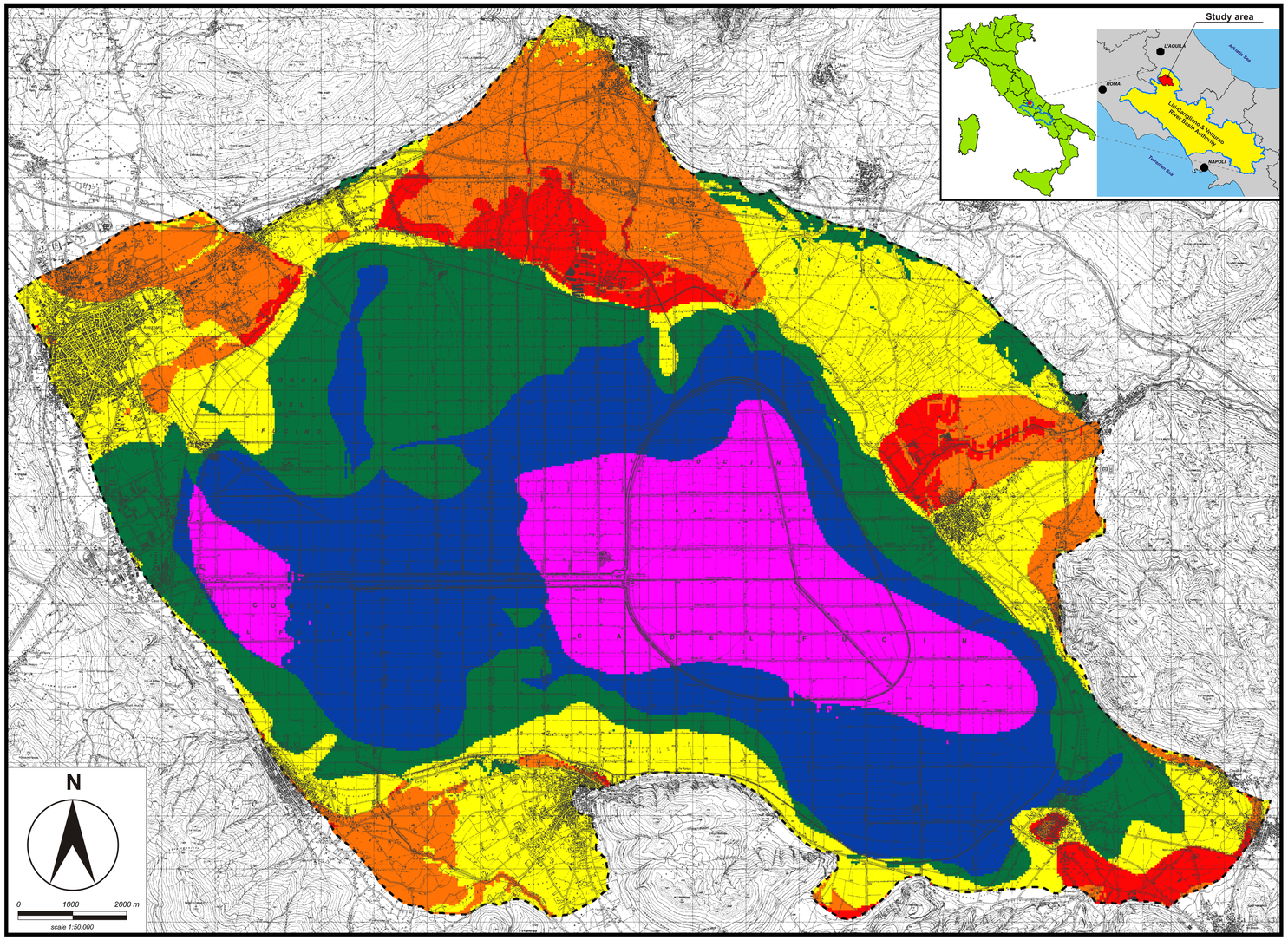
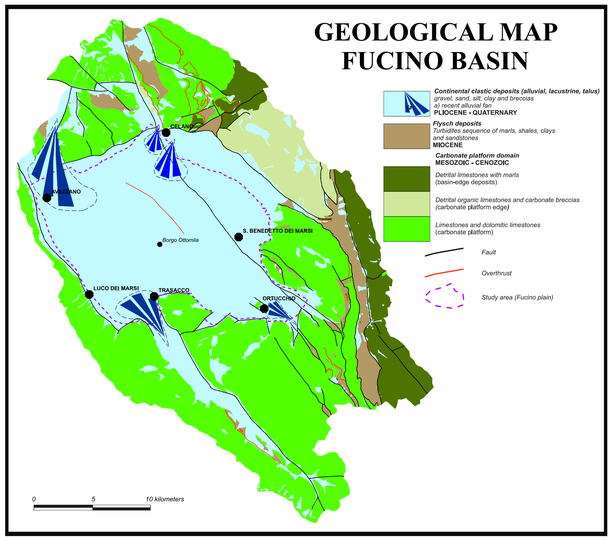
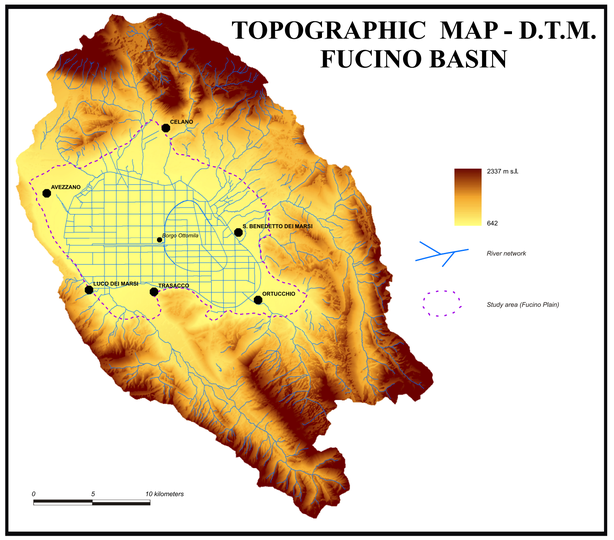
INTERREG III B project:

Development and utilization of vulnerability maps for the monitoring and management of groundwater resources in the Archimed area (WATER-MAP)

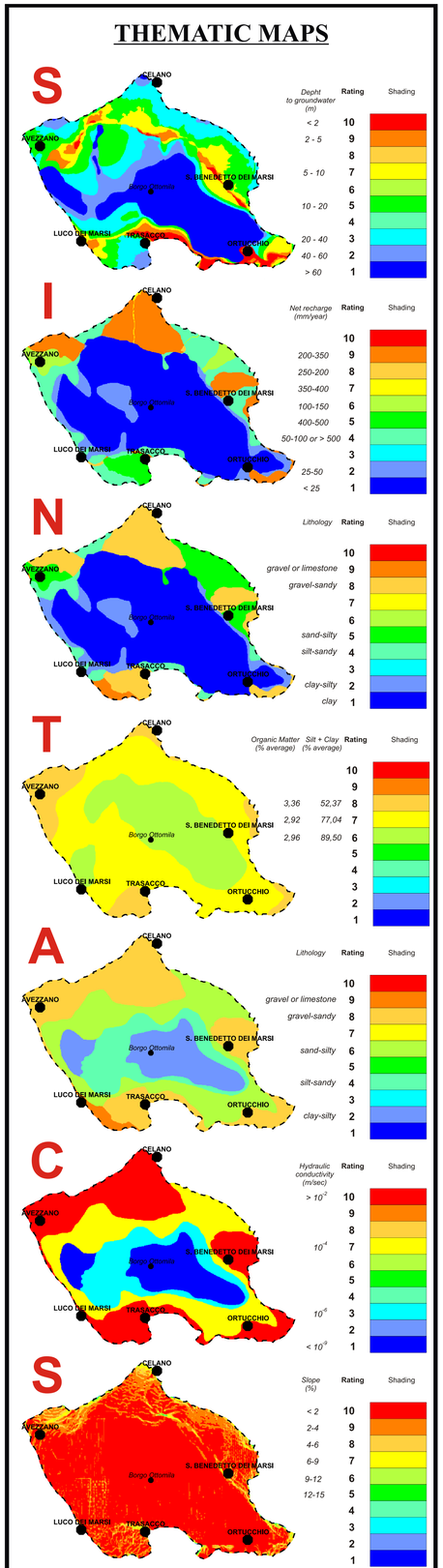
VULNERABILITY MAP OF FUCINO PLAIN



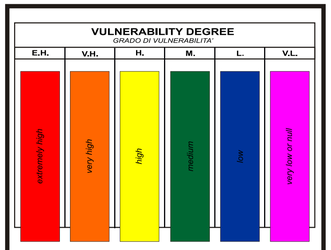




THEMATIC MAPS



VULNERABILITY DEGREE
GRADO DI VULNERABILITA'



SINTACS VULNERABILITY INDEX

The vulnerability index for each cell is:

$$I_{SINTACS} = \sum_{j=1}^{7} P_j W_j$$

Where P is the rating of the 7 parameters and W the correlated weight inside the chosen string.

A numerical value representing the intrinsic vulnerability of the aquifer is attributed through calculation to each cell. The raw score ranges between 26 and 260. The problem of subdividing the whole vulnerability index score into several value intervals or vulnerability degrees must be stressed. Statistically, analysing the results of over 500 test-sites located in the main Italian areas under contamination hazards, it was obtained 6 raw score intervals coupled to the 6 descriptive vulnerability degrees. The identification of intervals allows one to represent them by zoning on vulnerability maps in a directly understandable way.

The Fucino Plain constitutes a wide flat area between mountains, once a time center of a wide lake (third in Italy by extension) currently reclaimed, situated entirely in the territory of the Abruzzo Region. Fucino basin can be subdivided in two areas: a flat area, between 640 e 700 m o.s.l., and highlands on the boundary, with altitude until 2300 m o.s.l.

The Fucino Plain represents a structural depression like a half-graben, formed during Plio-Pleistocene tectonic events in correspondence to systems of faults in direction NW-SE, WSW-ESE and E-W.

It is filled up from Plio-Quaternary lacustrine deposits, alluvial depots and fan-delta deposits, with maximum thickness more than 1000 m, in middle zone, represented by some "lito-stratigraphyc units" that can be grouped in "lower units", and "upper units". Lower units present thickness about 500 m (medium-upper Pliocene), and they can be found along northern and north-eastern boundary. They are constituted by lacustrine and alluvial depots. Upper units , present thickness about 200 m (upper Pliocene – Olocene), they are constituted by series of lake and river depots with inserts of fan-delta depots in the areas next to the mountains. Such continental sequences cover, with discordant stratigraphyc contacts, the Meso-Cenozoic carbonate successions and Meso-Cenozoic neogenic terrigenous deposits of Simbruini-Ernici Mountains Unit and Western Marsica Unit.

Groundwater flow of Fucino Plain is strongly influenced by stratigraphyc and structural asset of Carbonate relief on the boundary of the plain. The Carbonate relief are characterized by an elevated permeability because of a relevant network of fractures. In these relief we can find groundwater bodies with elevated water potentiality, closed by terrigenous deposits present in the ground of plain and, in part, by clastic continental deposits accumulated on the bottom of reliefs. These condition originate important springs (Trasacco, Ortucchio, Venere, Fonte Grande, etc.) and to the feeding, by means of underground passages, of the clastics groundwater bodies of the plain, where the groundwater is confined by lacustrine silty and clayey deposits with elevated thickness.

The vulnerability map of the aquifer is an indispensable tool for the effective management of groundwater resources and to support environmental planning. Several approaches have been proposed by different authors to evaluate intrinsic vulnerability. Most of the methods for detailed vulnerability mapping are based on the integrated analysis of several variables using different algorithms. Geographic Information Systems are applied as advanced computer tools for the analysis of georeferenced data in 2D and 3D. The different data taken into consideration in this analysis, such as depth to water, actual infiltration, contamination attenuation capacity of unsaturated zone, top soil, hydro-geological features of saturated aquifer, hydraulic conductivity, terrain slope, geology and geological structures, were georeferenced and converted into digital form. Each variable corresponds to a separate data layer made of graphic and attribute data.

The intrinsic vulnerability map produced using the GIS approach reports the presence of every vulnerability classes in the study area: very-low, low, medium, high, very-high and extremely-high.

Very-low, low and medium classes characterize main part of study area and are present especially in the plain, where the groundwater is confined by lacustrine silty and clayey deposits. These deposits allow self-depurating processes into vadose zone and they are an obstacle to the direct infiltration of rainfall water and therefore to the transmission of the pollutants. Very-low class is located in the areas structurally more depressed of the lacustrine river basin constituted from clay and peat successions that are pushed until depth about 100 m or more from terrain level.

High, very-high ed extremely-high classes are present along the boundary belt of Plain, because the groundwater is in phreatic conditions, with depth lower than 20 m (somewhere surfacing), and it is located within sandy-clayey and gravely-sandy successions, that constitute even the groundwater that the non-saturated zone. Very-high and extremely-high classes characterize alluvial fans where prevail gravel-sandy successions.

Copia resa disponibile sul sito:
www.ildistrettoidrograficodellappenninomeridionale.it/aqua_index.html

Autorità di Bacino dei Fiumi Liri-Garigliano e Volturno