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The Multicriteria Representation and Eco-Technological Survey of Compromised Territories: the Case Study of the Regi Lagni

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It is important that the technical development, which tends to be sectored knowledge, is characterized by an integrated management of transformations especially in a time in history when the anthropic changes affecting more and more deeply on the environment. In this respect, the present work proposes a methodology of approach to the problem of the study of compromised territories that have multi-disciplinary nature and involves areas of the territorial survey and environmental technologies. These disciplines have the common aim of seeking operating reversible practices that constitute the basis to direct recovery project in an eco-oriented key.

The territorial survey and the multicriteria representation of acquired and processed data provide an important input to the territorial analysis through innovative detection systems. This systems allow the acquisition of data for the land use monitoring, the identification of surface waterway, the survey of areas exposed to landslide risk, the analysis of the physical and biological characteristics of watercourses and identifying polluted areas. This information, supplemented with historical documents and maps, allow the understanding of the dynamics of change occurred over time.

The eco-technological survey of the examinated territory is the investigation phase in which descriptive data on the environmental conditions (climatic and microclimatic data, fruitive characters, networks system, etc..) are systematized. This step is, therefore, preparatory to the definition of the strategic objectives for the recovery project in a sustainable key, that frames the territory as a complex fabric in which each process is controlled so that the cost of the changes, in environmental, economic and social terms, not is transferred to future generations. The research focuses on the area of the *Regi Lagni*, ancient system of artificial drainage in the province of Caserta (Italy), which is interesting for the concentration of significant alterations of the environmental subsystems of water, air and soil.

Keywords: *environmental recovery, multidimensional representation, systemic approach, technological-ecological issues.*

1. Introduction

The recovery of territories that have been environmentally compromised by anthropogenic uses is implemented through the preliminary reclamation of the sites, improvement of the existing structures, the introduction of safety systems for the uses, management of the changes of use as set out by the needs as well as using the infrastructural facilities which make the quality of the territory suitable in accordance to the highest standards for which new techniques and technologies increase the expectations of the users. The environmental control of the restoration interventions, therefore, implies a rational and environmentally friendly use of the resources through an optimization of the anthropogenic processes affecting the territory. For those who deal with resource management problems in the reclamation of a territory, the optimization of the performance and search for reversible working practices is a prerequisite for the principle of intergenerational equity to be implemented.

In this perspective, this work focuses on the preliminary analysis of the reclamation interventions of compromised territories by proposing a multi-disciplinary methodology. The considerations that follow are, therefore, the result of expertise gained both in environmental technology as well as land surveying in order to address the complex issues related to the recovery and reuse of an environmentally compromised area.

These considerations are inspired by the case study of *Regi Lagni*, in the Campania region, which due to the area having been significantly affected by human activity, is an interesting application context.

2. Research Methodology

The recovery process of compromised territories cannot be generalized since the numerous cases are always very different from one another, with the problem having various origins and the recovery and conversion interventions, therefore, being highly influenced by the previous uses of the area as well as the environmental specificities of the local contexts that tend to vary from case to case. However, a reading of the outcomes of reclamation interventions that have already been implemented makes it possible to indicate that for an intervention to be successful, it is necessary to support it with a thorough and comprehensive initial phase of environmental analysis, which is essential in order to achieve a high quality anthropic ecosystem of the environment. This analysis phase opportunely orients the transformation process and allows for the reclamation intervention to establish the territory as a complex tissue in which there is no boundary between the artificial and natural environment and in which each process is controlled so that its impact and, consequently, the irreversible degradation induced is the minimum possible in relation to the constraints of the process itself. It also allows to consider the territory as an "ecosystem", entering into the assessment of the interrelationships between the anthropogenic phenomena, while providing tools and methods for its balance.

Under these conditions, in the study of the reclamation interventions of compromised territories, a methodological approach to the initial environmental analysis phase is proposed, with a multi-disciplinary nature that involves the sectors of the territorial survey as well as ecological and environmental technologies with the common goal of research practices that constitute the basis to orientate the project in an eco-oriented direction.

The aim of this research is the assumption that multi-dimensional knowledge of the natural or built heritage is the basis to protect and to activate processes that safeguard the environment. This action is supported by the ICT tools that together with the multidisciplinary expertise are the best means to survey and manage the complexity, to recognise the basic elements of local identity through the reading of the signs that relate to the environmental systems, ecological networks, watersheds, coastal systems, historic landscapes, settlement and production types, agricultural fabrics, socio-cultural models, and so on.

The multidimensional representation includes all the dimensions of the knowledge of an object useful for safeguard and transformation action, to propose future scenarios. It is therefore the most effective means not only to analyse a territory, but also to plan its management by defining a hierarchy of interventions for sustainable development.

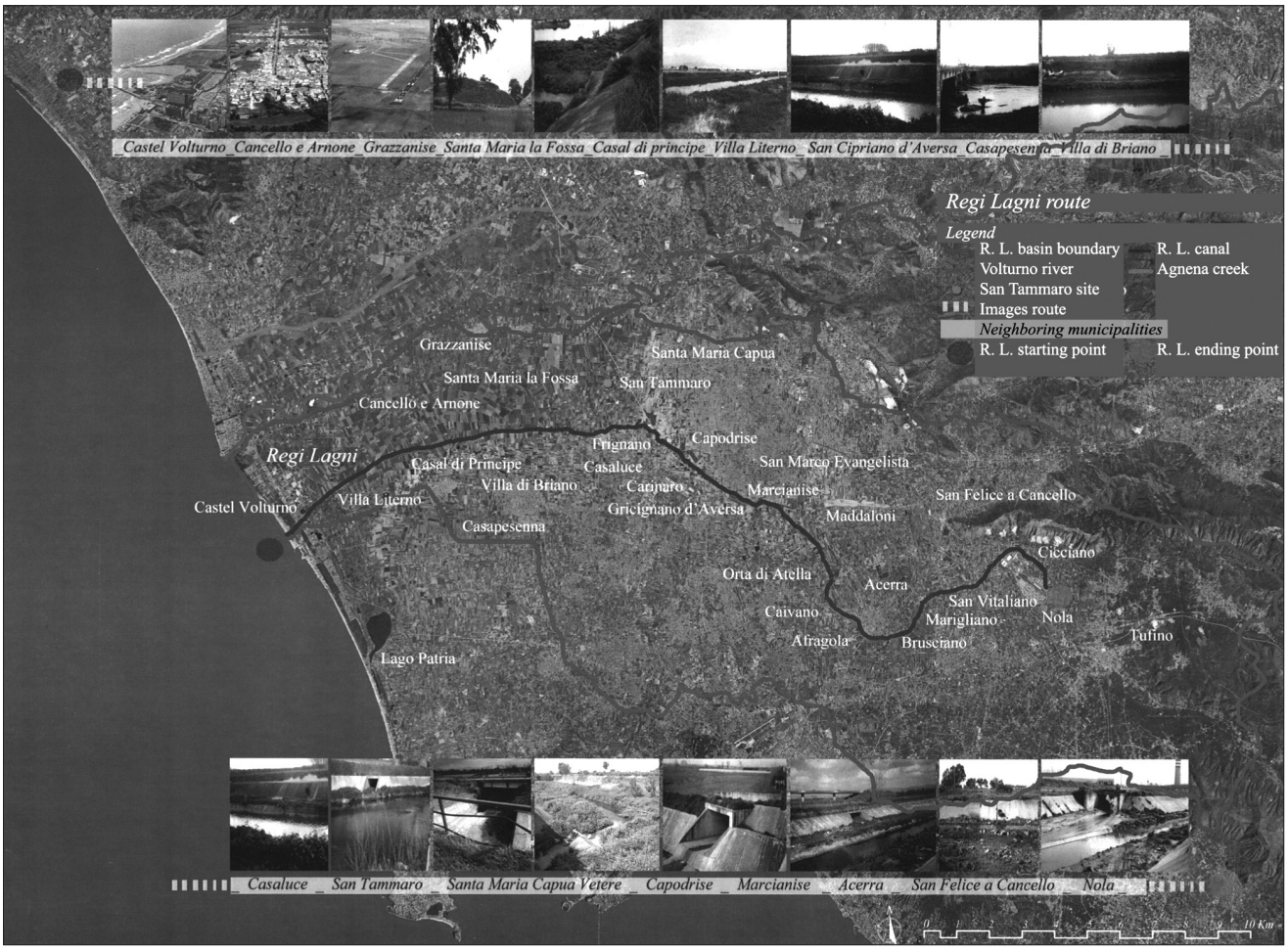

Fig. 1. *Regi Lagni canals route*

A GIS using geo-referenced information represents the mean available today that can handle the complexity of natural or built environment. In these systems it is possible not only transfer information about geology, morphology, hydrology, vegetation, history, physics, chemistry, environment, facilities, cultural, psychological and perceptual aspects, socio-economic, administrative, but also provide tools for judgment and evaluation, for analytic and synthetic planning.

The contribution of the field of ecological and environmental technologies consists of the research and systematization of information capable of orienting the definition of the project requirements. The extreme complexity of the ecological-environmental measures relating to the territory leads to carrying out a discretization in units that correspond, as discussed in the following paragraphs, from a technological point of view, to the spatial elements and from an ecological one to ecotopes. This leads to the construction of transects articulated according to the different units, each of which is associated with two levels of information concerning, respectively, the technological and ecological dimension.

The integration of the disciplines allows to carry out a thorough reading of the environmental characteristics of the compromised territory that leads, in a subsequent phase of the study, to defining the project requirements.

This methodology is applied to the case study of *Regi Lagni* in the Campania region, which due to its considerable environmental problem, represents an interesting context for the study. *Regi Lagni* is a vast territory with a network of canals that covers an area of about 1095 sqkm, characterized by 20 % hillsides and mountains and the remaining 80 % by large flat areas, which include a large numbers of municipalities in the Italian provinces of Caserta, Naples, Benevento and Avellino. The main canal passes through several municipalities over a distance of 55 km before running into the sea at the Domitian coast (Fig. 1). About 210 km of secondary canals flow it this main waterway from both sides. The hydrographic network of *Regi Lagni* is made up a system to control the water flow and prevent flooding. This network which was built in the 1900 s to control the water flow, however, has been turned into an appendage of the sewage system and there are currently no water sources supplying the canals, with them being filled by rainwater and uncontrolled discharges.

The territory of *Regi Lagni*, heavily anthropized, has more than one and a half million residents and is heavily industrialised with livestock holdings and intensive agricultural crop farms. In addition, there are numerous contaminated or potentially contaminated sites as well as uncontrolled abandoned waste sites (Fig. 3).

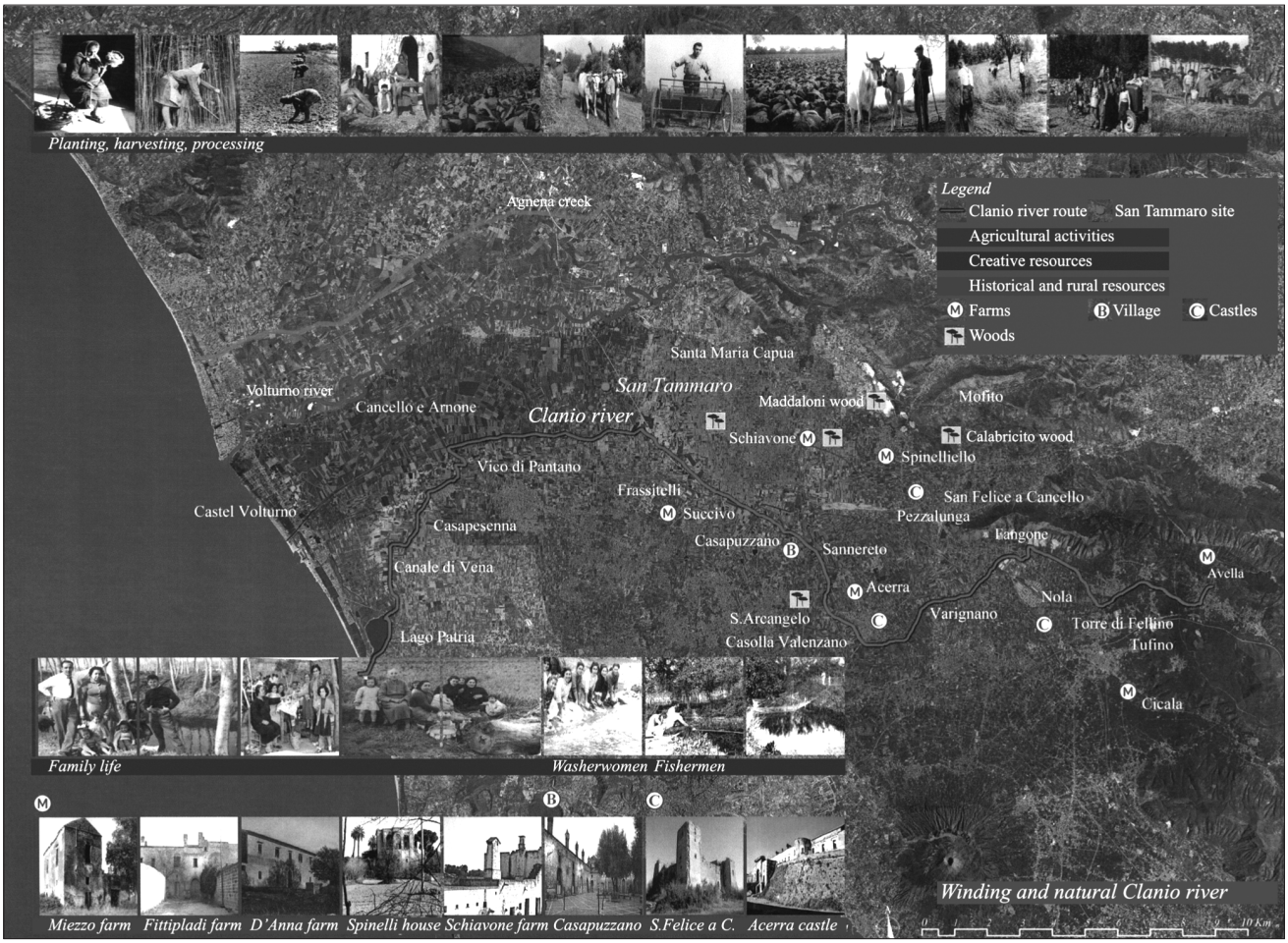

Fig. 2. *Regi Lagni comparison between old and new route*

3. Information and Communication technologies for the multidimensional representation of *Regi Lagni*

The history of the system of artificial and natural river canals called *Regi Lagni* is strictly related to their current history. It is important to describe shortly their construction and all transformations during the past to understand the present condition of the environment and to hypothesize future scenarios.

Regi Lagni have been one of the main remediation carried out in Southern Italy to counter the phenomenon of silting on the territories crossed by the river Clanio that are described in documents of the 14th century. These sources describe the river on its tortuous course and with the presence of deposits and dykes derived primarily from the operations of maceration of hemp and flax in the factories near to the river. In the middle of 16th century Don Pedro da Toledo, the first effective Spanish viceroy of Naples, ordered and realized the first land drainage interventions through hydraulic engineering work to regularize the water flow of the river Clanio (Fig. 2). The work, which included the draining of swamps and the remediation of a large portion of the territories of the so-called Campania Felix, were soon abandoned due to the contrast of local baronial class that believed them to be unnecessary and related to the resolution of a minor problem. The area quickly became depopulated. Subsequently, due to severe famines and epidemics of malaria, there was an acceleration of the healing process. A group of some engineers from the royal house surveyed the plan and the elevation of the river (the so called "*lo livello, et pianta de' detti lagni*"), understanding that all activities required to make this place a healthy place should be preceded by knowledge activities. In this activity were involved an expert engineer of the roads, a medical physicist, a medical doctor and a scientist for his expertise in agricultural engineering. The representation that ensued provides us the first topographical image of the Gulf of Naples and presented areas of flooding of Clanio and bridges along the new channel (Fiengo, 1988; Libertini, 1999).

Few years later began one of the most important works of hydraulic engineering and agricultural transformation taken during the Spanish viceroyalty: the *Regi Lagni*. The interventions were born from the need to capture and regularize the route of the water from different the sources of the mountains and surrounding hills (Mefito, mountains of Avella, Valle di Quindici, Monte Somma) and make them flow to the sea through a manifold. The creation of a network of canals to regulate the runoff into the sea water, resulting in the removal of most of the swamps, allowed the gradual recovery in agriculture of about ninety thousand hectares of fertile plains and the recovery of crops, such as hemp.

The works were designed by Domenico Fontana and directed by Giulio Cesare Fontana and realized in about

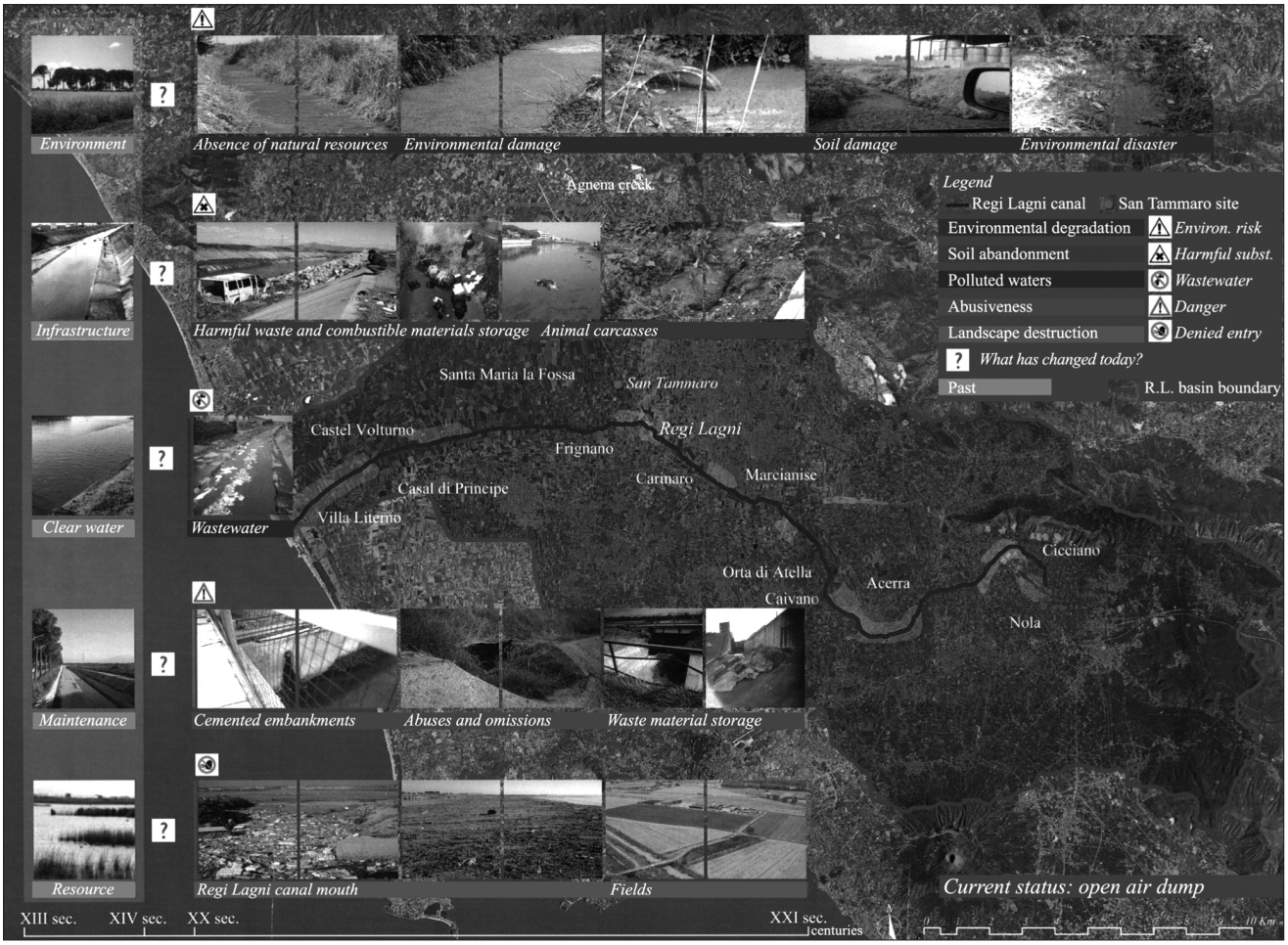

Fig. 3. *Regi Lagni environmental pollution*

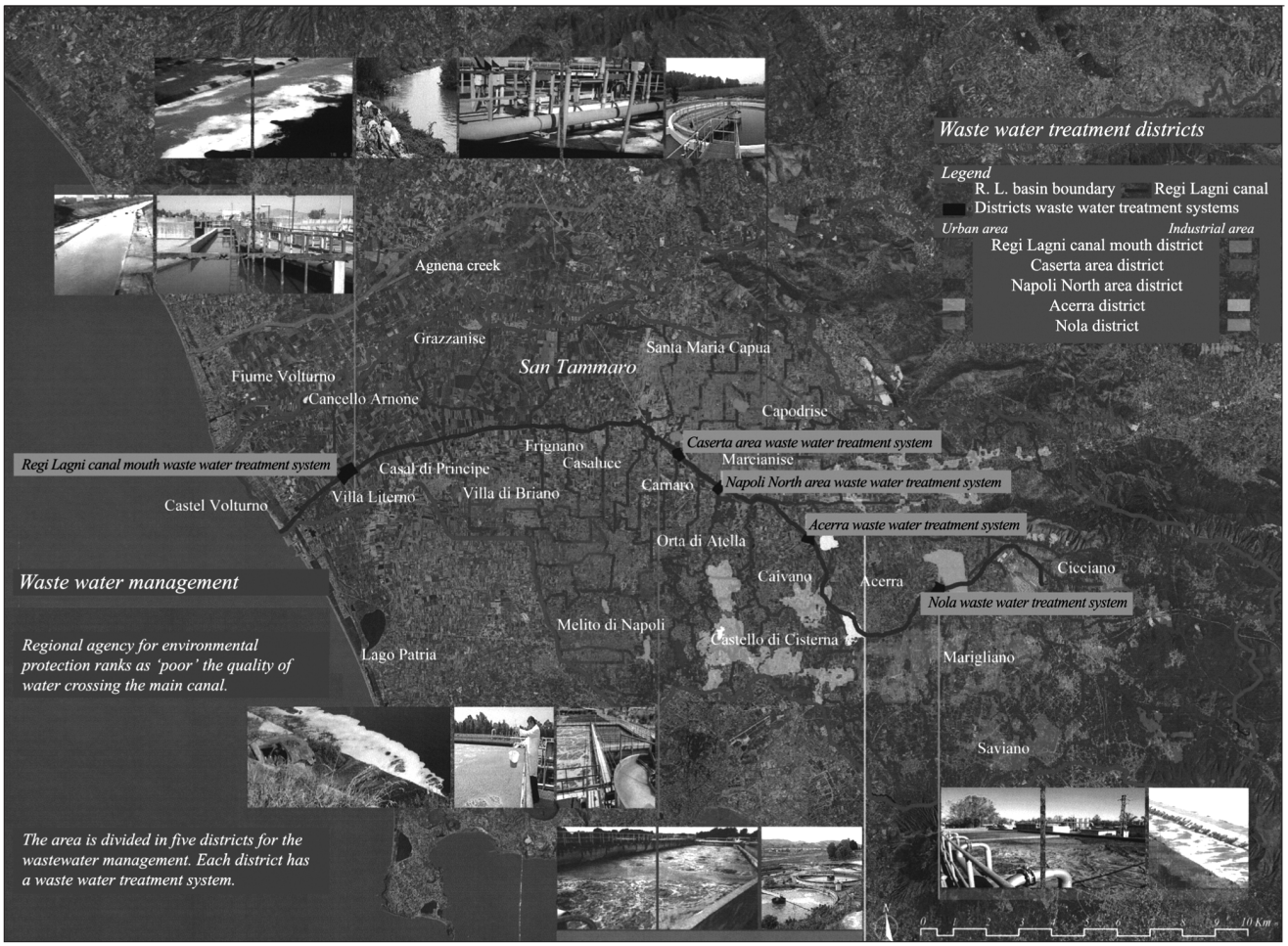

Fig. 4. *Regi Lagni waste water treatments systems*

six years and then subsequently enhanced with the creation of new channels, new ways for bypassing the towns, new branches for agricultural irrigation and to power watermills in the areas crossed by *Lagni*. For the realization of the works were employed hundreds of workers engaged in expanding, deepening and especially in the correction of the main channel that reaches the sea and in the suppression of the natural channel of Vena (seven miles long), to replace the winding bed of the Clanio river with a bundle of three parallel and straights canals. The main principle adopted in the work of draining was to separate channels of high water, which water flows received rain from the mountain areas by entering it in the main channel, from those of shallow waters receiving the stagnation of the plains, directing them according to the slopes in the central manifold.

At the same time there were also some infrastructure projects such as bridges that were either restored or built adapting them to the new size of the channel. At the conclusion of the works was ordered to Mario Cartaro to updated the survey of the territory.

In the next centuries the Royal house of Bourbon gave a further boost to this intervention through the arrangement started in 1750 of more than six thousand plants in order to stabilize the banks of the levees and configuring the image of the landscape.

Nowadays the massive and inappropriate overbuilding on the canal banks has almost completely destroyed the ecosystem, which for centuries had characterized those places. The interruption of the natural exchange between surface water and groundwater stopped the auto-purifying, adding that damage to the uncontrolled presence of illegal dumping. The presence of pollutants has had direct influences on groundwater wells used for irrigation of agricultural land, with obvious damage on the quality of the place. The framework of knowledge, concerning the complexity of the environment and their evolutionary dynamics covered by this research, is aimed in decision-making support to address the processes of transformation of the territory itself (Fig. 3).

The methodology applied for the study of Regi Lagni canal is the verification of the analytical tools already tested in similar cases study. The use of techniques for surveying complex territorial cases has already been used for the knowledge of similar land with a very strong impact of human action in places with an high environmental value. In particular, this study refer, for example, to many similarities with the research carried out on Sarno river (Pisacane, 2011). Sarno river canal (Campania Region, Italy), also interested in reclamation works aimed at improving the land quality of the areas crossed by it and people who lived in that place, today is like Regi Lagni canal an example of environmental

destruction related mainly to human uncontrolled action. Another case study is focused on the compromised territory of Lago Piatto site (Pisacane, 2012), inside the municipality of Castel Volturno (Campania, Italy), interested by a large urban settlement, built without architectural and technological qualities in an area near the sea coast and the Volturno river with a high hydraulic risk. The census carried out data on buildings and infrastructures and data entry into GIS has allowed us to create a tool for land management, planning and control of the territory in a site with an high environmental and natural valence, but highly degraded by human action.

These are the basis for the analysis of Regi Lagni canal site, in fact, the support for analysis and knowledge is provided by the integration of different analysis that contribute to the representation of multidimensionality of the built and natural environment. In particular innovative technologies support the analysis of knowledge but also aim to allow the project management and the development of large flows of information. The use of GIS technology to realize a Geographic Information System of the territory crossed by *Regi Lagni* allows the integration of all the components, physical and intangible, with enhance the protection and safeguard of the area.

The work was capitalized through the creation of a Geographic Information System for the dynamic representation of the territory, implementable in real time. GIS is a platform capable of handling the multi-dimensionality of the natural and built environment and to transfer and to relate information about the different layers of knowledge (geology, morphology, hydrology, vegetation, history, physics, chemistry, environment, cultural heritage, settlement contexts, historical transformation, socio-economic, administrative, etc.). according to multiple routes and combinations.

The need to set up alternative scenarios for the assessment in time and space, based on the comparison and of the various dynamic factors, has, in fact, made of particularly relevant the need to make continuously updatable data and knowledge, whose collection becomes fundamental in defining what are the strengths and weaknesses of the territory in general, as well as to track the definition of plans and programs and, in general, of all the territorial development policies.

4. Construction of the descriptive scenarios: the systemic approach

The eco-technological survey of the examined territory is the investigation phase in which descriptive data on the environmental conditions (climatic and microclimatic data, fruitive characteristics, network systems etc.) are systematized. It is, therefore, preparatory to the definition of the strategic objectives for the recovery project in an eco-oriented perspective.

Technical-scientific studies that necessarily precede the reclamation of compromised territories return a lot of data, both quantitative and qualitative, that are instrumental in prioritizing the interventions and their estimated costs. Thus, there are studies, plans and projects of significant scientific interest and value that address the various hydraulic and environmental problems present in the catchment area of *Regi Lagni*.

Our interest, in this context, mainly concerns the design phase that accompanies, overlaps and intersects the problems related to land reclamation. What intrigues us is the phase in which the multiplicity of the findings must set up so as to support the design strategies of the individual sub-areas in which it is appropriate that an extensive and varied are as *Regi Lagni* is studied. The terms reclamation, revitalization and brownfield lead, from a strategic and design point of view, to the example which still represents a vital cultural and scientific reference: IBA Emscher Park. In fact, it constitutes the most important intervention in the world of the overall redevelopment of a large industrial region, in which the balance appeared to deeply compromised. The rebirth of the Emscher river has been the unifying element, physical and symbolic, that has bound itself to every piece of the larger project that had to deal with urban planning, territorial, ecological-naturalistic and socio-political-cultural issues. Among the many interesting aspects of the projects planned and implemented, the various phases in the long and medium term are a common denominator.

This logic is the basis for the masterplan drawn up by LAND Milano S.r.l. (LAND Group team: Andreas Kipar, Matteo Pedaso, Giorgia Borrelli), which, by synthesizing the process of building the potential development scenarios, outlines a strategic framework within which micro-projects relating to specific areas of application and design issues mainly relating to the use and integration of software functions were included (Kipar, 2013).

From a review of the current literature on both the structural (geological-environmental) and design (space-functional and fruitive) aspects of *Regi Lagni*, there is a need to bring together a great deal of different types of information in an organized system with which it would be possible to define the project requirements.

To build the analytical-descriptive component, it is worth working on the controllable units of territory, due to size and criticality, which could be defined by applying the systemic approach of Technology of Architecture, environmental units (and spatial elements), followed by, due to analogy, technological units (and technological systems). Taking the definitions of environmental and technological system related to the decomposition of the building organism (UNI 10838:99), we could therefore consider the usable space for the carrying out of the activities of an environmental unit (group of assets resulting from a given intended or spontaneous use, spatially and temporally compatible with each other) as a spatial element.

The idea of proceeding according to this decomposition stems from the need to provide a reading of the context of departure within which the data of the technical-scientific investigations can converge and, at the same time, return an instrumental description of the territory to the decision-making phase of project, or rather meta- project.

Despite the complexity of the study area, it is possible to identify some sort of generator element of the entire infrastructure system of the basin, the canal, which will,

therefore, be an ever-present component in the reconstruction of the different descriptive scenarios of departure realised by reassembling the different spatial elements identified. Thus, the decomposition could follow the following logic: starting from the supra-system *Regi Lagni* Basin, the sub-canal system is identified, and, descending to a lower level, the n spatial elements that follow according to specific relations.

The idea being expressed is based on a methodology known as "transect", a tool that has been developed to describe the location and distribution of resources, the landscape and the main uses envisaged. Biologists and ecologists use these sections to study the many symbiotic elements that create different habitats. Subsequently, in 2003, Duany Plater-Zyberk s refined and codified this tool by building a transect prototype that was articulated in six areas (T-zone) with the aim of describing the transition from a rural context to an urban one of an American city: the components vary depending on the relationship and the level of intensity of their natural, built and social elements. This methodology is known as the Smart Code, and is configured as a planning tool at different application scales.

Synthesizing the ideas discussed and revising the references cited, we propose a critical description of the supra-system *Regi Lagni* through the construction of transect divided according to different spatial elements, each of which is associated with technical-scientific information resulting from the different disciplines involved. Specifically, each element of the transect is associated with two levels of information that is relevant to both the technological and environmental dimensions. Only in a later phase of the study, integrating the different skills, will it be possible to define the project requirements.

A summary of the spatial elements identified, taking into account the findings of multi-criteria analysis described above, is contained in the abacus (Fig. 5) and, in a next step, it also will underline the content related to the performance analysis, in the specific case, made explicit with respect to the classes of requirements of usability and environmental protection.

The aim is to identify, for each patch, the parameters characterizing the technological and ecological functions associated with them. For example, with respect to the function relating to environmental sustainability, the ratio of permeable surfaces and impervious surfaces, the presence/absence of native species, the presence/absence of territorial biological corridors, represent only some of the descriptive criteria to be used for the implementation of the abacus shown in figures 5 and 6.

The descriptive model of the transect contains, as previously mentioned, two levels of information: technological and ecological. The transect model originates from an ecological context, in fact, biologists and ecologists use it to study the various elements that contribute to the habitat where certain plants and animals grow. A transect, or environmental section, through the composition of the individual components, allows to simulate different configurations of a systemic environmental system offering an immediate and intuitive reading of the elements that compose it, and, above all, of their relationships.

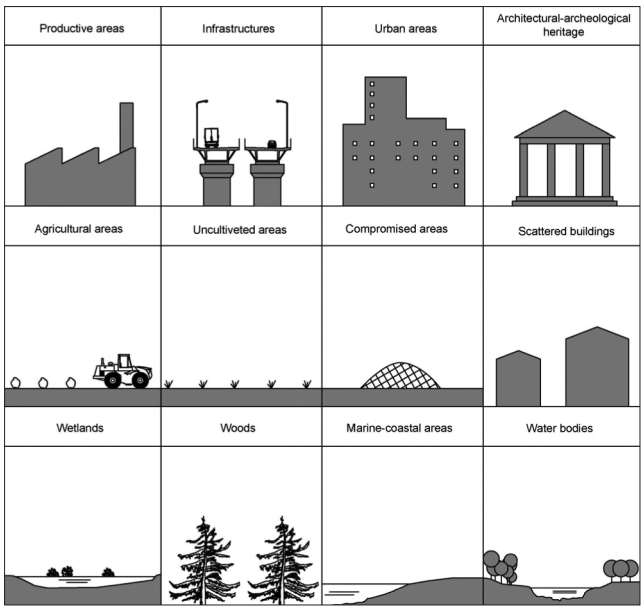

Fig. 5. *Spatial elements abacus*

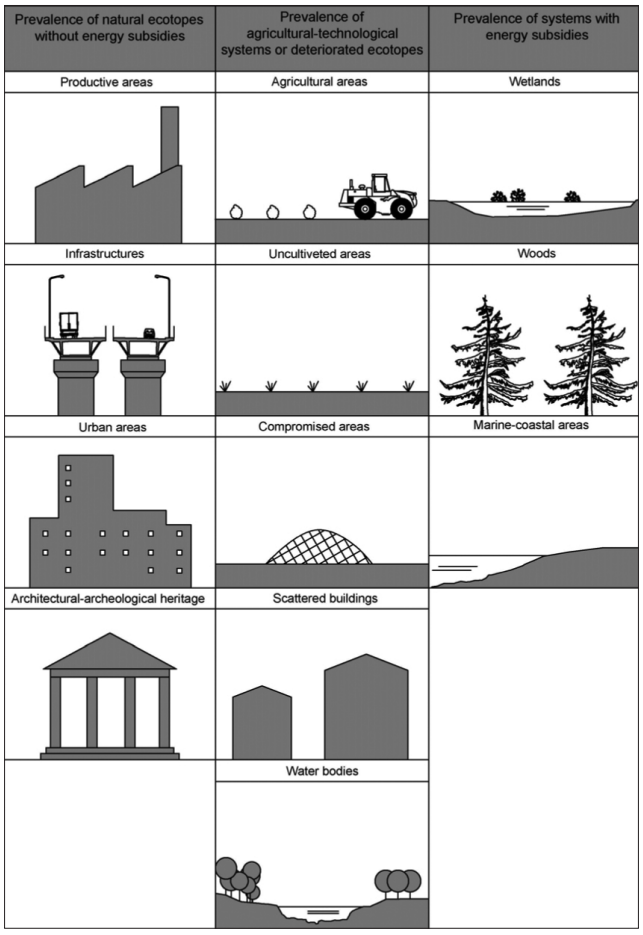

Fig. 6. *Ecotopes abacus*

5. Construction of the descriptive scenarios: the ecological issues

From an ecological point of view, each component can be considered an ecotope which is defined in ecology as the elementary spatial unit of a landscape that has homogeneous structural and functional characteristics. The structure refers to the physical characteristics of a unit while the function

refers to the relationships that are established between the individual units in terms of flows of matter and energy.

The structural and functional characteristics of an ecotope may change. When this happens, a new ecotope starts and a border area that is defined ecotone is created. Ecotonal zones are areas of transition between two types of environments and play an important role from an ecological and ecosystemic point of view. They are, in fact, areas where energy flows and transfers of matter are very high and therefore the analysis and evaluation of their conditions is particularly important in order to estimate the environmental permeability of the systems analysed.

The components of the transect, therefore, will return, from an environmental point of view, information on the type of territorial resources, their quality as well as information on the links the individual tiles create with the adjoining ones, through the ecotonal zone, as well as with the environmental system with which they belong.

Table 1. *Ecological-ecosystemic requirements*

Requirement categories	Requirements
Control of the ecosystemic quality	▪ Quantity of the resources ▪ Quality of the resources
Control of the ecological connectivity	▪ Systemic continuity ▪ Quality of the connections

Control of the ecosytemic quality (table 1) makes it possible to identify the territorial portions of higher value and therefore deserving special attention, since it is through them that there is greater support for the entire environmental system. Similarly, there are areas with a modest or poor energy content, where possible transformations from semi-natural to artificial are without doubt desirable.

In general, the quality of an ecotope is related to land use: for example, the presence of natural systems without benefit of energy (forests, wetlands, etc.) makes the examined territory of high ecological value. In contrast, the presence of systems with a considerable energy subsidy (industries, infrastructures, etc.) result in a poor quality ecotope from an ecosystemic point of view (Fig. 6).

Analysis of the ecological connectivity makes it possible to detect the presence of biological barriers, highlight the state of territorial fragmentation as well as identify links present within the territorial mosaic indicating any eventual corridors to restore, protect or enhance in order to increase the degree of overall connectivity of the system's environmental impact.

The connection to the network of natural areas, which is intended to preserve potentially threatened plant and animal species is a prerequisite for the construction of an ecological network. It should be noted that the aim of this paper is to describe, through the development of system data already present in current literature, the eco-technological characteristics of the *Regi Lagni* river basin.

The complexity of the elements and relations characterizing the territory has led to its discretization in units that correspond, from a technological point of view, to the spatial elements (see paragraph 4), while from an ecological point of view to ecotopes. As previously mentioned, it is assumed that the base unit of the environmental system, due to its widespread and characterizing presence in the territory of the *Regi Lagni*, is the canal.

Within a landscape, artificial canals as well as all the rivers are characterized by highly significant ecological properties for maintaining the functionality, in terms of flows of energy and matter, as well as the protection of widespread nature. The canals and, more precisely, their riparian systems in shrubs and trees, are important ecological corridors of the area, assuming a decisive importance for the movement of many species as well as to maintain the functionality of the ecosystems that are crossed by them.

The physical and biological characteristics of the canals, such as the width, connectivity, structure, edge-interior ratio and length, determine the functionality of the ecological corridors. The canal-corridors also have the function of filter in the landscape that they cross according to the permeability of the borders.

Similar to cell membranes and how they may be filtering, semi-filtering or impermeable with respect to the presence-absence of voids, or in other words landscapes that oppose the crossing (Mininni and Lamacchia, 2004).

The level of biological permeability depends on the conditions of the canal and its bank systems.

The canals that make up the hydrographic system of *Regi Lagni* are now in a state of profound deterioration: tampered with over time, they have been reduced in stretches to open sewers, in others partly covered or turned into cement pipes (Miano *et al*., 2007).

The phenomenon of overbuilding has had serious implications on the appearance and environmental balance of the canals/river beds. Cement creates a waterproof layer that disrupts the exchange between the waters of the canals and groundwater, reducing the amount of dissolved oxygen in the water and causing a significant reduction of the flora and fauna of the ecosystem.

Due to these problems of neglect, pollution and progressive loss of the relationship with the cultivated areas, the relationship between the canals and the nearby settlements has changed over time, with there being a clear division between form and meaning of *Lagni.* The form remains, but the collective significance of the place has changed (Miano *et al*., 2007).

Many studies show that the quality and dynamics of river systems are deeply affected by the condition of the surrounding territories. It is therefore obvious that an environmental regeneration of the area that also seeks the creation of a local ecological network, capable of connecting with the top-level, must aim to reconstruct the long-term balance between the territory and the system of canals/ riverbeds.

6. Conclusions

The research is based on the preliminary analysis of the reclamation interventions of compromised territories with a multi-disciplinary approach. The considerations are the result of expertise gained both in environmental technology as well as territorial surveying in order to address the complex issues related to the recovery and reuse of an environmentally compromised area.

The contribution, starting from the innovative methodological approach of the integration between the territorial survey and environmental technologies, allows to carry out a thorough reading of the environmental

characteristics of a compromised territory that leads, in a subsequent phase of the study, to defining the project requirements.

The relationship between technological and ecological issues for survey of compromised areas emerges both in the analysis and design phase: the ecosystemic assessment is helpful to orienting the project choices as well as to verify the performance levels achieved.

This methodology is applied to the case study of *Regi Lagni* in the Campania region, which due to its considerable environmental problem, represents an interesting context for the study.

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References

Fabbri P. 2007. Principi ecologici per la progettazione del paesaggio. Milano, Edizioni Franco Angeli.

Fiengo G. 1988. I Regi Lagni e la bonifica della Campania Felix. Firenze.

Kipar A. Regi Lagni Terra Felix. Back to the future, Available at: http://www.landsrl.com/media/file/news/Regi_Lagni_Terra_Felix_Back_to_the_future_1.pdf (accessed 10 March 2014).

Libertini G. 1999. Persistenza di luoghi e toponimi nelle terre delle antiche città di Atella e Acerrae. In: Istituto di Studi Atellani. Sant'Arpino.

Miano P., Di Natale M., De Falco G. 2007. Programma Integrato dell'area dei Regi Lagni come "Business Park per l'agricoltura". In: Atti del Convegno Nazionale Territorial areas and cities in Southern Italy. How many suburbs? What policies for territorial government, S. Giovanni a Teduccio - Naples, 22–23 March 2007.

Mininni M., Lamacchia M. R. 2004. Paesaggi dell'acqua e nuove infrastrutture. In: Lanzani A., Fedeli V. (a cura di), Il progetto di territorio e di paesaggio – Cronache e appunti, Atti VII Conferenza Nazionale SIU Trento 13–14 febbraio 2003, Franco Angeli Editore, Milano, pag. 181.

Pisacane N. 2012. Knowledge and representation for landscape re-design: the area of Lago Piatto in Castel Volturno. In Gambardella C., Le Vie dei Mercanti. Less/More. Architecture, Design, Landscape, Atti del Decimo Forum Internazionale di Studi, Aversa-Capri 31maggio-2 giugno 2012, La Scuola di Pitagora editrice, Napoli, pagg. 1396–1403

Pisacane N. 2011. Pompei, città del Mediterraneo. Il fiume Sarno. In Giovannini M., Prampolini F. (a cura di), Spazi e culture del Mediterraneo 3, PRIN 2007–2009, Edizioni Centro Stampa d'Ateneo, Università Mediterranea di Reggio Calabria, Reggio Calabria, pagg. 409–414.

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