

The System of Environmental Networks for the use of Archaeological Sites in Areas of Natural Beauty

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Every action to protect archaeological heritage requires environmental transformations, especially when such interventions are aimed at make available (usable, accessible, readable even in the early stages of investigation) a site through a proper infrastructure of the area. An archaeological site is, in fact, a system characterized by complex interrelated relationships that must be supported by networks able to provide technological control of complex functions. In this regard, this research aims to study in particular the system of infrastructural networks (communication, energy supply, integrated water cycle) in the service of taking care of archaeological sites as well as the interaction with the ecological and landscape network that covers the area. The encounter between infrastructural networks and ecological and landscape creates a new type of network, that can be defined as “environmental” and which takes account not only of supply and flow of matter and energy, but also the needs of environmental sub-systems water, air and soil. The research is also applied to the archaeological site of “the Villa di Pollio Felice” in the town of Sorrento, which, for the characteristics of the archaeological park with strong environmental and landscape values, is particularly suitable for the application of the aforementioned concepts.

Keywords: *archaeological heritage, environmental networks, sustainable fruition, ecological networks.*

1. Introduction

The valorisation process of archaeological heritage requires an interdisciplinary scientific approach capable of controlling the numerous variables that characterise the historical, cultural and environmental elements of the asset.

Therefore, the considerations that follow are the result of expertise gained both in the fields of archaeology as well as technology-environment in order to address the complex issues surrounding the opening to the public of an archaeological site. The aim of this paper is to test the applicability of the concept of environmental networks to a limited geographical area with particular historical and environmental values. In particular, starting from a case study, the problematic context of the compatibility between public use and preservation of the quality of existing ecosystems will be studied in greater detail.

These considerations will take into account the site of Villa di Pollio Felice, in the town of Sorrento (Naples), which due to its archaeological and natural peculiarities is an interesting application context.

2. Research methodology

The relationship between archaeological heritage and the environment in which it is located is very delicate

for various reasons, but mainly because it involves two dynamic entities that are in constant transformation, with different times and ways, and are required to interface with each other. This relationship also appears to be of particular importance because it is directly linked to the conservation and use of the asset. The study of the relationship between the system and the historic environment, conceived as the sum of the natural and man-made forms, requires that the archaeological data are correlated with the morphology of the area, the climate and the natural and ecological resources of the area. In addition, the relationships with environmental water, air and soil in which it is customary to divide the environment are well defined.

Every protective action of the archaeological heritage imposes some form of environmental change, especially when the interventions are orientated to making a site available (usable, accessible, readable even in the early stages of investigation) through the creation of an infrastructure. An archaeological site is, in fact, a system characterized by a set of interrelated relationships that must be supported by a network system capable of ensuring the technological control of complex functions. These relationships are based mainly on the exchange of energy or energy products as well

as on the transfer or disposal of materials. These exchanges or distributions are supported by networks in continuous or non-continuous vectors.

A network is a stable system, with a programmable and repeatable supply of services, exchange of information, transfer of products, energy transmission, transportation of goods and people, organised and built in such a way that, unless due to accidental failures, it is always available upon the request of the users. It works with the only limitation on the amount of service or supply in a given time interval, handling, and the quality or usability of the service, the level. Due to the infrastructure networks being in the territory of a mesh made of nodes and connections whose aim is to establish relationships with all the flows of materials and energy, it is important that any interventions on the infrastructure of an archaeological site are in relation to the ecological networks and landscape, that in this type of interventions play an essential role.

Thus, an important role is given to this reconfiguration so that the integration of the infrastructure and environmental networks and landscape leads to a new type of network, which can be defined as “environmental”, taking into account not only the supply and flow of materials and energy, but also the needs of the environmental water, air and soil subsystems. This is aimed at the conservation of local resources and the connection between the historical, environmental and landscape values of the area for a complete valorisation of the land.

It is, therefore, important to identify the links of the networks of energy and mass with the environmental base in which they are carrying the service in such a way as to optimise the configurations for which the networks assume the status of environmental in relation to the various types of contexts. Studying the control of the transformations of the state of the environment with the aim of conserving and preserving, through the development of environmental networks, requires an integrated approach that involves complex, specialised and interrelated issues.



Fig. 1. The Villa di Pollio Felice: the internal basin (photo by T. Budetta)

The aforementioned methodology is applied to the archaeological site of “Villa di Pollio Felice” in the town of Sorrento in Italy, due to the characteristics of the archaeological park, with strong environmental and

landscape values, being suitable for the application of the previously described concepts.

3. The Roman Villa di Pollio Felice in Capo di Sorrento

This seaside *villa*, in ancient times, from the I century BC – I century AD, lay on the promontory of Capo di Sorrento. Today, ancient references and comparisons with other Roman *villae* of the Gulf of Naples, from Posillipo to Campanella (cf. Strabone V 47) give us account of its ruins. The *villa* of Capo di Sorrento, which the popular tradition knew as *I bagni della regina Giovanna* (the baths of Queen Giovanna), had an extent of about two hectares.



Fig. 2. The Villa di Pollio Felice: overview (photo by T. Budetta)

The property maybe included, besides the seaside *villa*, also a *domus*, more upstream, used predominantly for agricultural purposes. The two units were connected with slip roads and tunnels, whereas, the differences in height of the promontory were settled with artificial terraces. Today, we can only see some parts of the walls of terracing, mostly in *opus reticulatum*.

The *villa* is accessible either overland or oversea. The current secondary sloping road of Massa traces out to a large extent the ancient access road to the *villa*. A little bridge connected the promontory to the actual cape and surmounted the access to the internal basin. Not far away, an entrance led into the rooms of the house. These were arranged around a *peristilium* – whose porch floor was in *cocciopesto* – surrounded by a series of room. Other rooms with different functions, were arranged, instead, into several levels on the promontory.

The eastern part – with mosaic floors – acted as the lodging house, while, the other block of barer rooms, on the western part, was assigned to the servants and to the service rooms, as we can see from the presence of a kitchen. The two units were separated by a secondary entrance on the sea, which allowed the passage to the lower buildings up to the seaside stores, on the outermost strip of the cape.

Without any doubt, the compound was also provided with a spa, although it is impossible to establish its precise location only analysing the ruins. The information by Vetruvio, according to which the apse of the *calidarium* was south-west oriented for the maximum sun exposure during the day, may be of some help. A continuous water-supply could justify a location upstream.

The architecture seems to take a great advantage of the landscape beauties. The rooms show the greatest usability of the scenery, also thanks to some tricks: divergent walls, wide windows, up to the sophisticated solution of a promenade around the little harbour, with a panoramic viewpoint into the internal part of the apse overlooking the entrance. The most evocative element of the landscape is a natural basin, which the masters used wisely as a dock and swimming pool. It was scenically furnished as we can see from the two examples of the Grotta Azzura in Capri and the Grotta of Sperlonga. The two western small islands show several wall structures and, therefore, it is likely that were connected to the promontory with a bridge.



Fig. 3. The Villa di Pollio Felice: the ruins (photo by T. Budetta)

Considering that the promontory obstructed the access to Sorrento, it is probable that it was equipped with a lighthouse. The productive activities of the *villa*, the *negotium*, were bound to the fields, on the upper part of the *villa*, and to the sea. The fields produced oil and the high-quality wine of Sorrento (Strabone, Oratio, Macedonius and Plinius), while, the sea supplied fish and shellfish, one of the Romans' favourite dishes. Everything, architecture and decoration, was functional to the *luxuria* and *otium*. Even the shaded areas – the roof – gardens and the *pergoles* – veiled the sunny trails and reflected the desire to live well as the greatest expression of luxury.

4. Systems for fruition: accessibility, comfort and safety

It is widely believed and “accepted” that a visit to an archaeological site can be a cause of its deterioration but the relationship has only partially been verified. What makes the visit “dangerous” is not so much the presence of the users, but rather the lack of appropriate routes that can support them during their visit. In fact, one of the main problems in archaeology is the need to rationalise the visit routes. From a purely architectural point of view, this results in crossing systems that possess some basic requirements, i.e., they do not interfere visually with the ruins, do not alter the subject and ensure continuity and clarity during the visit. Allowing the public to use an asset entails numerous archaeological interventions, often invasive, as well as the resolution

of problems related to the musealisation of the site, the presence of protective systems, the safety and welfare of the users, the accessibility of the place and the exhibition. Accessibility, comfort and safety of the visit are the strategic points of a fruition project to be developed starting from the user's needs and in compliance with the environmental and technological compatibility of the asset to be protected.

In addition, there are interrelated aspects that cannot be separated from the environmental features of the site, as in the case study. If on the one hand, the strong integration between the archaeological remains and the environmental context of natural beauty makes the site of Villa di Pollio Felice unique and attractive, on the other, it amplifies the difficulty in making it a place to visit with the conditions of comfort and, above all, safety. In summary, this paper goes beyond the communicative component of the use, i.e. all those aspects which, when properly integrated into “extended” accessibility help to make the archaeological ruins comprehensible, readable, and therefore fully accessible.

In order to outline a problem reference framework aimed at the methodological definition of a project focusing on the sustainable use of the area, the first element to focus on is the morphology of the site that is highly structured: it goes from the sea to the coast, crossing the archaeological area finally reaching an area of dense vegetation. From an architectural point of view, this naturalistic conformation poses some delicate design issues in relation to overcoming significant slopes, the more or less sinuous trend of the coast line to be followed or stayed away from, the ability to make the environmental complexity of the site visible and, in particular, the dual relationship of the archaeological asset with both the sea and the green area above. In the design phase, it would be desirable to establish a hierarchical system, identifying the archaeological and/or natural features that represent a kind of “priority to visit”. The selected elements will form the focal points of the nodes or networks of the routes, whether museums and/or historic.

The presence/absence of an order of the elements to visit, as well as the presence/absence of routes *designed specifically* for the museum exhibition provides an opportunity to consider the most appropriate museum logic to adopt, identifying what degree of freedom to allow visitors. In fact, the museum routes, depending on whether they are arranged according to artistic or scientific criteria, assume a more or less “binding” role for the user. The notion that the visitor should be guided solely by the fascination of the ruins, from the suggestions, is not always desirable in a cultural project which has the aim of making the asset known. It is a delicate balance, with the case of the Villa di Pollio Felice being no exception: it is almost impossible to perceive the line between the site and the context. Especially in such situations, it is worth considering a strategy that, if on the one hand gives the public the opportunity to walk freely among the ruins, while on the other, guides it through the installation. Whatever the case, giving “autonomy” to users is never an easy choice and, above all, is not devoid of design implications. On the contrary, as long as dangerous situations for the users and the protection of the asset,

visitors should be provided with tools that allow them to interpret the space surrounding them. For example, the two spatialities that coexist in the archaeological areas should be distinguished: the “archaeological” and “museological”. The remains are often found on the plane closer to that of the foundation, protruding from the ground level, at times, a few tens of centimetres. This implies a difficulty of perception of the same due to the fact that it is not easy to understand the architectural aspects, the spatiality, with visitors, spontaneously, searching for better, and not always safe, views. Many amateur images show visitors at the site of Villa di Pollio Felice, leaning over the rocky cliffs without any protective systems looking for new views.

There is the same difficulty when distinguishing the external areas from the internal ones, especially where there are no floors. When the walls or elements of the atria of the buildings are no longer able to evoke the architectural space of the body now reduced to a state of ruin, it becomes important to provide diversified modes of treatment of the soil in order to highlight those difficult to understand aspects, inserting, if compatible with the context, privileged points of view.



Fig. 4. *The Villa di Pollio Felice: the paths (photo by T. Budetta)*

The inclusion of any system of delimitation, aimed at preventing a movement or, more simply, to allow it safely, needs to be verified for compatibility with the archaeological and environmental context starting from the architectural integration. In fact, looking at several small infrastructures currently present on the site, it is impossible not to make some considerations. If on the one hand, they clearly manifest their “provisional” and, in some way, “spontaneous” nature, clearly highlighting the objective difficulty of confronting an environment of great natural beauty as well as archaeology. The use of fences or “building-site” structures as well as walkways on stilts, highlights the actual complexity in the context of a dialogue with a delicate ecological and perceptive balance, requiring, therefore, a design approach of extreme methodological rigor.

These initial considerations lead to an integrated approach for an integrated use that, starting from

the archaeological context, it takes into account the environmental quality of the area according to a design logic that could be called an “interconnection” between the more sustainable microsystems.

5. Core areas and corridors in the ecological coastal-marine network

Villa di Pollio Felice is located in the Protected Marine Area of Punta Campanella. Protected Marine Areas play a primary role in the protection of the territory and, in particular, the protection of the coast. They were introduced by the Law of Defence of the Sea n. 979/82 which defines “*marine environments by their waters, seabed and stretches of overlooking coastline having a marked interest in the natural, geomorphological, physical, biochemical characteristics, especially with regard to the coastal and marine flora and fauna as well as the scientific, ecological, cultural, educational and economic importance*”(art. 25).

The successive Legislative Framework n. 394/91 supplements the regulatory framework, establishing, among other things, the purposes of Protected Marine Areas. The main aspect includes the preservation of animal and plant species, the application of management and/or environmental restoration methods suitable to realising an integration between man and the natural environment and the promotion of education, training and scientific research. The Protected Marine Area of Punta Campanella was established by Ministerial Decree n. 46 of 12 December 1997, subsequently amended by the M.D. of 13 June 2000. Along this 40 Km coastline, there are green capes and cosy bays that make it possible to catalogue it, from a perspective of the nature, as one of the most beautiful and lush coastlines in Italy, for both the terrestrial and marine environments. Sheer cliffs alternate with gently sloping walls, while further off-shore, there are several shoals, which are highly interesting.

The territory is divided into areas with different degrees of protection, denominated A, B and C. The aim is to ensure both the full protection of the nature (zone A) as well as the correct management of the territory for eco-tourism (zone B) and for the maintenance and development of local economies (area C), combining the preservation of environmental values with the sustainable use of the marine environment.

Villa di Pollio Felice falls into area C, in other words, a partial reserve, which represents a buffer zone between the areas of greatest natural value and sectors outside the Protected Marine Area, where activities and sustainable use of the sea with low environmental impact are allowed.

The establishment of protected marine areas, as well as parks and state reserves, has as its primary objectives the development of local economies, the preservation of natural values and the recovery of threatened areas.

These policies, which can be described as a “system”, tend to export correct methods of land management outside of the protected areas, in order to enable the development of ecological corridors that link the parks and reserves together. The aim is to achieve a “local” ecological network capable of joining the higher level.

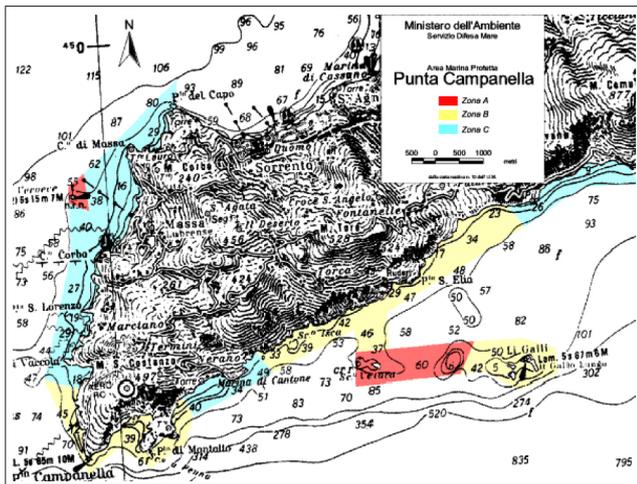


Fig. 5. Zoning of the Protected Marine Area of Punta Campanella (Map attached to the Ministerial Decree n. 46 of 12 December 1997)

The ecological network is configured as a means to interrelate and connect territories with a greater presence of naturalness, allowing species to move from one environment to another, thus avoiding confinement in closed habitats. It should not be forgotten that an ecological network can be realised only if it adheres to the species-specific functionality principle, i.e., if the particular habitat requirements of the species in the area are considered.

This is even more true for the marine and coastal environments where the importance of an approach to the conservation of habitats and species based on the concept of ecological network is now widely recognized. The construction of an ecological network in marine and coastal environments, namely the identification of *core areas* and *corridors* to a certain target species, is without doubt more complex than for the terrestrial environment.

Along the coast, exclusively in a terrestrial environment, the core areas may consist of wetlands, from behind the dunes and dune environments to them frequently associated with coastal reliefs and cliffs, vast delta areas, from plain environments and hydrographical basins. Coastal-marine networks may be composed of specific sedimentary environments or rocky sea-beds. While with the open sea, the possible elements of an ecological network obviously depend on the individual species, but, as a first approximation, it is worth considering that the archipelagos and the big banks constitute the core areas.

In greater detail, in the coastal-marine environment, it is the identification of corridors i.e. those areas of ecological-functional communication essential for the migration, dispersal and genetic exchange of wild species. In fact, along the coasts, biological connectivity is guaranteed only if there is:

- *horizontal connectivity*, that is capable of providing connections between core areas located along the coast through exclusively land or air corridors;
- *vertical connectivity*, which allows connections between coastal and marine areas and includes both underwater and above water corridors (aircraft).

In Villa di Pollio Felice, the human activities in the marine environment are governed by the provisions of the Regulations of the Protected Marine Area. These are activities and sustainable use of the sea will not impact on the vertically ecological connection.

It is different for the horizontal connectivity which depends on the biological permeability of the territory, i.e. the ability of a type of land use to be crossed by certain species. This depends not only on the characteristics of the territory and the species that pass through it, but also on the level of anthropic use of the area under study.

The part of the land occupied by Villa di Pollio Felice is not affected by intensive anthropogenic forms of use, so as to consider it an ecological risk area.

However, it is worth considering that any planned intervention in a project to enhance the archaeological site, whether it concerns the forms of use or the infrastructure of the areas, aimed at improving the conditions of comfort and security, must be preceded by an accurate verification of the compatibility with the horizontal ecological connection of the coastal areas. This is to avoid the formation of barriers and fragmentation phenomena in the environmental system.

6. Conclusions

The contribution, starting from the innovative concept of the environmental network, which takes into account not only the supply and flow of materials and energy, but also the needs of the environmental water, air and soil subsystems, studies issues related to the ecological and fruition contexts of an archaeological site conceived as a sustainable microsystem.

Starting from the particularity of the site of the Villa di Pollio Felice, it identifies, in the morphological characteristics of the area, the elements of complexity and at the same time of attractiveness. This premise, from a fruition point of view, mainly focuses on accessibility, comfort and safety during the visit.

Finally, it highlights the nodal role assumed by the site in question, placed inside a protected marine area, with respect to the local ecological network, with particular attention to the issue of the biological connectivity of the core areas, located in different geographical areas: marine, marine-coastal and terrestrial.

The results provide a cognitive reference background that should precede the definition of a methodological design framework, which can be studied in greater in further studies.

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