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Risk Management Planning. Phlegrean area and the case study of Bacoli

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Abstract

The coastal region from Bacoli to Sorrento Coast contains, besides an alternation of fine landscapes and large areas of unplanned urban sprawl, different natural risk elements, object of planning tools that affect substantially urban policies and urban plans

In fact, if a Civil Protection and Emergency Plan is a project of all activities and procedures that need to be adopted to deal with an expected disaster in a region, it is evident that the coordination with urban planning is fundamental, especially in sensitive areas such as the coastal ones.

In the article, using the case study of the Italian city of Bacoli (near Naples), I'll explore the possibilities offered, in the emergency planning, by the sea as a specific escape route in case of natural disaster. The reflection starts from an examination of the particular orography and geography of the Phlegraean coast, the area topography, the level of interconnections and infrastructures. The strategies developed during the preparation of the emergency and civil protection plan, from which this article starts, identify in the waterfront, especially adapted, infrastructured and safe, a fundamental option in the management of major emergencies of the Phlegraean area.

Keywords: safety & security, large scale plans & projects, social practices

1. Introduction. The risk as a variable

The contextual nature of risk perception and response is very typical of contemporary society and of a "second kind of modernity" (Beck, 2000), in which the risk factors "described by science" are relativized by the cultural background of the society in which they occur, exposing to oblivion some obvious risks or, conversely, believing that anything is potentially dangerous, according to the perspective from which the events are observed (Lupton, 2003).

Throughout the metropolitan area of Naples there is an overlap of risk factors that periodically generate more or less serious events: landslides, soil pollution, earthquakes, bradyseism and volcanic hazards, which are quite infrequent but extremely dangerous.

The latter is a real evolving risk (among the biggest all over Europe), connected to the volcanic activity (Vesuvius and the Phlegrean caldera), that weighs significantly on spatial planning, on its possibilities and on direction of its development paths.

The relativization of this risk and the characteristic cultural approach held by population (Douglas, 1996), have almost reduced its perception and only in the last decade, institutions have undertaken preventive works, planning actions and regulatory constraints .

Regione Campania (the authority appointed to territory administration and coordination of risk prevention) has been promoting longstanding actions and instruments of coordination-prevention on many different levels of cogency and institutional spheres which converge in order to form a strategic reference frame in dealing with natural disasters.

The final outcome will be a network of plans and programs connected to emergence, whose core is the writing of Emergency and Civil Protection Municipal Plans meant as planning instruments of all the organized activities and all the procedures adopted in case of expected disasters in a given area, in order to ensure the effective and immediate use of needed resources required to overcome the emergency.

Therefore those plans may define both the risk scenarios for a proper management of crisis situations, and the explanation of planned urban actions that can be integrated to and complementary with other types of plans and policies for the area (especially the municipal urban planning).

In this scenario land resources are the central point of reference for emergency control, in terms of safe places, waiting areas, infrastructures and equipment, both existing or proposed.

In this regard the Civil Protection Plan can have a strong connection with urban and territorial planning, partially overcoming the intrinsic sectoriality of the approach.

This paper will use the case study of Bacoli, near Naples, to describe the path of Emergency and Civil Protection Plan associated with the various forms of risk caused by the Campi Flegrei caldera as well as its acting as a strategic and complementary instrument in urban planning.

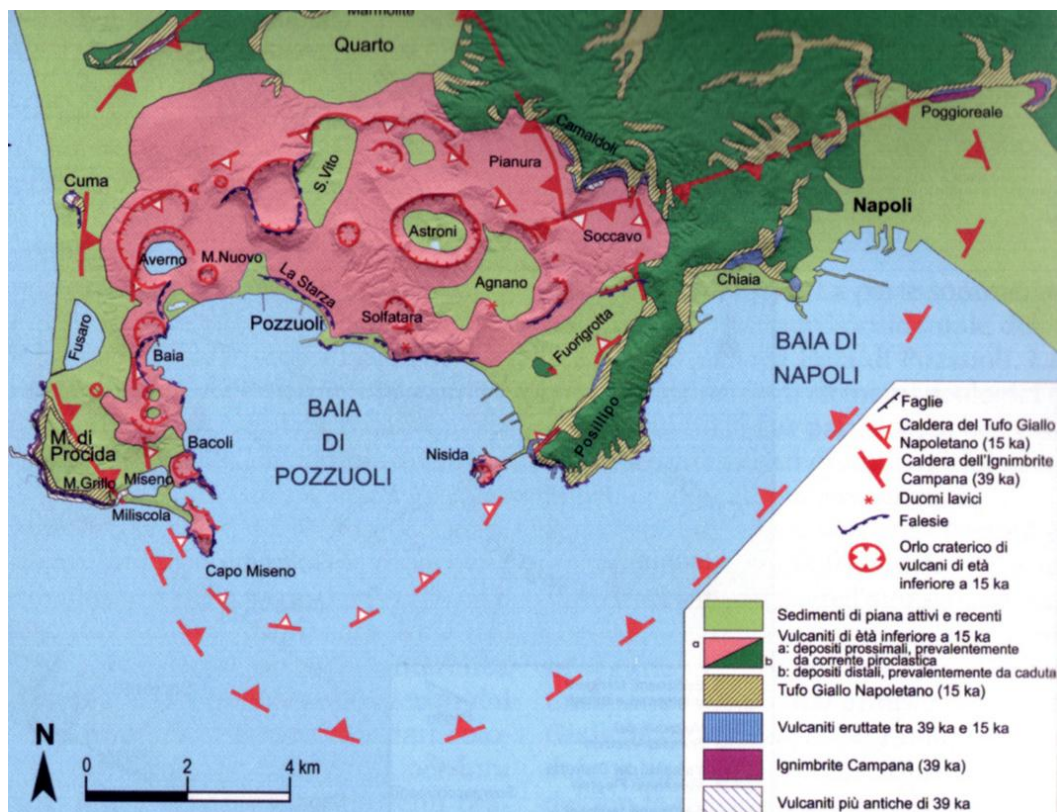


Fig. 1: Schematic geological map of the Campi Flegrei caldera (Source: Orsi et al., 1996).

2. Morphology of the risk in the Phlegean Area

The whole Gulf of Naples is characterized by the presence of four volcanoes: The Somma-Vesuvius system, Campi Flegrei and Ischia resurgent calderas, Procida volcanic field (Orsi & Zollo, 2013). For what concerns Campi Flegrei system (whose last eruption took place in 1538), the activity is proved by intense and millennial fumaroles, by hydrothermal waters and frequent bradyseismic events, which cause ground deformations together with seismicity and variations of chemical-physical characteristics of the fluids emitted from fumaroles (*ibid.*).

The most recent bradyseismic activities occurred in 1970-72 and in 1982-85; the 1970 one took by surprise the unprepared scientific world and the emergency apparatus. Indeed up to that moment the area was not monitored, and the only precedent related to ground motion phenomena was in 1538, as already mentioned.

In 2012 the alert level of that area grew from "basic" to "attention" on a scale of four levels defined by the 2001 Area Flegrea Emergency Plan.¹

This new standard was adopted by the Civil Protection Department after a consultation with the Major Risks Committee, as a result of the new parameters detected by the Vesuvius Observatory, even if there aren't many elements which may help to predict a short-run evolution (Martini, 2013).

Despite this risk scenario, the urbanization of the whole Phlegrean area and specifically of the town of Bacoli grew up along the second half of the 900, in a fragmented, uncoordinated and, of course, partly abusive way, considerably increasing the load settlement². All this occurred in spite of several planning instruments operating on the municipal area: the 1976 General Plan, the 1999 Campi Flegrei Landscape Plan, the establishment of Campi Flegrei Park, four S.C.I.'s (Sites of Community Interest) and Regional Basin of Campania Centrale predictions.

At the same time, the chaotic building of many areas of the city produced as a consequence the lack of infrastructural system, which is poorly interconnected and not adequate to cope with natural disasters, even the smaller ones, as often reported and repeated by media.

3. Emergency Planning as a urban strategy. The case study of Bacoli

Emergency and Civil Protection Municipal Plan is a planning instrument able to assess and prevent the effects of common risk factors that can statistically affect a territory.

The goal of this Plan is to define scenarios for an incisive management of crisis situations. It is in this sense that goes the recent amendment of the Law 225/92 (already complemented by the Law 401/2001) that introduces specific requirements for municipalities through the Law 100/2012.

The Bacoli Emergency and Civil Protection Plan is currently only a "preliminary project"³, and it establishes as pivotal matter of the planning the risk connected to bradyseism and to all other kinds of risks (geological, seismic, fire risks and so on), and primarily all their possible interaction.

With the aim of satisfying these needs we must at first define the risk scenarios basing our consideration on the vulnerability of the territory (areas, involved population, damageable structures etc.) in order to have overall and reliable information related to the expected event (above all in the specific case the volcanic and bradyseismic risk) and therefore be able to assess in advance the operational response required to overcome the emergency stage. All that will be considered in terms of resource allocations, infrastructures sizing and forecasts that are realistic and compatible with the spending power of the local authority or with projects funded by other institutions (especially those actions financed by Structural Funds and European Investments).

¹ The bradyseism, which is characterized by a slow lifting motion (negative bradyseism) or a decreasing motion (positive bradyseism) of the soil, happened on September 7, 2012 with a low energy earthquake swarm and some events perceived in the area located between the historical center of Pozzuoli and Arco Felice. The statement issued by the Vesuvius Observatory showed that the swarm was not an isolated phenomenon, but an event connected to a larger process that involves the whole Phlegrean Area. At the time of writing this article, the phenomenon seems to have settled down with a clear decreasing of significant events.

² In the four countries of the area (Bacoli, Monte di Procida, Pozzuoli and Quarto) the population has increased from about 70 thousand inhabitants in 1951 to almost 160 thousand in 2013. In the metropolitan area, the city of Naples has decreased from 1.004.577 inhabitants of 2001 to 959.574 of 2012, whereas during the same decade some of the Vesuvian countries (Somma Vesuviana, Ottaviano, San Giuseppe Vesuviano and Terzigno) and those located Northwest of Naples (Giugliano in Campania, Pozzuoli, Bacoli and Monte di Procida) recorded the highest average growth of all the current Province of Naples (Guida, 2014).

³ The Bacoli Emergency and Civil Protection Plan is being drafted by Municipality Urban Area (SPM arch. Gennaro Ciunfrini), with scientific advice of the Department of Architecture of the University of Naples "Federico II", prof. arch. Michelangelo Russo (Scientific Responsible), arch. Giuseppe Guida (Scientific Adviser), arch. Giovanni Bello (Collaborator). The final plan will identify in details what has been established at level of strategies. Additionally, the project will adopt an analytical approach of ELC (Emergency Limit Condition) which concerns the test of behavior of the various components with the intent of urban emergency management (Bramerini *et al*, 2013).

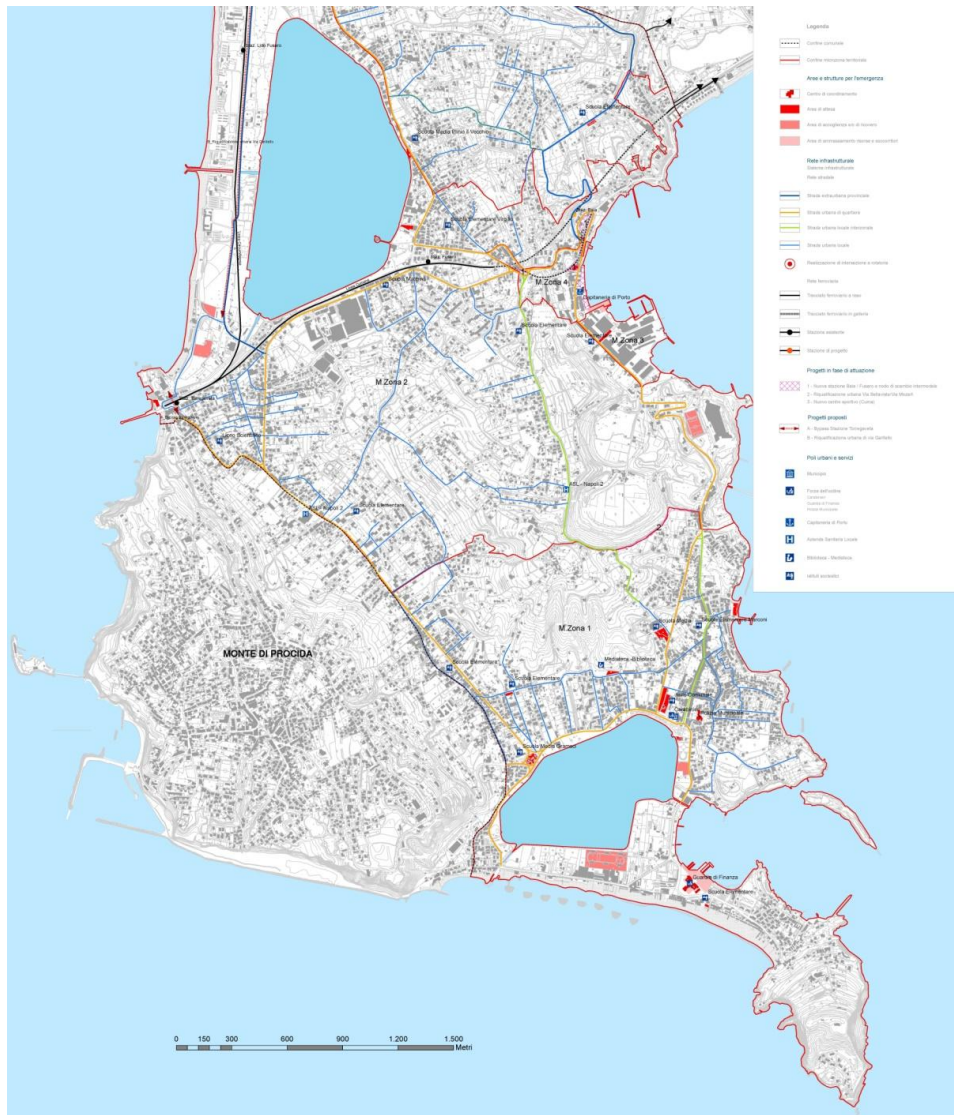


Fig. 3: Emergency and Civil Protection Preliminary Plan of the Town of Bacoli Areas and facilities for emergency (excerpt).

Provincial and regional plans are less detailed than municipal plan, which allows citizens and Civil Protection workers of different sections to have a frame of reference corresponding to the real size of expected event, involved population, alternative roads, possible evacuation routes, waiting areas, temporary lodging camp, gathering places and so on.

Proper planning strategies for mobility and evacuation routes are critical to the success of the plan. Strategies must include provision of new projects of reorganization, adjustment or increase of the current network and standing areas. Notably, Bacoli Emergency Plan identified the sea resource as a specific evacuation route for expected catastrophic events.

In this sense, one of the basic elements contemplated here is population and its distribution on the territory. Through the interpolation of Istat data and their georeferencing, it has been possible to graphically and dynamically identify the different "weights" within the geographical subdivision.

Subsequently local territory has been divided into 5 "micro-areas", representing section of territory characterized by uniformity of positional, urban, historical, cultural, environmental, socio-economic factors, as well as of delivery of service and infrastructure related to mobility. Table 1 describes the entity of the gathering places previously located in the plan for each micro-areas.

Further refinement of data and follow-up inspections of the effectiveness of the evacuation routes, especially the maritime ones, and of different types of risk dimension will lead to identify or modify what have been indicated and downsized.

Microzones	Gathering place	Surfaces	Population
Microzone 1	Miseno/Fondi di Baia	37.402mq	10.581
Microzone 2	Torregaveta	27.620mq	9.803
Microzone3/4	Porto di Baia	9.925 mq	882
Microzone 5	Fusaro	15.125mq	5.369
TOTALE		90.072mq	26.645

Fig. 4: Entity of micro-areas in terms of surface and population

4. Evacuation routes and planning strategy

The available data about Bacoli infrastructural level show a mobility system that doesn't seem to be insufficient, but barely interconnected, fragmented and consisting of a limited intermodality among different kinds of transports. For example, it's clearly showed how the mobility network, both road transports and iron transport, can't assure presently evacuation and safety measures not only for the most of Bacoli inhabitants, but also for the nearby town Monte di Procida, whose whole flow converges on Bacoli's territory, and then gather with Naples' Ringroad routes and Domitiana's routes, passing through the Town of Pozzuoli.

Additionally, in case of significant natural calamity, the iron transport can't be seen as crucial in evacuation plan, due to railroad's risk of deformation.⁴ Emergency and Civil Protection Plan, here partially explained, tested and prorated ponderal incidence on maritime transport's infrastructure network, that is a strategic system in the management of evacuation routes.

Geographic and morphological location of Bacoli's territory has led Emergency Plan to provide as preferential evacuation route, especially for certain micro-areas (1, 2, 3, 4, where 4/5 of 27 thousands of Bacoli inhabitants live), the maritime way, trying to locate from time to time the best destination for each path.

On Bacoli territory there are three small harbor areas: Baia, Miseno and Torregaveta.

Presently, Baia harbor has a 4.5 meters of maximum draught and it is generally used by leisure boats for docking and laying over. The harbor, which can contain approximately 600 boats, with 25 meters of maximum length, is adequately equipped for assistance and nautical service. There are commercial docks, also used by local shipbuilding. Porto Miseno, further South, is essentially subdued to Finance Police's boats; here there aren't leisure boats, but it's possible to drop anchor and moor to buoys, which are usually granted to licensed private citizens, who during the summer, may create a congestion of people and vehicles, provoked by the excessive number of leisure boats. Additionally, it should be considered also the risk caused by the huge presence of mussels breeding at the harbor entryway.

Therefore, it's evident that even in this case, specific spaces assigned to emergency use must be provided in case of need. Lastly, on the West part of the Coast, the small Torregaveta harbor is located; it is endowed with a dock and well linked to the nearby Cumana Railroad.

The ponderal rate of evacuation routes given by these landing places (especially the one in Torregaveta), will be able to absorb in perspective also part of the charge of the neighboring town of Monte di Procida, which, as already said, weighs completely on Bacoli territory in matter of mobility.

Thanks to initial tests, done on location of waiting areas, reception and gathering places, it is possible to quantify, in regard to the involved micro-areas, that almost ¼ of Bacoli population may be engaged in a generalized emergency exodus through the sea (about 5000 people, together with a variable index given by Monte di Procida citizens).

⁴ Iron connectivity is provided by Cumana railway, which connects the centre of Naples with Campi Flegrei area.

The Emergency Plan identifies for the whole evacuation routes system some necessary adaptations. This orientation is going along and simultaneously with the redaction of the new PUC (City Urban Plan), so that to obtain planning previsions which at the same time can be univocal, more feasible and effective.⁵

Figure 5 shows in form of concept the first strategies derived from the preliminary plan. These strategies summarize data at the present stage, and use them to draw possible configurations, related particularly to the connection network and tools, be they already available or in progress.

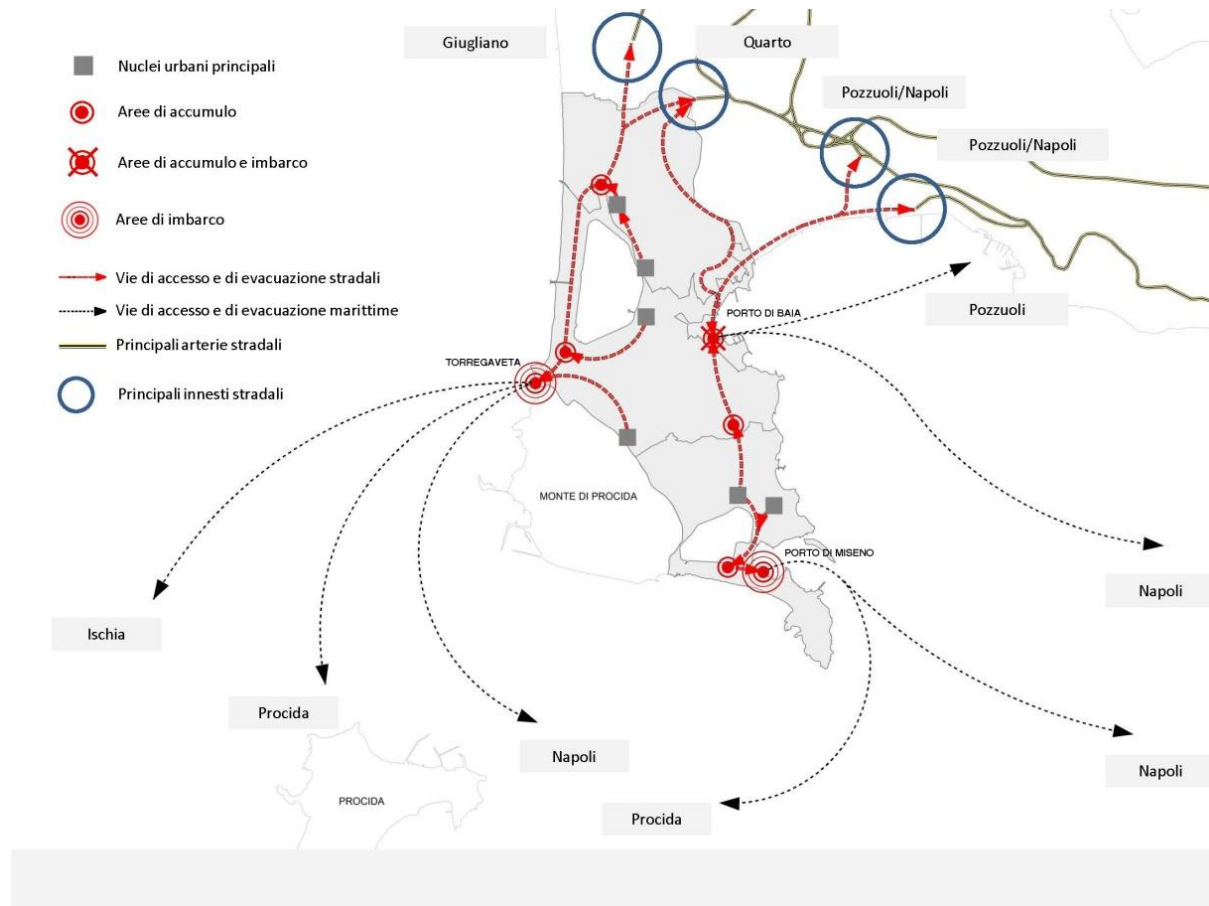


Fig. 5: Emergency and Civil Protection Preliminary Plan of the Town of Bacoli - Outline of strategies for evacuation routes.

5. Conclusion

Emergency planning, *ex ante* and *ex post* event, can also give the opportunity to think over the planning models and urban strategy in certain territories which are subject to natural hazard and to a misuse of territory and resources that have considerably increased the so-called “exposed value”. Additionally, this risk is at the mercy of social and cultural variables which may modify its perception beyond scientific evidence, negatively affecting in particular the phase of prevention and priority definition. Therefore, risk management is not an issue that should be addressed uniquely to the limited field of emergency plan, but on the contrary it should be connected with a wider territorial and urban planning in cognitive, planning and operative way.

In this sense, emergency plan must accurately take into account urban and geographic condition of territory and its ongoing planning and development. The example here exposed is hinged precisely along this project, and Bacoli is the first of Phlegrean towns to be endowed with an emergency plan in which different parts of urban system are evaluated according to a relational approach, able to better identify strategic elements (strategic buildings, emergency areas, accessible and connecting infrastructures, by integrating in the specific case, evacuation ways, etc), using the available civil protection resources in a more effective ways.

⁵ In 2014 Municipality of Bacoli started, together with Emergency and Civil Protection Plan, the redaction of the New Urban Municipal Plan, committed to Studio Architetti Benevolo with Goldstein Architettura and arch. Guido Riano.

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