

ENVIRONMENTAL SURVEILLANCE AND VOLCANIC RISK. BRADYSEISMIC CRISIS AND VULNERABILITY OF BUILT-UP AREAS: NEW INTERVENTION STRATEGIES ON PUBLIC AND PRIVATE HERITAGE



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INVESTIGATION PERSPECTIVE

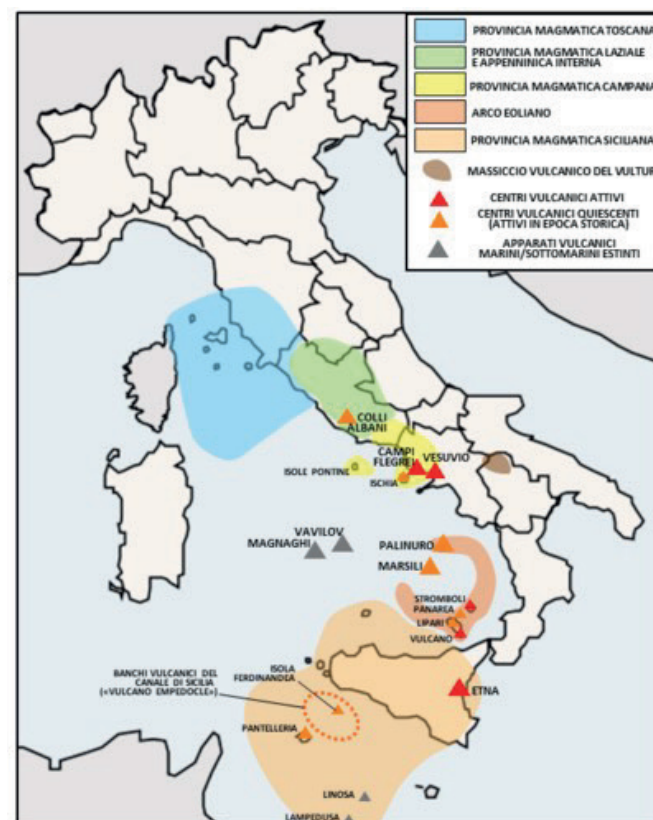
Assessment of seismic and volcanic risk. Prevention policies and scientific tools available to public administrations in the "risk society" for the security of territories and the stability of public and private heritage in the anthropocentric vision.

INTRODUCTION

Italy, for its geographical location and its geological dynamism, is a country particularly exposed to natural events such as earthquakes and volcanic eruptions.

Science teaches that while an earthquake is not predictable, with reference to volcanic activity it is possible to detect in advance the onset of phenomena that are precursors to an eruption.

In both cases it is possible and necessary to monitor the phenomena and make an **analysis of the negative effects** that an event, although unpredictable, can determine on population and on the public and private housing stock and if it occurs.



Italian map of volcanic risk.

ANALYSIS OF CRITICAL ISSUES

With volcanic eruptions, lava and ash cause **structural damage to buildings and electrical subsystems** as ash is often charged of electricity.

In addition, in magma there is a large concentration of gas that, with the eruption, is released over a very large area causing emissions of harmful gases, ash and metals that cause a **harmful climatic alteration** at local or regional level.

Some risk areas are also characterized by a high rate of illegal construction that can generate structural and environmental damage. Moreover, the illegal practice does not allow a complete and safe evacuation of the area in case of an adverse event. The **abusive building endanger public safety**.

The catastrophic events linked to natural phenomena periodically affecting Italy have generated a **fracture between State and Population**. The state is accused of doing little or nothing for prevention. An image of a State among the first in the world in terms of post-disaster solidarity and efficiency has been consolidated, but at the bottom of the list for prevention policies. This has increased the litigation for civil liability.



Etna eruption, April 5 2024. (lgiornale.it, Foto Kevin Saragozza)

"SCIENCE" FOR PREVENTION

The principles of precaution and prevention, which often remain at the abstract level of the rules, can now have practical value with an adequate use of technology applied to the monitoring of volcanic activity and earthquakes.

The use of **drones** to analyze the volcanic cone is useful to exploit the advantages of photogrammetry that accurately shows critical data never studied before and allows local public administrations to provide an immediate response on the actions to be taken.

The fiber optic cable also allows the technique of **Distributed Acoustic Sensing (DAS)** with which you can pick up seismic signals that conventional sensors can not detect. This system is being tested on Etna, which is the most active volcano in Europe and also one of the most monitored in the world that recently emitted unusual and spectacular gas rings.

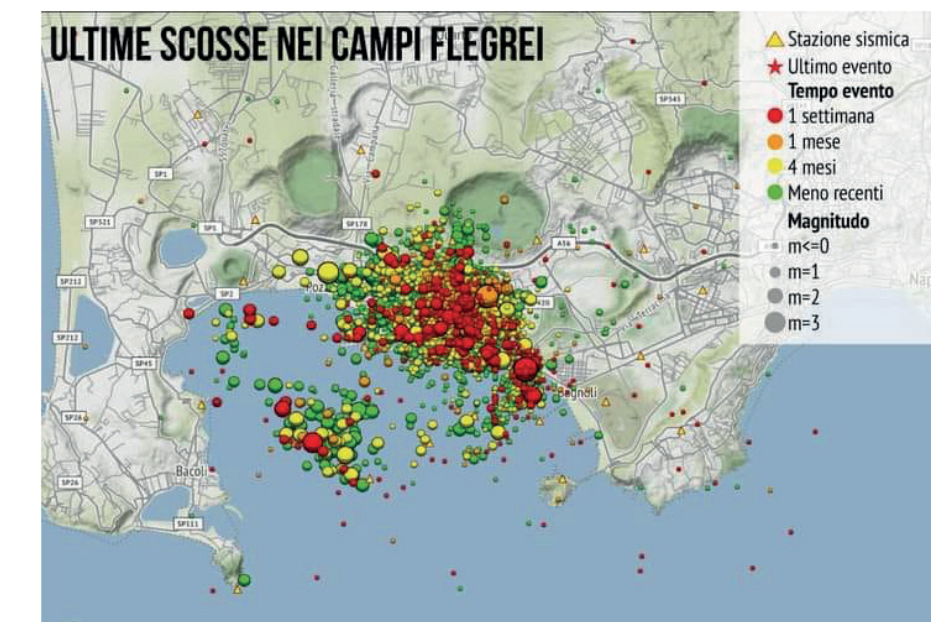
The technology must also be used for monitoring the stability of the building stock. In the areas of bradyseismic risk, **structural monitoring sensors** can measure constantly imperceptible deformations and vibrations that, over time, determine structural criticalities.

In addition, **non-invasive inspection technologies** such as ultrasound, thermography, and ground penetration radar can highlight apparently imperceptible critical issues of the structures. The building heritage near volcanoes must be characterized by environmental monitoring, such as temperature, humidity and other factors. By integrating these tools, it could be possible to ensure greater stability of buildings, extending their "useful life" even in critical areas.

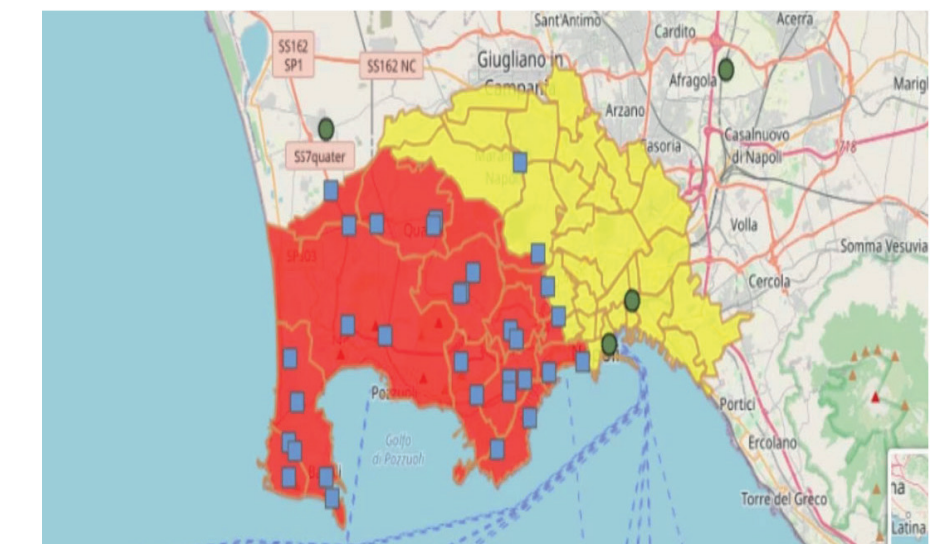
"LAW" FOR PREVENTION

Law must play its part to make the technology that exists today concretely applicable. The involvement of companies according to the **in-house model** should be authorised by law, without waiting for long public tenders. This model can facilitate the use of the digital tool by improving administrative action with concrete benefits for the territory and the community that inhabits it.

The general evacuation Plan must be updated very frequently. Now, in the Campi Flegrei's Area, according to studies carried out, the current Plan would not allow the immediate release of the area involved, due to the high population density.



Bradyseismic crisis (INGV)



Campi Flegrei: evacuation zone (PROTEZIONE CIVILE)

CONCLUDING REFLECTIONS

Prevention is a culture, a story with long times. The use of technology requires a transformation of structures and a radical re-engineering of procedures. The public administration is called to transpose digital tools in equity and security and ensure effective and appropriate action to respond to the critical issues of the territories.

"Science" and "law" must not proceed with a double speed, but should go **hand in hand**. In this way, the "risk society", in its preventive and post-disaster actions in an anthropocentric approach, can bring benefits to the Community and to everything that is preordained to the health and **psycho-physical wellness of people**.