Sicilian Water Task Force Meeting
Pollution Permanent Monitoring Panel
World Federation of Scientists
August 2005 Seminar
Erice, Italy

World Federation of Scientists Pollution Task Force
Richard Ragaini, Ph.D., Lawrence Livermore Laboratory,
Livermore, California USA (Panel Chairman)

Presenter:
Lorne Everett, Chancellor, Lakehead University
PROPOSAL

World Federation of Scientists

A proposed collaborative effort with Sicilian Universities and Italian Agencies

Vulnerability is the sensitivity of the groundwater quality to anthropogenic activities causing contamination (Bachmat & Collins, 1987)

Submitted to:
Professor Antonino Zichichi
World Federation of Scientists
Lausanne, Switzerland

Submitted by:
World Federation of Scientists
Pollution Panel Task Force

Developed in September 2003, Updated August 2005
Claude Manoli, World Lab/World Federation of Scientists – Overview of ILSEAT Proposal Requirements

- Professor Aurielio Aureli, University of Catania
- Dr. Salvatore Carrubba, University of Palermo
- Dr. Richard Ragaini, Lawrence Livermore National Lab
- Dr. Gina Calderone, EA Science and Technology, USA
- Prof. Frank Parker, Vanderbilt University, USA
- Dr. Richard Parker, Parker GeoSciences, USA
- Prof. Paolo Ricci, University of San Francisco, USA
- Professor Massimo Civita, Polytechnic of Turin
- Professor Giovanni Barrocu, University of Cagliari
- Chancellor Lorne Everett, Lakehead University
**Purpose of Proposal - Protecting Groundwater Resources**

- **Sicily** is identified as a high risk area for groundwater impact due to increases in:
  - Population growth
  - Industrial land use
  - Salt water intrusion
  - Limited groundwater resources

- Groundwater is the **main source of drinking water for Sicily** and requires effective management to reduce risk of impact

- **No centralized database** is currently available to assess groundwater vulnerability
  - Identify and delineate those areas where aquifers and drinking water resources are under threat by ongoing land use and development
  - An integrated database will provide a **long-term planning tool** for further development and growth
Example - Choice of the Weight and Setting for Each Cell of the Grid

A = UNTILLED AREA
B = FLOODING AREA
C = AREA FOR FLOODING IRRIGATION
D = CHEMICAL TREATED CULTIVATION
E = BREEDING
F = FRACTURED ROCK AQUIFER
G = CARBONATIC ROCK AQUIFER

Source: Prof. M. Civita
Releases of Contamination by Seismic/Volcanic Activity—Areas in chemical processing facilities and water storage/distribution systems may be impacted by seismic and volcanic activity and pose a release of hazardous materials to the groundwater.

Aquifer Vulnerability Mapping/Assessment include the more developed areas of Sicily:
- Palermo
- Gela
- Syracuse
- Augusta
- Catania
- Milazzo
Areas with completed aquifer Vulnerability Maps

Source: Prof. A. Aureli
Groundwater Pollution Vulnerability Mapping - Project Phases

- Create an up-to-date comprehensive database
  - Hydrogeologic zones
  - Site-specific pollution sources

- Develop/update aquifer vulnerability maps of Sicily with local University collaboration

- Deploy maps on website with Geographic Information System (GIS) tools

- Train the potential end users (i.e., government agencies, local land use planners, developers, etc.)
Vulnerability Mapping and Environmental Database Management for Sicily

**Database Development**
- Identify existing data sources:
  - Universities of Catania, Messina, and Palermo
  - Italian Civil Protection Agency
  - Additional government agencies
  - National Research Council
- Integrate data within central database

**Pollution Vulnerability Mapping**
- Develop a GIS tool to display all available data
- Generate pollution vulnerability maps for Sicily, including local and regional scale maps
- Partner with Italian and Sicilian government bodies to identify significant data gaps

**Web-Based Deployment and Training**
- Create web server to house comprehensive database of environmental and pollution vulnerability data
- Utilize internet-based tools to display pollution vulnerability maps
- Complete training for GIS and database and aquifer vulnerability maps
- Inform interested parties of pollution prevention techniques
Action Items for Project

Inventory of Pollution/Impact Sources
- Solid and hazardous waste disposal facilities
- Industrial facilities
- Petroleum hydrocarbon bulk storage, oil fuel power plants, and refineries
- Salt water intrusion areas

Map Existing Land Use
- Industrial growth areas, agricultural land use, and land use patterns
- Artificial recharge areas due to irrigation or discharge of treated water, and other activities that may have long-term effects

Natural Resources
- Aquifers in Sicily
- Geology (surficial and bedrock)
- Soil types
- High yielding aquifers, drinking water supplies, recharge areas
Example of GIS Database Created for Sicily

Source: EA Science and Technology
A methodology that allows the pollution potential of any hydrogeologic setting to be systematically ranked

The system has two major parts:
- The designation of mappable units – “hydrogeologic settings”
- The superposition of a relative rating system called “DRASTIC”

The system optimizes the use of existing data to rank areas with respect to pollution potential, such as:
- Depth to groundwater
- Recharge
- Aquifer media
- Soil media
- Topography
- Impact of the vadose zone
- Hydraulic conductivity of media
**Example of Aquifer Vulnerability Mapping - To Prioritize of Groundwater for Land Use/Development**

Example of final aquifer prioritization map created using the DRASTIC Model for selected locations in southwestern Wyoming, USA

*Source: Groundwater and Remediation, Winter 2005*
Groundwater Vulnerability Map of Trapani, Sicily

Source: Prof. Aureli
WFS Task Force

Dr. Richard Ragaini, Lawrence Livermore National Lab, USA
Chairman of the Pollution Monitoring Panel

- Dr. Gina Calderone, EA Science & Technology, USA
- Chancellor Lorne G. Everett, Canada/USA
- Prof. Frank Parker, Vanderbilt University, USA
- Prof. Paolo Ricci, University of San Francisco, USA
Grazie!