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The use of a GIS Red-Amber-Green (RAG) system to define search priorities for burials

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The aim of this research is to promote among the Italian police, magistrates, and geologists, the applications of a Geographical Information System (GIS)-based RAG system for use in ground searches for burials. To date the RAG system has not been used and documented in Italy and would potentially be useful for searches related to clandestine burial sites. This technique, was originally documented by the British Army in the 1st World War. The RAG method is based on the construction of theme maps. RAG maps can facilitate the deployment of appropriate search assets (such as geophysics, probe or search dogs) and therefore applied to ground searches for the potential location of homicide graves or other buried objects (including weapons, explosives, etc.). RAG maps also may assist in the management of resources such as the deployment of search personnel, search teams and dogs.

A GIS RAG (Red-Amber-Green) system related to a search for a homicide grave was applied to a test site in Italy, simulating the concealment of a victim in the area of Alì. This is an area of hill in Sicily, characterized by Palaeozoic phyllites. It was assumed during this test that information was provided by an observer who saw a suspect carrying tools on his land during daylight hours.

A desktop study of the rural area was first implemented. Data was collated from previous geological, geomorphological, hydrogeological, geophysical and land use surveys. All these data were stored and independently analysed in a GIS using ArcGIS software. For the development of the GIS-based RAG map a digital elevation model (DEM) including a digital surface model (DTS) and digital terrain model (DTM) types were used. These were integrated with data from soil surveys to provide a preliminary assessment of "diggability" – including the possible thickness of loose superficial deposits and soils.

Data were stored in different layers within the GIS. These included the delineation of the search area with consideration of access/exit points, diggability (easy: red, difficult: green), ground slope (<27°: red, >27°: green), vegetation type (easy access: red, difficult access: green), geomorphology (stable area: red, unstable area: green), anthropogenic structures (not present: red, present: green), visibility of the site from a potential eyewitnesses perspective (not visible: red, visible: green). Overlaying these layers, using the ArcGIS tools, enabled the RAG map to be composed with red showing the high priority search areas, amber the intermediate priority search areas and green the low priority search areas.

The GIS-based RAG map of the simulated test-site allowed the original extent of the search area of 39.315m2, to be significantly reduced to 7.45% (2.930m2: extension red area) by desktop study and to 2.93% (1.152m2) with a further reconnaissance site visit. During subsequent field training conducted by forensic geology students at Messina University, the grave was found after 2 hours of searching, both using the RAG map and a soil probe and observing topographic disturbances. A subsidence of some centimeters and an anomalous growth of vegetation was found on the superficial surface of the grave (75cm deep).