PROHIBITION MAP FOR THE SPREADING OF REFLUENT WATER OF ZOOTECHNICAL PLANTS

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ABSTRACT

Water pollution is among the primary concerns of Public Administrations both along plains and in the piedmont areas, because of the presence of agricultural, zootechnical and industrial activities on very permeable terrains; in rural areas this risk mostly derives from bovine and suilline sewage.

Nowadays, geographic information systems (GIS) allow to follow new ways for the conservation of untouchable natural heritage, such as natural resources. Using this advanced method, experimental research project has been carried out in the territory of the Municipality of Macerata (Adriatic side of Central Italy), aiming to produce an easy-to-interpret map which will help both the Administration, for preliminary purposes and for the issuing of permits, and the farmers, allowing them to know in advance how to operate properly . The project has been carried out according to the provisions of the law (D.L. 27 January 1992) on the application of the EC directive 86/278 on environmental protection, in particular of soil, when using liquid animal sewege in agriculture.

The study has been articulated in two phases:

1. Creation of a data base where cadastral parameters and boundaries, deriving from both the national and the regional laws, have been recorded;
2. Production of the prohibition map for the Municipality of Macerata (scale 1:12,500) in which the areas where it is allowed to pour refluents of livestock is highlighted.

The potency of GIS is shown in the second phase, during which all the data set were used, taking into consideration overlapping area information and relating territorial data with legal parameters, in order to individuate areas for sewage spreading. This resulted in the production of a map which is fully operative and easy to update for the Public Administration. Moreover, the data could by used by local government through the GIS also for different aims in environmental planning.

1. GEOLOGY OF THE AREA

The present geological structure of the area derives from the effects of two tectonic phases: the former compressional (upper Miocene - lower-middle Pliocene) and the latter extensional (starting from upper Pliocene).

As a consequence of compressional tectonics, huge folded structures were created (Fig. 1), such as the Umbro-Marchean and the Marchean Ridges (trending NW-SE), divided by the Inner Marchean Basin. These structures are associated with reverse faults, backthrusts and transversal tectonic lines (maybe transcurrent).

The following extensional phase was sided by a strong regional uplift and progressively (moving eastward) brought to the emergence of the whole area, and particularly of the Outer Marchean Basin (Fig. 1). During this tectonic phase, these transversal lines acted as normal faults, dislocating the Apenninic belt (already emerged) and conditioning the hydrographic network (which generally crosses the Marchean ridge through narrow valleys and gorges).

The study area (92.73 sq.km) mainly belongs to the Outer Marchean Basin and is mostly made up of clayey pelitic terrains (having a thin to medium stratification) interbedded with arenaceous and arenaceous-pelitic layers having a lenticular section and slightly dipping toward the Adriatic Sea.

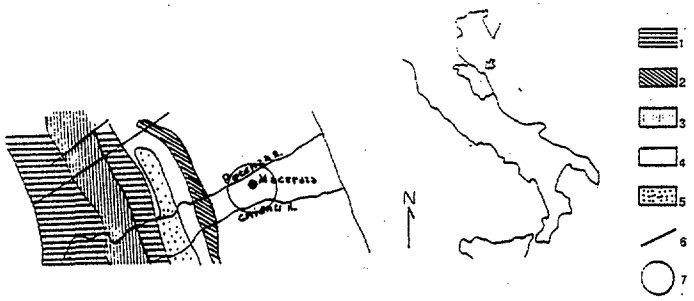

Fig. 1 - Location map and geological sketch of the vicinity of the study area. Legend: 1) Umbro-Marchean and Marchean Ridges; 2) minor ridges; 3) Inner Marchean Basin; 4) Outer Marchean Basin; 5) Laga Basin; 6) main transversal faults; 7) study area.

After the emergence, selective erosion modelled the landscape emphasising outcrops of coarser material, thus giving origin to a hill on the top of which (311 m a.s.l.) the town of Macerata was built. The northern and southern limit of the municipality are respectively bordered by the Potenza and the Chienti rivers. Along the valley bottoms, terraced alluvial deposits made up of sand and coarser material are widely present.

The area is generally covered by silty-sandy colluvial deposits which reach a maximum thickness (up to some ten metres) along the slopes of the hill of Macerata.

The clay content of the bedrock, its dip and the morphological character of the area often made the territory prone to mass movements, such as mudflows and slow plastic deformations of soils.

2. THE RESEARCH

This research started with the aim of providing a working methodology based upon modern scientific and technological solutions, such as the use of geographic information systems which represent the most advanced tool for territorial planning.

Only some of the legal regulation have been taken into account, since some parameters (such as chemical and physical characteristics and thickness of soils, and depth of the water table) vary too much even within short distances, and therefore closely spaced samplings and boreholes are needed to define homogeneous areas.

It is to be pointed out that the national law (D.L. 27 January 1992, art. 6, par. 3) imposes some absolute prohibitions but leaves regional governments free to determine (taking into account permeability of terrains, slope angles, meteo-climatic conditions and characteristics of refluents) the minimum distances from inhabited areas, roads, wells for drinking water, and waterways. It is therefore self-evident that the distances used to calculate the map have only a local value, and therefore the system might have to be adjusted for other Italian regions.

In accordance the national laws (D.L. 27 January 1992 and L. 319/79), the following areas have been subject to absolute prohibitions:

- urban areas;
- quarries;
- areas subject to hydrogeological bound;
- forested areas;
- badlands;
- flood prone areas;
- areas with a slope angle greater than 15%;
- unstable areas;
- areas having a naturalistic interest (L.R. 30 December 1974, n. 52);
- areas for the protection of water resources (D.P.R. 236/888).

The following minimum distances have been set:

- from drinkable water wells, 200 metres (D.P.R. 236/88);
- from urban areas, 200 m (D.G.R. 5827/88);
- from houses and state or provincial roads, 80 m;
- from waterways, 150 m (L. 431/85).

To create the data base, a set of georeferenced maps were included, each portraying the spatial distribution of restrictions deriving from one particular bound. these maps were automatically overlaid (Fig. 2), generating a map which is the combination of all the legal bounds.

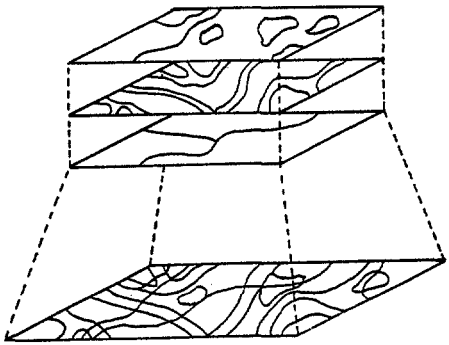

Fig. 2 - Example of map overlay.

In this way, the final thematic map at a scale of 1:12,500 has been produced (using the Italian Gauss-Boaga cartographic projection) in which the sites where it is possible to spread refluents are indicated (Fig. 3).

Such a map, capable of synthesising and showing what has been defined by legislation is particularly important both for the technician who has to issue the permits for spreading refluents and for the farmers who have to know where to spread sewage deriving from livestock.

The adopted methodology, based upon a GIS vector (GHEO), allows us to have a continuously updated data base, following additions and/or variations to legal bounds.

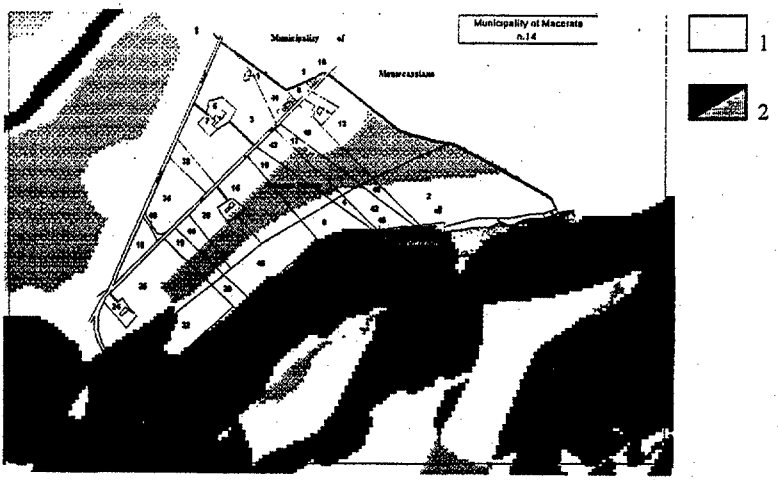

Fig. 3 - Sample of the resulting prohibition map (reduced to scale 1:25,000). Legend: 1) sites where is allowed spreading refluents; 2) areas where spreading refluents is prohibited.

In a second stage, it was possible to overlay the cadastral planimetry of the Municipality of Macerata; GIS techniques allow to feed the computer through an alphanumeric data base with information for every single cadastral lot starting from any possible theme (such as owner, use, area etc.).

In this way, technical offices will obtain from the computer the full knowledge of the territory by simple queries.

3. FINAL REMARKS

In the future, territorial planning will experience a sudden leap of quality through the creation of suitable information systems (and, therefore, of appropriate maps).

The availability of such a large quantity of information, thanks to advanced technologies (such as GIS), will undoubtedly imply a revolution at all levels in the formation processes for planning methods, as well as a sharp reduction in the time required to acquire information, and an upgrading of the competence of technical-administrative staff in the offices in charge of territorial control and planning.

The example here reported aims to underline how it is possible to change planning methodologies (also for day to day administration) in the sector of territorial management, which (considering the huge amount of data to be analysed) needs the full use of modern computer-based technologies.