

SISI PROJECT: DEVELOPING GIS-BASED TOOLS FOR VULNERABILITY ASSESSMENT

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CRESCO PROJECT (ENEA - Ministry of Education, University Research)

Centro computazionale di RicErca sui Sistemi COmplessi
Computational Research on Complex Systems



Aim of the Project: Developing a High Performance Computing infrastructure (HPC) located at ENEA Portici Research Center.

Applications will focus on complex systems of different natures (life sciences, sociology and natural/technological systems)

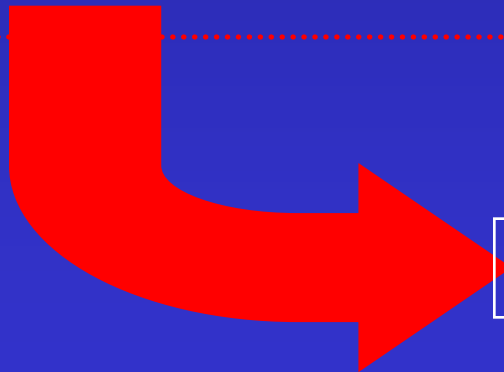
Main features of CRESCO HPC platform:

- Estimated 10 Teraflops
- Major node of ENEA GRID which links HPC platforms located in the different ENEA Research Centers throughout Italy
- Rank 125 in TOP500 supercomputers (June 2008)

www.cresco.enea.it

Activities of CRESCO Projects

1. Realization of HPC Infrastructure. Implementation of innovative solutions in computing system architectures and GRID computing for the activities of ENEA, requiring the use of computational resources highly performing
2. Computational Models for description of biologic complex systems and innovative materials. Study of biologic objects in "systemic" point of view and study of natural systems (animal and social communities) according to paradigm of complex systems
3. Computational models for analysis/simulation of complex technological networks. Study of technological complex systems with their mutual interactions and the creation of suitable tools for modeling, simulating and control processes



SISI PROJECT

SISI Project

Sistema Informativo per la Salvaguardia e la sicurezza delle Infrastrutture e della popolazione

Information System for Protection of Infrastructures and Population

Aim of the Project: Developing a GIS for locating vulnerable sites on territory, considering human/natural factors.

- Innovative approach based on concepts of dangerous/vulnerable geographical features
- Analysis at National scale
- Delimitation of vulnerable sites

Partnership ENEA – University of Salerno



Works in progress



GEOGRAPHIC FEATURE

Any human or natural element/structure with a specific function or any "object" of particular interest, present on territory (e.g. buildings, pipelines, streets, industrial plants, water bodies, wildlife sanctuaries ...)

DANGEROUS FEATURE

Any geographical feature that, due to human or natural causes, is likely to induce failure/loss of functionality of other geographical features in its neighborhood (e.g. land subject to landslides, chemical plants, dumps, discharges, power stations, ...)

VULNERABLE FEATURES

Any geographical feature that, due to presence of dangerous features in proximity, can be subjected to failure/loss of functionality (e.g. civil infrastructures, human settlements, water bodies ...)



Some geographic features can be considered both dangerous and vulnerable (e.g. water bodies considering flooding/pollution)

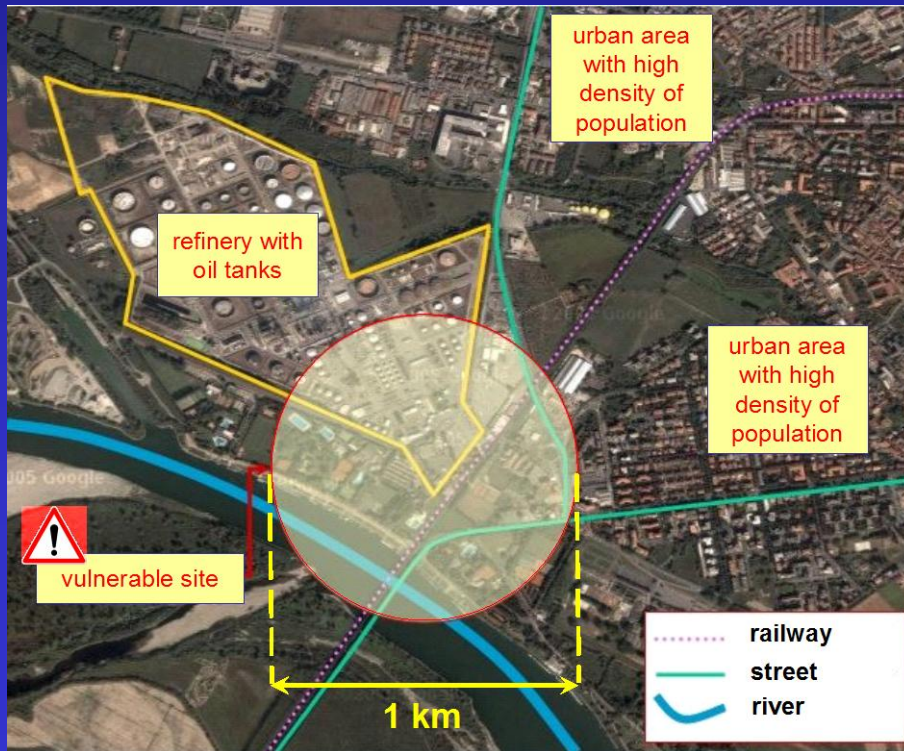


VULNERABILITY CRITERIA

Vulnerability criteria implemented in SISI project are based on the co-location of user-defined dangerous/vulnerable features in a given research area (focus).

Optionally, one can include in the criterion:

- Topological conditions among features
- Dimensional conditions for given features
- Morphological conditions for given features
- 3D Conditions on elevation for given features



EXAMPLE OF VULNERABLE SITE

In the red circle with radius 1000 m (focus) the following features are present:

- Refinery (dangerous/vulnerable)
- River (dangerous/vulnerable)
- Railway (dangerous/vulnerable)
- Street (vulnerable)
- High density urban area (vulnerable)

Research of vulnerable sites at national scale for a given criterion



Vulnerable sites

How many vulnerable sites exist?

Where are vulnerable sites located?

The system performs a scanning of the whole territory to search for focus areas in which the vulnerable criterion is verified.

Result is a collection of vulnerable sites, described by cartographic features

Vulnerability criterion

SISI Architecture

GEOPROCESSING TOOLS

User defines and inputs vulnerability criteria

DIAGNOSTIC TOOLS

- Research and localize vulnerable sites
- Define boundaries of vulnerable areas
- Create vulnerability maps

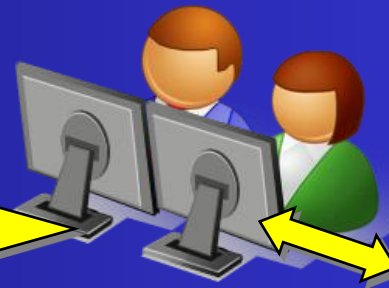
National Scale

SELECTION OF SAMPLE AREAS

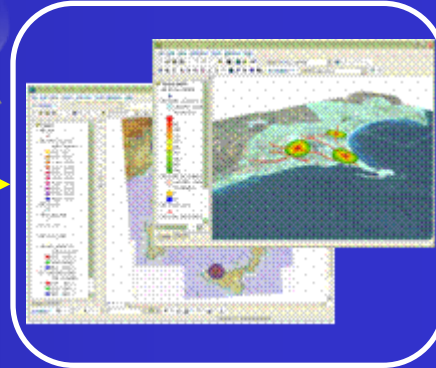
Detail scale

SIMULATION TOOLS

- Modelling specific events for detail analysis



WEB GIS



GEOSPATIAL DATABASE



Geospatial Database

Stores and manages geographical features

Geoprocessing tools

Customized GIS geoprocessing analysis and modelling tools

WEB GIS

Viewing and sharing vulnerability maps on the web

Overview of diagnostic tools functions

1. Selecting geographical features to be used for analysis
2. Defining extension of research area (focus) in which all selected geographical features must be present (e.g. circle with radius 1 km)
3. Possibly including morphological and/or topological and/or 3D conditions
4. Perform analysis

Vulnerability
criterion



ESRI ArcGIS Environment

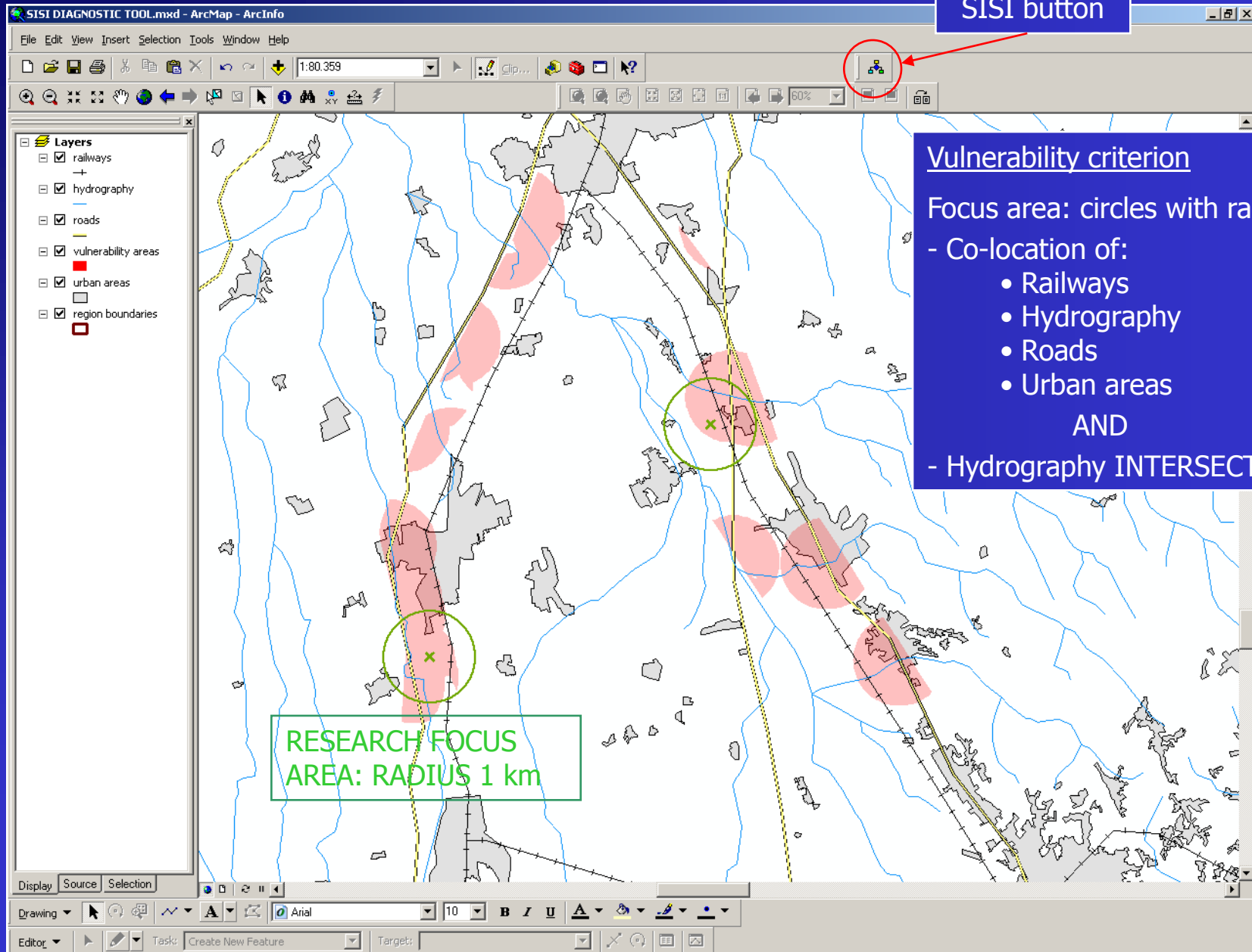


Software Development using ArcObjects

Buffer / Intersect Geometric Operators

Spatial Filters (Select by Location)

Example: Selection of vulnerable areas



SISI button

Vulnerability criterion

Focus area: circles with radius 1 km

- Co-location of:

- Railways
- Hydrography
- Roads
- Urban areas

AND

- Hydrography INTERSECT Roads



Thank you for your attention

