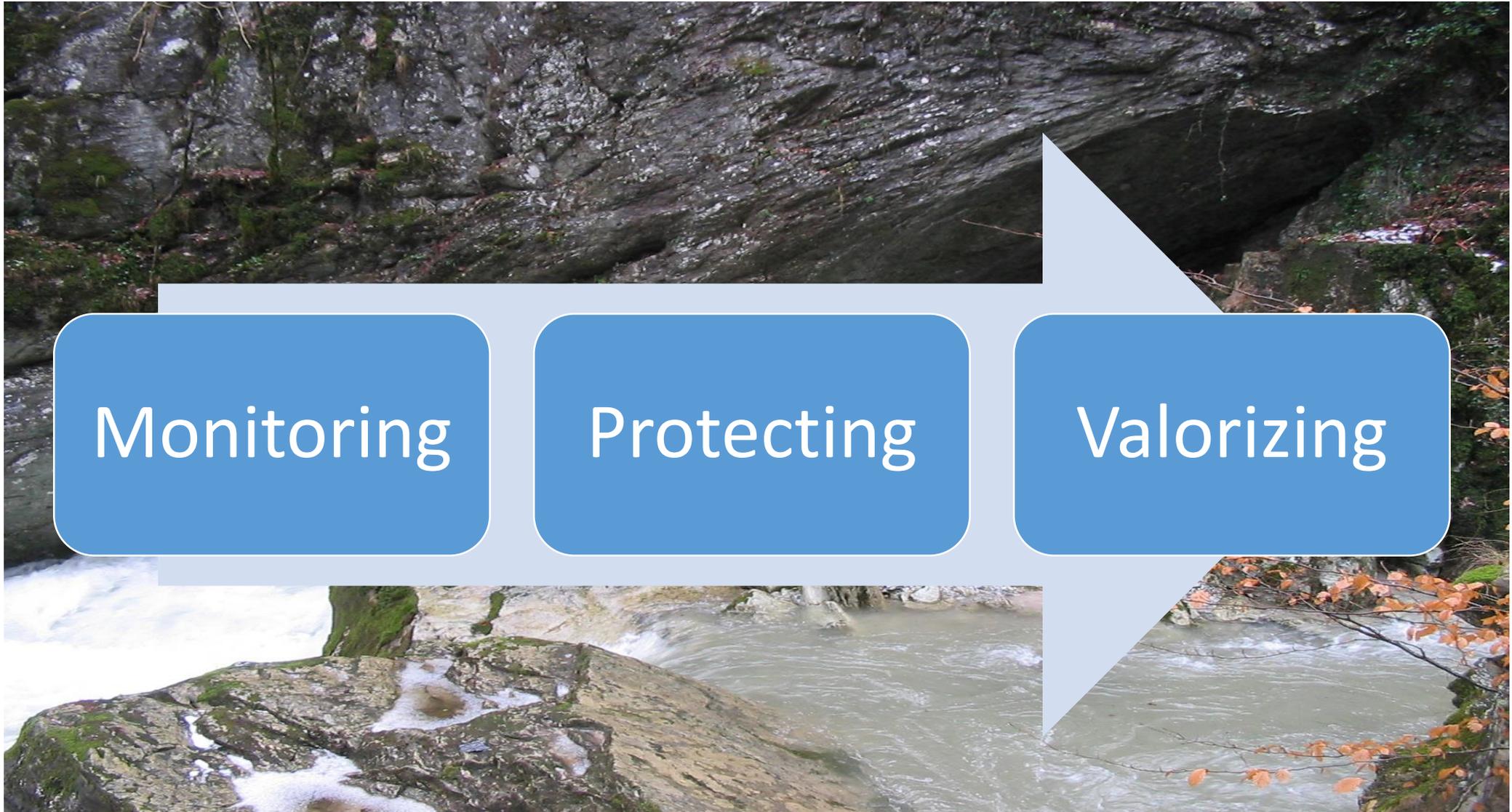
The lack of digitization standards is due to the ambiguity of the object (what is natural heritage) and to the huge variety of reasons that lead to the digitizing process.

Digitization of Natural Heritage

Methodology



Why digitize the Natural Heritage

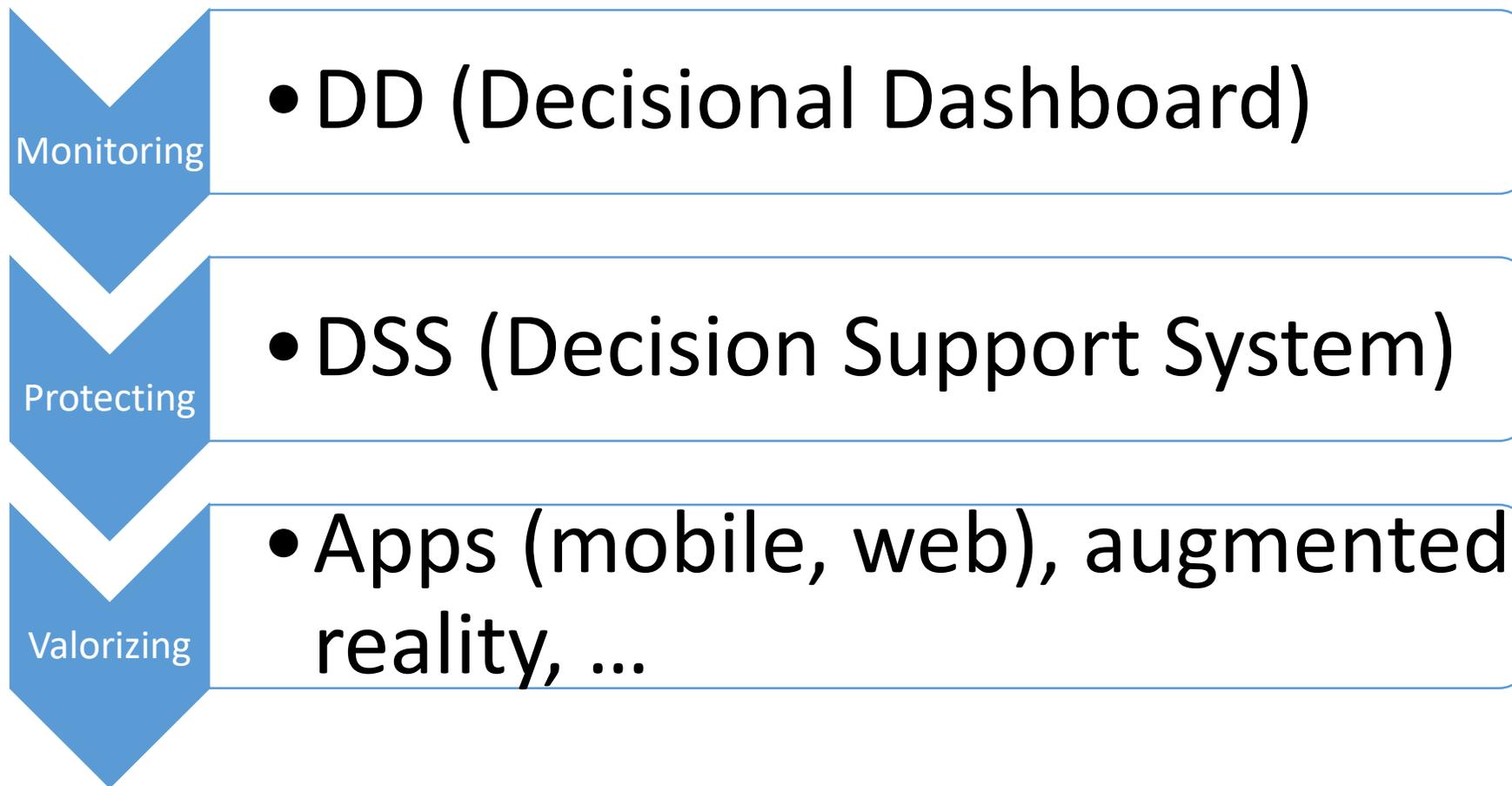


Monitoring

Protecting

Valorizing

Each action needs specific tools



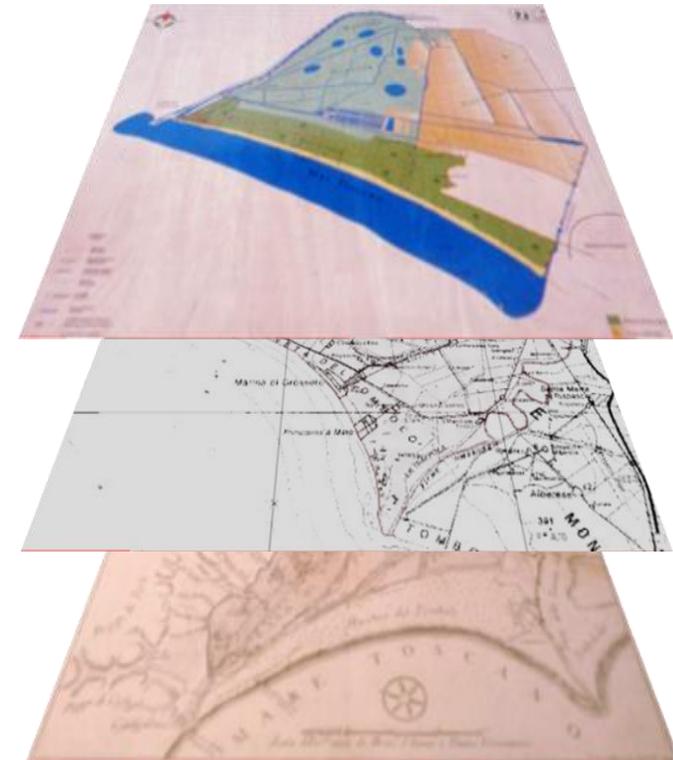
Time and Space

Natural heritage must be contextualized both in space, to understand the relationships that determine, for example, its vulnerability; and in time, to capture its transformations.

GIS use is effective in this field, since it allows for managing multiple data types and series of historical data as well as highlighting the transformation processes.

The setting up of a geodatabase capable of describing land complexity presupposes the selection, the acquisition, the managing and the analysis of many information layers organized into conceptual areas.

In order to create an effective tool (DD/DSS), it is necessary to have a GIS implementing the greatest amount of information functional to the definition of the land characteristics. It is obvious that the effectiveness of each evaluation tool is proportional to the accuracy and the completeness of the data inserted into the system.

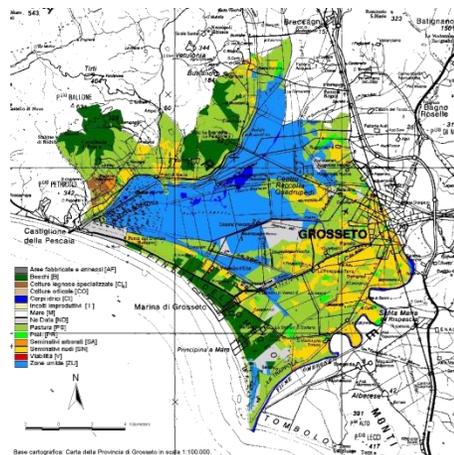


Time and Space

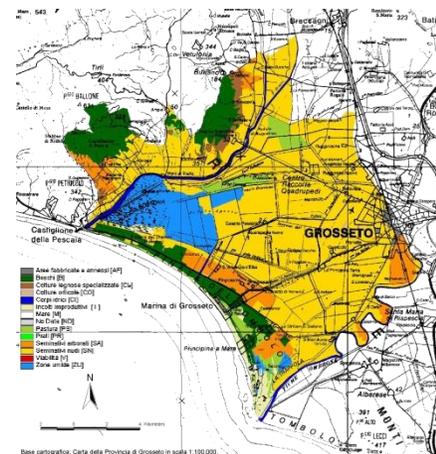
The representation of land dynamics can be achieved thanks to a geodatabase design capable of handling the time dimension, that is to say, able to implement structured data in a time series.

Transformation analysis techniques are divided into two categories: the comparison of two images (image ratioing, regression differencing, change vector analysis), and the analysis of tendencies and abnormalities through the use of time series, in other words, of different images (time series analysis, time profiling, image deviation, change vector analysis).

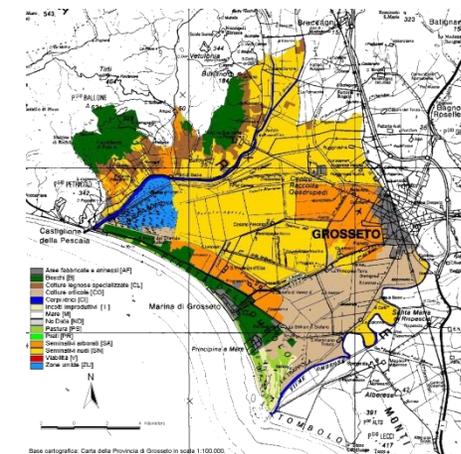
It is important to stress how this kind of research unveils knowledge of the land which takes into consideration the dynamics which have affected it through time and the historical values sedimented in the current landscape forms so as to activate local development policies which are actually sustainable and long lasting.



1822



1954



2006

Problems

Many produced databases cannot be used because they are:

- unknown,
- out of date,
- undocumented,
- not interoperable.

Each database produced must be accompanied by metadata describing its features.

There is a need to create a database of all existing databases.

The national geoportals partly function as this general database, but the coverage is not complete.

Lack of a standard acquisition methodology.

A methodological standard is a formal, agreed set of determining characteristics or benchmarks that describe the specific quality requirements for procedures and practice within a given context.

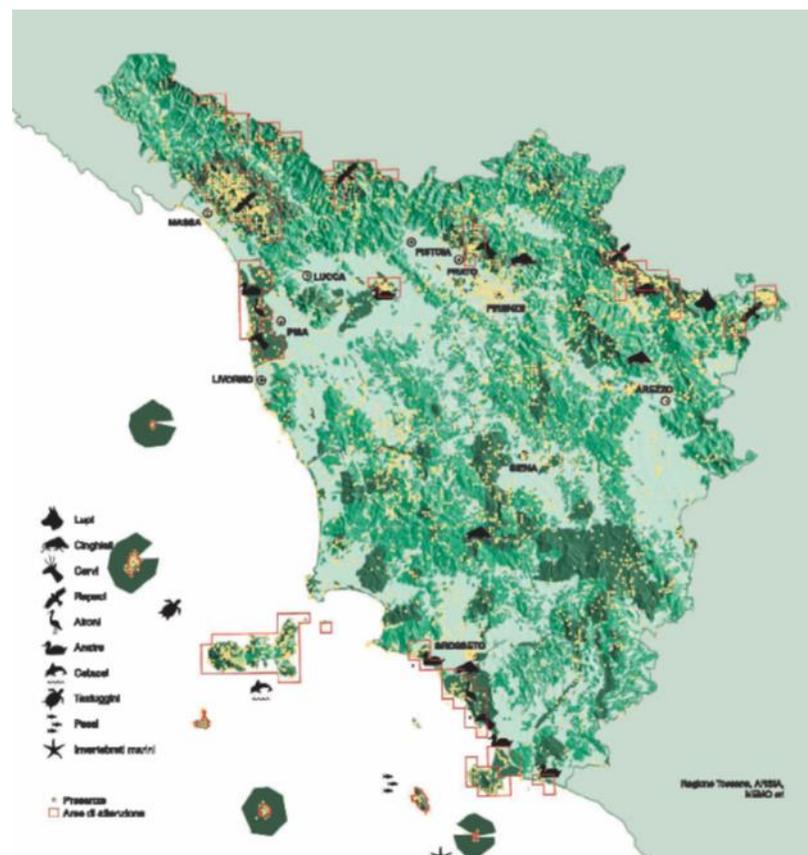
Methodological standards seek to bring consistency to the ways work is carried out.

The use of methodological standards:

- ensures best practice principles and guidelines in collection methodology
- ensures data is collected in a consistent and solid way
- improves the validity and reliability of data
- increases efficiency when collecting data.

Digitization of Natural Heritage

Best Practices



Geosites

GEOSITES in Tuscany (<http://www.regione.toscana.it/-/conoscere-i-geositi>)

55 Geosites of Regional interest (GIR) and 62 Geosites of Local Interest (GIL) according to LR 56/2000.

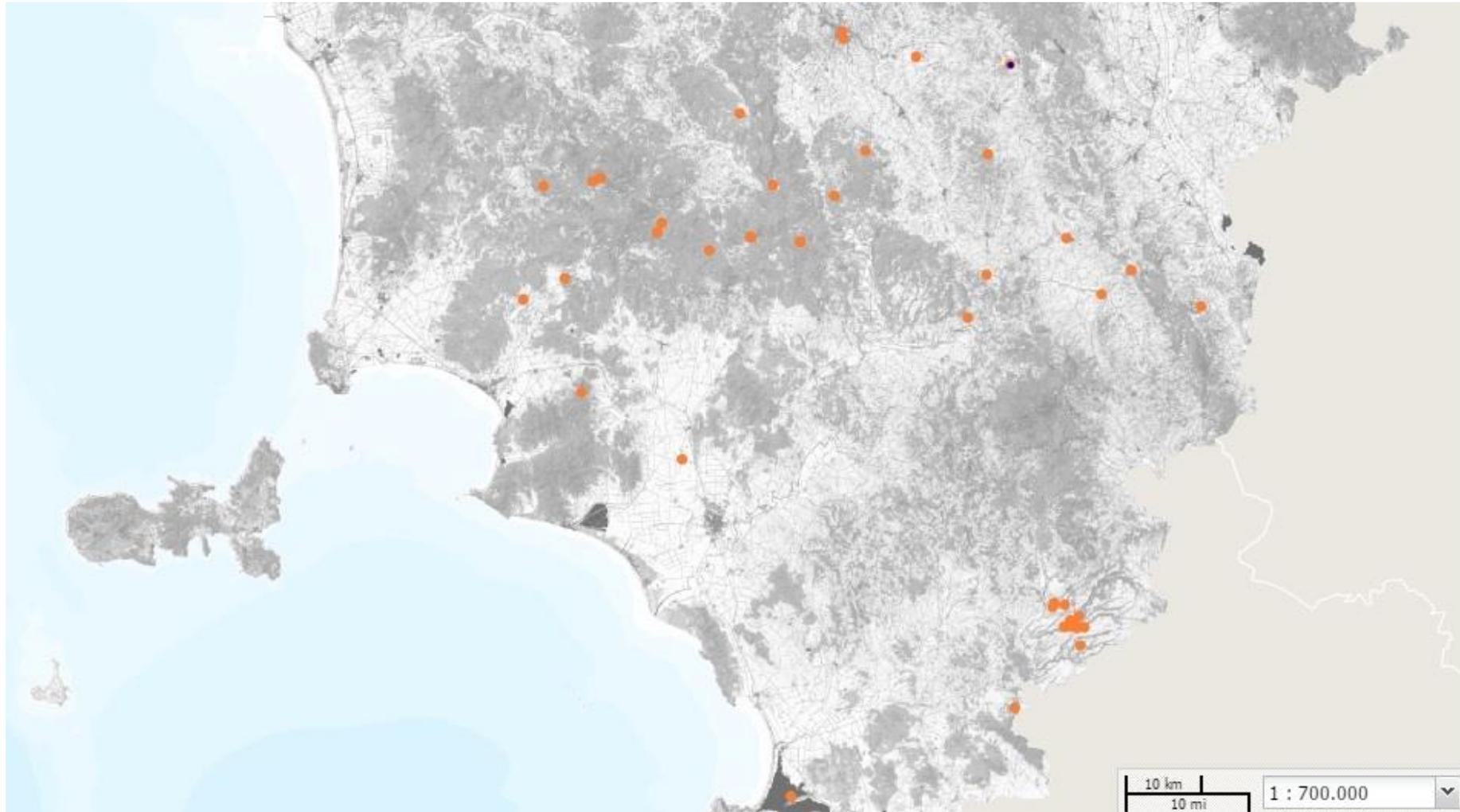
The benefits of identifying particularly significant geological sites include:

- the conservation and enhancement of the geological heritage,
- the promotion of a part of the territory;
- the integration of spatial data in the Territorial Plans (PTC);
- enhancing the attractiveness exerted by the specific territory and therefore its touristic offers;
- increase in the job occupation through the creation of environmental guides (appropriately trained) and personnel providing services connected with touristic - educational activities;
- expansion of the educational offers.

For each geological site, an information sheet has been produced. A documented geodatabase is available for download, although it is not updated. No specific enhancement policies.

Other Italian regions (Emilia Romagna, Liguria, ...) have set up similar projects.

Geosites



Geosites

There is a National Geosite Directory created by ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) whose primary intent is geoconservation and, secondly, establishing a national database.

The project began in 2008 and has involved Regions and Autonomous Provinces in order to:

- assess the overall condition of the national geological heritage, especially after the introduction of geosites in land use planning (Codice Urbani, Dlgs. 42/2004);
- establish criteria to select among regional and local geological sites, those of national importance;
- align the content of the existing data banks, also those used on a local level, with those of the ISPRA Geosite Data Bank;
- discuss the issues related to the protection of geological sites.

**ISPRA**
Istituto Superiore per la Protezione e la Ricerca Ambientale

**DIPARTIMENTO DIFESA DELLA NATURA
SERVIZIO AREE PROTETTE E PIANIFICAZIONE TERRITORIALE**

SCHEDA PER L'INVENTARIO DEI GEOSITI ITALIANI

N.B.: La scheda compilata, completa del file DESCRIZIONE, dello *shapefile* e della documentazione fotografica (.jpg) dovrà essere inviata via e-mail all'indirizzo: geositi@isprambiente.it

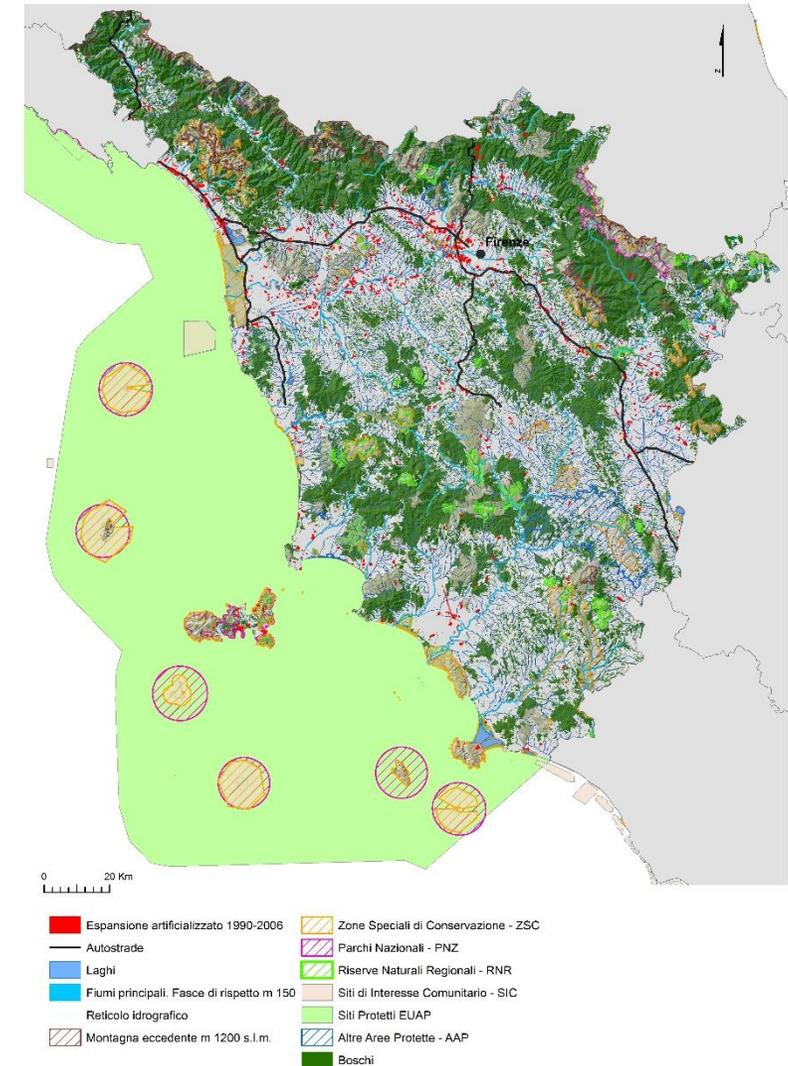
A - DATI IDENTIFICATIVI

NOME DEL GEOSITO	<input type="text"/>		
DIVULGABILE	<input type="checkbox"/>	TIPO GEOSITO	<input type="text"/>
DATA	<input type="text"/>		
TIPO ACQUISIZIONE DATI	RILEVAMENTO	<input type="checkbox"/>	BIBLIOGRAFIA
COMPILATORE	<input type="text"/>	ENTE	<input type="text"/>
E-MAIL	<input type="text"/>	URL	<input type="text"/>
COMPILATORE	<input type="text"/>	ENTE	<input type="text"/>

Atlas of Landscape Risks in Italy

Geohistorical analysis, evaluation and monitoring indicators in the study of landscape risks.

This project (LabGeo, University of Florence in collaboration with MiBACT, Ministry of Cultural Heritage and Tourism) has produced a preliminary survey on the evolution of Italian landscapes with particular attention given to the evaluation of landscape risk, a concept still not clearly defined in literature, and here connected particularly to the changes in land use and coverage. In order to identify these risks, the main available and accessible basic maps and statistics were reviewed with the final aim of conducting a homogeneous nationwide analysis, singling out the appropriate indicators and consequently analysing the data using a GIS. A first application of the indicators to the available databases resulted in achieving interesting conclusions concerning the changes that have occurred in the Italian landscape over the past 25 years, highlighting the particular risk situations for the Italian landscape and commending larger scale analysis methodology.

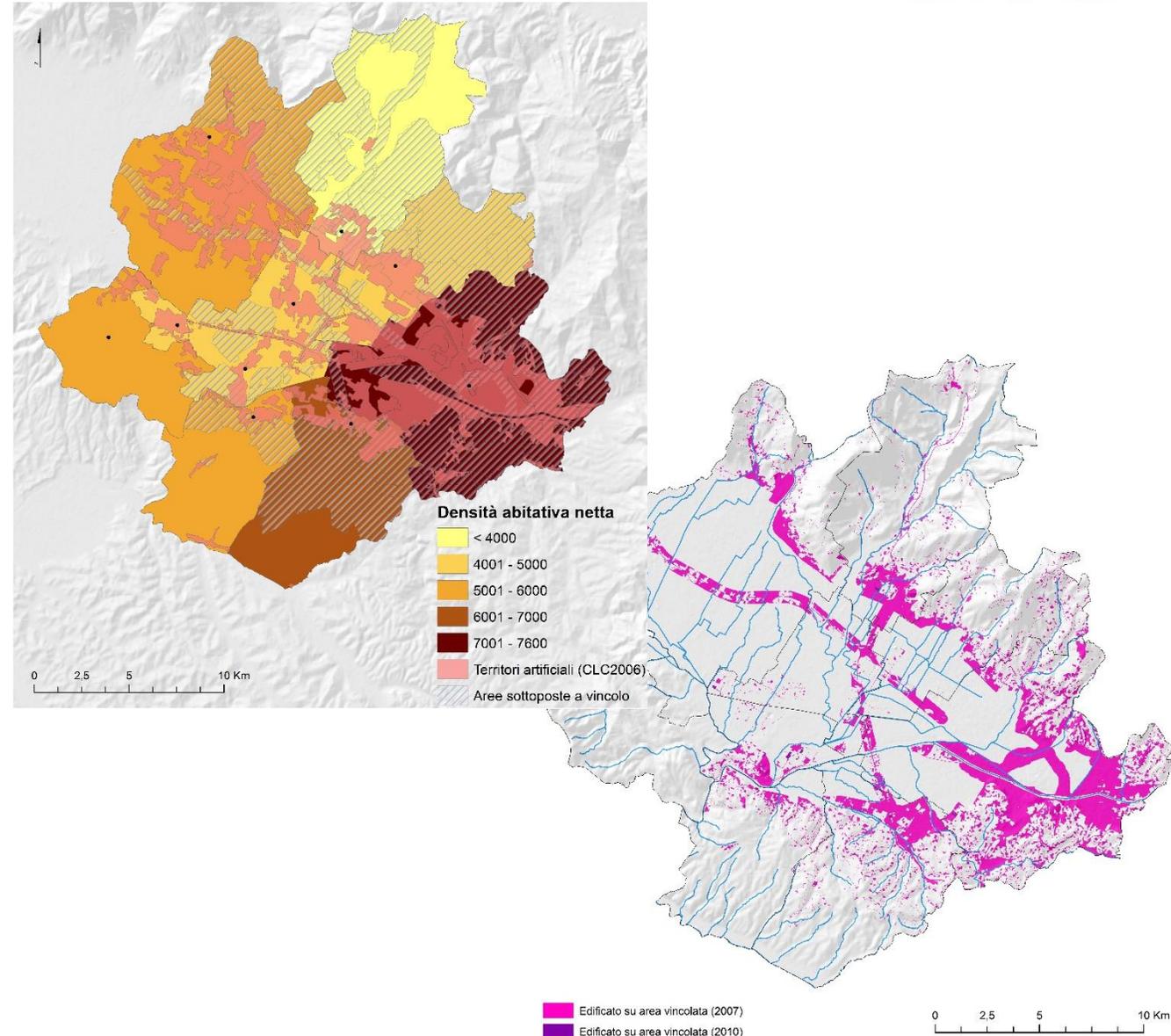


Atlas of Landscape Risks in Italy

The research was divided into the following operational phases:

1. census and classification of existing, accessible databases for the homogeneous analysis of the entire national territory;
2. dataset selection and acquisition;
3. identification of possible indicators deriving from the available datasets;
4. statistical analysis and cartographic production;
5. identification of sub-regional scale case studies;
6. geo historical analysis and cartographic production.

The aim was to single out some processes that could lead to landscape risk situations and then to identify appropriate indicators for the definition of de facto states and the determination of worrying trends.



Wetlands Atlas of Tuscany

In Tuscany as many as 59 wetland areas have been registered.

Among these we find mountain, fluvial, coastal and karstic areas, all of which are unique and with an extremely fragile ecosystem. Some of these are naturalistic oases of considerable interest and can also be considered open-air laboratories for environmental study/education; others still require more adequate instruments of conservation.

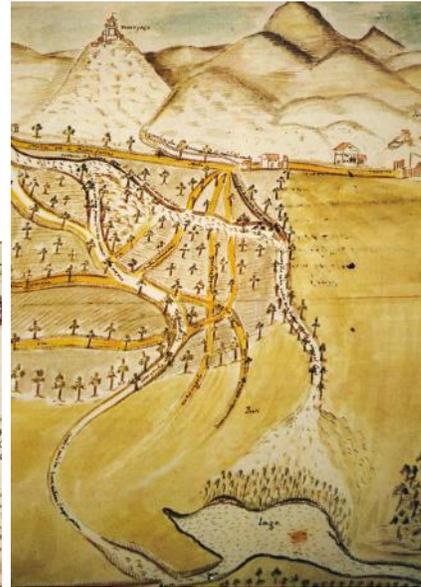
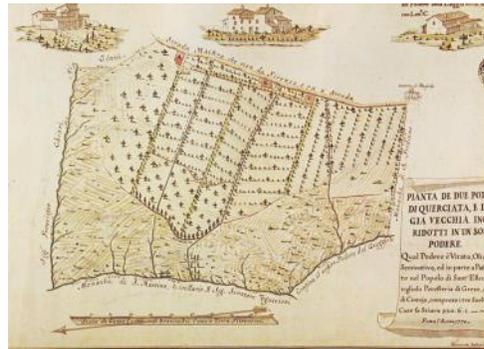
Wetlands, once economically marginal and unhealthy, are now considered a resource in terms of biodiversity and as places that attract responsible tourism.

The aim of the project (LabGeo, University of Florence) evolved in response to the desire to visualize and analyse land-use changes and the spatial pattern that results from existing and proposed land-use policies.



Wetlands Atlas of Tuscany

The adopted methodology is based on the integration and comparative analysis of archaeological, historical and geographical data coming from different sources (historical cadastral maps, large scale historical cartography, historical documents, aerial photographs, thematic cartography, vector databases relating to the theme land use/land cover and other digital vector layers) in a GIS environment.



Wetlands Atlas of Tuscany

W e t T u s

W e t l a n d s A t l a s o f T u s c a n y

WetTus - Wetlands Atlas of Tuscany

The core of the project are the wetlands of the coastal and inland Tuscany (historical transformations and environmental, historical-cultural and socio-economic components). Wetlands, once economically marginal and unhealthy, are now considered a resource in terms of biodiversity and as places that attract responsible tourism. The deliverables of the project are: 1) a geodatabase that provides an integrated management system of different sources of knowledge (cartographic, photographic, statistical, documentary, archeological, etc.) and allows the identification of structural invariants of the landscape and the development of a support system to evaluate sustainability and durability of the environment impacts and socio-economic development projects. 2) a tool, accessible via Internet, for data exploration and production of reports and dynamic maps. The choice of formats and data infrastructure can ensure the highest interoperability and it has been carried out in a perspective of dialogue and integration between regional information systems.

Satellite

Legend

click on the boxes to see the thematic overlay

- Existing Wetlands
- Wetlands (nineteenth century)
- Reclaimed Areas

Remove selection

LABgeo - Applied Geography Lab - Via S. Gallo 10 50121 FLORENCE

Tuscany Landscape Plan

Paesaggio



Piano di indirizzo territoriale con valenza di piano paesaggistico

Avviso di approvazione dell'integrazione del piano di indirizzo territoriale (PIT) con valenza di piano paesaggistico.

Deliberazione Consiglio Regionale 27 marzo 2015, n.37

Oggetto

Atto di integrazione del piano di indirizzo territoriale (PIT) con valenza di piano paesaggistico. Approvazione ai sensi dell'articolo 19 della legge regionale 10 novembre 2014, n. 65 (Norme per il governo del territorio)

Elaborati del Piano

- Relazione Generale del Piano Paesaggistico
- Disciplina del Piano

Elaborati cartografici

- Carta topografica 1:50.000
- Carta dei caratteri del paesaggio 1:50.000

Invariante I: i caratteri idro-geo-morfologici dei bacini idrografici e dei sistemi morfogenetici

- Carta dei SISTEMI MORFOGENETICI 1:250.000
- Carta dei SISTEMI MORFOGENETICI 1:50.000

Invariante II: i caratteri ecosistemici dei paesaggi

- Carta della RETE ECOLOGICA 1:250.000
- Carta della RETE ECOLOGICA 1:50.000

Invariante III: il carattere policentrico e reticolare dei sistemi insediativi, urbani e infrastrutturali

- Carta del SISTEMA INSEDIATIVO STORICO E CONTEMPORANEO 1:250.000
- Legenda sistema insediativo storico e contemporaneo
- Carta dei MORFOTIPI INSEDIATIVI 1:250.000
- Legenda morfotipi insediativi
- Carta delle FIGURE COMPONENTI I MORFOTIPI INSEDIATIVI 1:250.000
- Legenda figure componenti morfotipi insediativi
- Carta del TERRITORIO URBANIZZATO 1:50.000

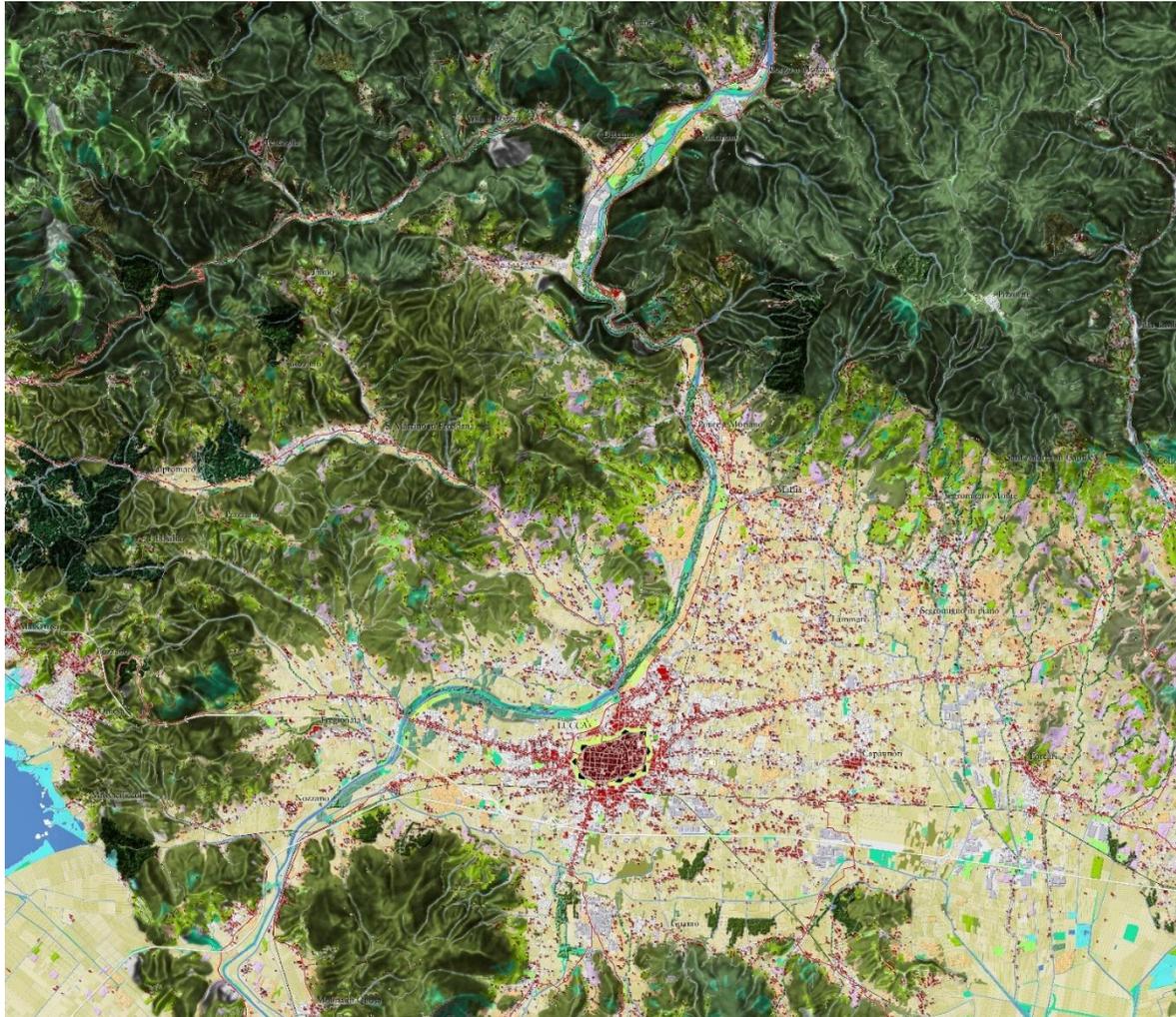
Invariante IV: i caratteri morfotipologici dei sistemi agro ambientali dei paesaggi rurali

- Carta dei MORFOTIPI RURALI 1:250.000

Visibilità e caratteri percettivi

- Carta della intervisibilità teorica assoluta 1:250.000
- Legenda intervisibilità teorica assoluta
- Carta della intervisibilità ponderata delle reti di fruizione paesaggistica 1:250.000
- Legenda intervisibilità ponderata

Tuscany Landscape Plans



ELEMENTI STRUTTURALI DELLA RETE ECOLOGICA

rete degli ecosistemi forestali

- nodo forestale primario
- nodo forestale secondario
- matrice forestale ad elevata connettività
- nuclei di connessione ed elementi forestali isolati
- aree forestali in evoluzione a bassa connettività
- corridoio ripariale

rete degli ecosistemi agropastorali

- nodo degli agroecosistemi
- matrice agroecosistemica collinare
- matrice agroecosistemica di pianura
- agroecosistema frammentato attivo
- agroecosistema frammentato in abbandono con ricolonizzazione arborea\arbustiva
- matrice agroecosistemica di pianura urbanizzata
- agroecosistema intensivo

ecosistemi palustri e fluviali

- zone umide

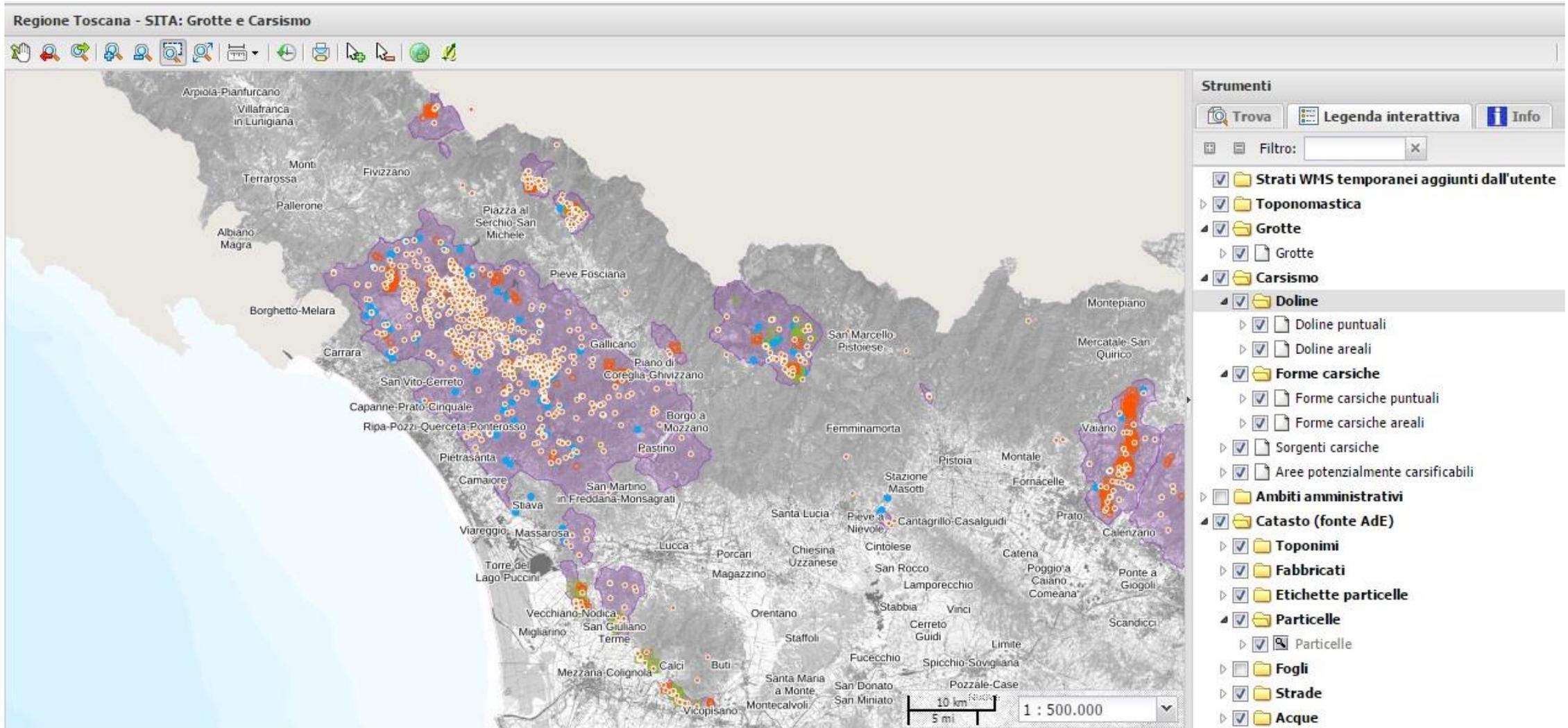
In the Plan have been identified four “invariant” characters of Tuscan landscapes:

1. hydro-geo-morphological characters
2. **ecosystem characters**
3. urban and infrastructure systems
4. rural landscapes

Landscape features Map.

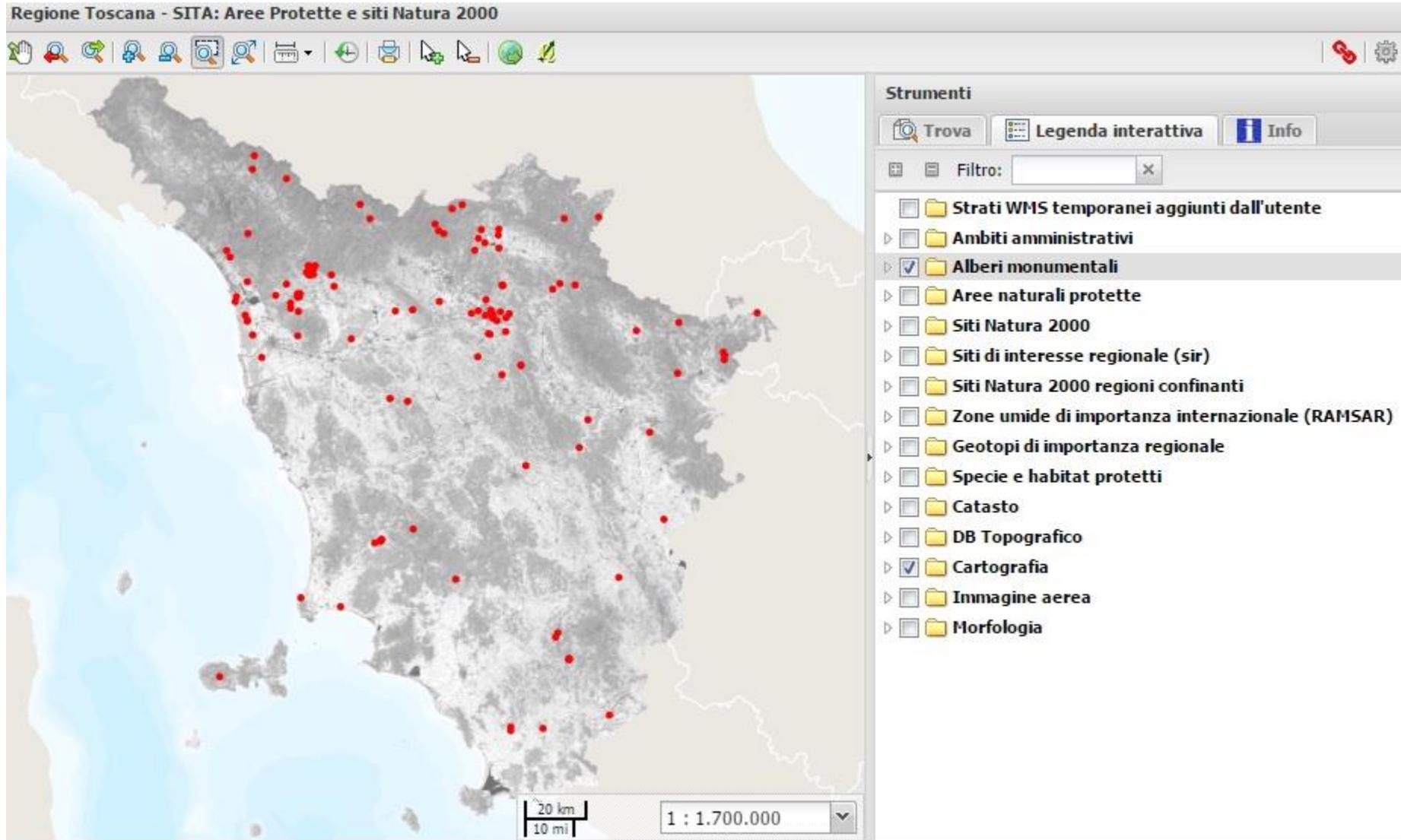
Framework of the Tuscany Region Landscape Plan (2014).

Monitoring



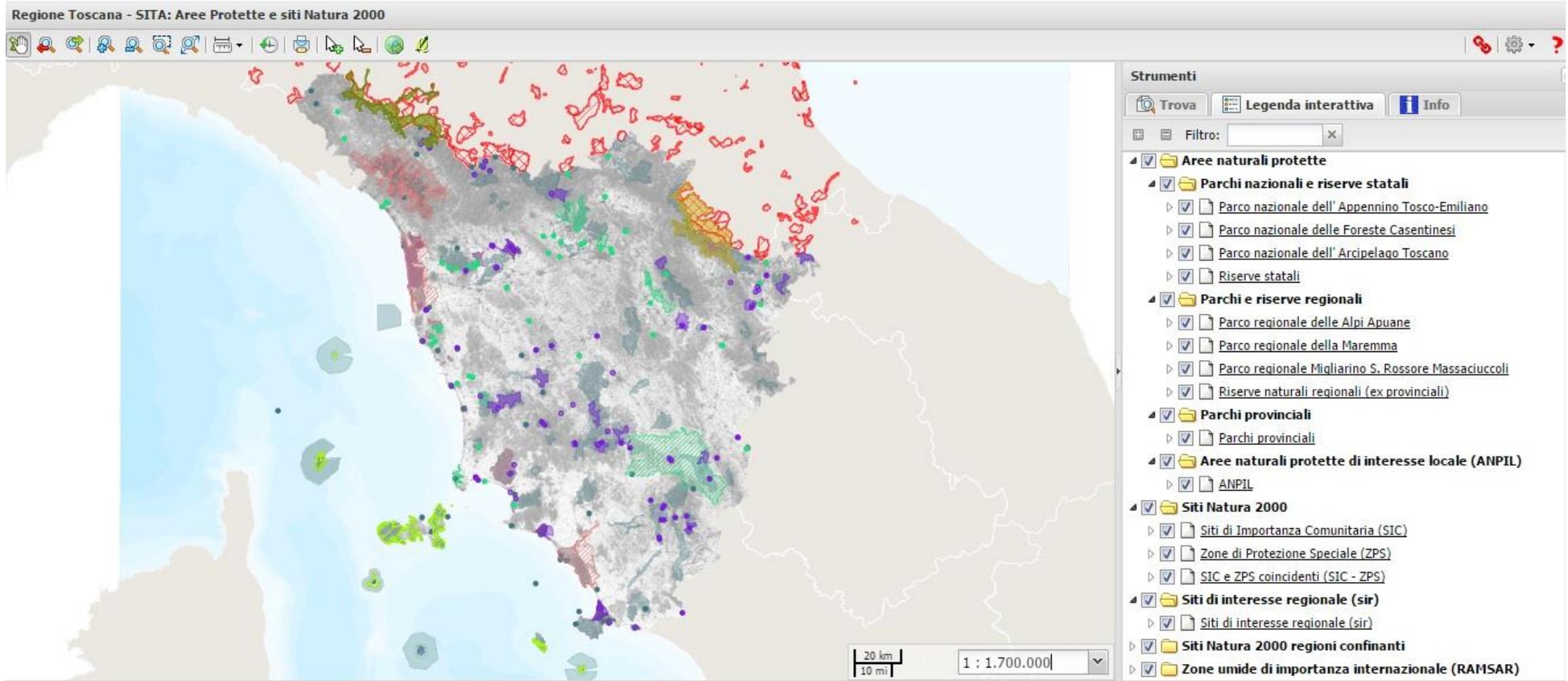
Caves and Karst morphology

Monitoring



Monumental Trees

Protecting



Natural Parks and Natura 2000 sites

Protecting

Regione Toscana - Cartografia del PIT con valenza di Piano Paesaggistico

Strumenti

Trova Legenda interattiva Info

Filtro:

- Strati WMS temporanei aggiunti dall'utente
- Ambiti comunali
- Ambiti di paesaggio
- Elaborati cartografici
- Beni paesaggistici
 - Download
 - Immobili ed aree di notevole interesse pubblico (D. Lgs. 42/2004, art. 142)
 - Aree tutelate per legge (D. Lgs. 42/2004, art. 142)
 - Lett. a) - I territori costieri
 - Aree tutelate - I Sistemi costieri
 - Lett. b) - I territori contermini ai laghi
 - Lett. c) - I fiumi, i torrenti, i corsi d'acqua
 - Lett. d) - Le montagne per la parte eccedente 1.200 m
 - Lett. e) - I circhi glaciali
 - Lett. f) - I parchi e le riserve nazionali o regionali
 - Lett. g) - I territori coperti da foreste e da boschi
 - Lett. h) - Le zone gravate da usi civici
 - Lett. i) - Le zone umide
 - Lett. m) - Le zone di interesse archeologico
 - Beni architettonici tutelati ai sensi della Parte II del D.Lgs. 42/2004, art. 142
 - Ulteriori contesti
 - Catasto

2 km | 2 mi 1 : 182.200

Protected Areas (Codice Urbani, art. 142)

Valorizing

[Il Progetto](#) | [Mappa](#) | [Area Riservata](#)

Geopaesaggi della Toscana

A passeggio tra natura e cultura

- Alta valle dell'Albegna e del Fiora
- Apuane
- Crete senesi
- Dorsale Monticiano-Roccastrada
- Garfagnana
- Isola d'Elba
- Monte Argentario
- Monte Cetona - Valdorcia
- Uccellina
- Valdarno Superiore**

Valdarno Superiore

Il Valdarno Superiore individua quella sezione del bacino dell'Arno compresa tra la piana di Arezzo e quella di Pontassieve (a cavallo dunque tra le province di Arezzo e Firenze) e delimitata dalle dorsali del Pratomagno ad oriente e dei Monti del Chianti ad occidente. Il bacino del Valdarno Superiore è quindi un'area di sedimentazione intermontana, colmata fra il Pliocene ed il Pleistocene superiore da sedimenti fluvio-lacustri. Il substrato dei depositi fluvio-lacustri è costituito dalle stesse formazioni litoidi che formano i rilievi circostanti: il Macigno (Serie Toscana non metamorfica) nei Monti del Chianti, e le arenarie dell'Unità Cervarola-Falterona nel Pratomagno.

La formazione del bacino risale all'inizio del Pliocene, circa cinque milioni di anni fa: da quel momento questo bacino è stato sede di varie fasi di sedimentazione in ambiente continentale e di altrettante fasi erosive. Nella prima fase (Pliocene superiore, Villafranchiano inferiore), quando il mare lambiva i Monti del Chianti, nel Valdarno Superiore si erano formati alcuni bacini poco estesi e di scarsa profondità in cui erano presenti ambienti sia di tipo lacustre che palustre, caratterizzati da un clima caldo umido di tipo tropicale. Nelle depressioni erano presenti ampie aree paludose, sedi di quelle torbiere nella quali si avrà la formazione dei giacimenti di lignite xiloidi come quella coltivata nella

[mappa](#) | [stampa](#)

- La Valle dell'Arno
- Lungo la Cassia Vetus
- Ai piedi del Chianti

Geological
Landscapes

Thank You