Track: Climate proof cities and resilient societies

Planning and architecture for climate adaptation: the experiences of the "structure-territories" in low and high density city

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Abstract: The paper reflects on the awareness that climate adaptation planning becomes more effective when it is dealt with a local context. This approach focuses on the relationship between vulnerability, adaptation and urban regeneration processes in territories of a low and high density. It refers to new balances of the urban ecosystem in the two case studies. The experiences highlight fields of experimentation of new forms of the urban project that take into account the peculiarities of each territory. Some urban areas are experimenting new ways of cooperation between public and private stakeholders which, although belonging to two different situations of low and high settlement density, are dealing with the issue of resilience and adaptation in both fields urban planning and architecture. The experiences of these different contexts, spread urban forms in Sardinia and high settlement density in the city of Tunis, reflect on how to rethink the structure of the city through adaptive urban strategies such as the design dispositive of "Structure Territory". This planning approach aims to promote the adoption of new design solutions that satisfy the contemporary needs of inhabitants and, at the same time, are oriented towards the nature-based solutions.

Keywords: Structure-Territory, Climate adaptation, Vulnerability, Urban regeneration

Introduction. Climate adaptation and place-based proximity

The increase in the frequency and intensity of some phenomena related to climate change, such as urban floods, heat islands, land consumption and desertification increase the level of risk to which cities are exposed. If we interpret the contemporary environmental crisis, we can argue that all territories are vulnerable and that the implementation of urban transformation projects must take that into account the different sensitivities and peculiarities of the individual territories from the environmental and socio-cultural point of view.

In this scenario, how the tools of projects and the government of the urban territory can incorporate the processes of adaptation to climate change. What planning actions on the territory can build forms of governance capable of making the solutions adopted durable?

The experiences conducted by the research group investigate project devices in relation to some experiences that implement adaptation actions addressed in relation to the micro-situations of a local

context. The “local” has the meaning of “proximity relational space”. The “localized” approach to changing climate adaptation processes aims to identify more general forms and processes starting from local needs, making the logical link between apparently distant phenomena explicit.

In this direction, the adaptation processes are implemented through the project of transformations that create an anchorage to the place (Augé, 2000), which favour the redefinition of the relationships between territories and inhabitants, which in turn stimulate their ability to take care of the space in which they live, even in situations of environmental fragility. Adapting to the changing climate, which does not always respond to forecasting models and mitigation technologies, means facilitating and preparing the conditions for creating a network space, ensuring that the most vulnerable places in our cities are involved in a process of regeneration that involves new forms of community (which may include institutions, organized social groups, individual citizens, etc.), not necessarily characterised by physical proximity. The regeneration of places as an adaptive process is the instance of one or more communities and their action incessantly, animated by the proximity of interests for places that need not be overwhelmed by climate change. The adaptation calls for a sharing of objectives, the ethics of responsibility, the passion for the same territory, an awareness that local processes have important global repercussions. This is the perspective that the 17 objectives of the 2030 Agenda open up.

The local dimension of the experiences dealt with refers to two distinct situations: the urban territories of low settlement density that regards urban areas, such as the small cities of Sardinia, characterized by a dispersal of settlements and a pervasive environmental dimension; the territories of high settlement density, which we study in relation to complex cities, such as Tunis, where urban growth multiplies the effects of urban concentration that are not always positive.

The “adaptive” project actions we have experimented are based on a close relationship between vulnerability, adaptation and urban regeneration processes in reference to the two territorial situations of Sardinia and Tunisia. What the two experiences have in common is the search for a design approach that makes the strategies of adaptation contextual that different countries both in Europe and in North Africa are implementing. Starting from the sharing of the need to maintain the socio-ecological balance of a city, we explore two devices for planning and governing the territory:

_a *governance* model that realizes it that we have called “adaptive”, recalling some research that calls into question models based exclusively on the central role of institutions. The space of the networks in this second device refers to the new forms of “alliance” (Albrecht *et al*., 2010) between public and private subjects and those in Europe and more recently in Italy, are fuelling environmental protection policies through the so-called “lagoon contracts”, the “river contracts”, and the “coastal contracts”.

_a spatial device that in our research we have called “territory-structure” to present new urban equilibriums through the settlement transformations, starting from the fragile situations that occur both in small cities and in large urban areas.

Through these devices, we study actions and policies of reconstruction, re-use, redevelopment, having in the background the possibility to design and govern the existing settlement heritage of our territories, to develop scenarios that adapt to climate change as a continuous process of urban and the environmental regeneration of our cities.

Climate change and adaptive governance

The scenarios of the Fifth Report on the Intergovernmental Panel on Climate Change (2013) and the National Strategy for Adaptation to Climate Change highlighted the urban effects and risks associated with climate change. The study confirmed that it is no longer a question of determining whether the climate is changing, rather how quickly it is changing (IPCC et al., 2014). As we know, various critical factors emerge, including drought and a lack of water resources, extreme meteorological events and hydrogeological risk and heat waves. Cities, in this sense, need to evolve with respect to adaptation strategies no matter the action they bring into their urban transformation processes, governance and land management (Wamsler et al., 2013), operating at the local scale which is the level at which we can avoid those that have been called "maladaptive actions" (Swart et al., 2014).

Climate adaptation cannot be separated from the cultural, political, economic, environmental and development contexts in which it occurs and therefore, it is only part of a series of social responses to change. Adaptation has been considered highly specific in relation to the territorial and urban peculiarities of a place, as it depends on its specific climatic, environmental, social and political conditions (Füssel, 2007). For this reason, the adaptation actions involve a wide range of measures aimed at reducing the economic, environmental and social vulnerability to climatic factors (Füssel 2007; Walker et al., 2013).

The extreme events that occur at the local level have more and more repercussions in a wider context, generate new sensitivities and partially influence the public policies of the government of the territory. These events can be considered "catalysts of adaptation actions", despite the difficulty in realising planning paths and government policies that develop with continuity and strategic visions for the future. The main "adaptation mechanisms" have been institutional (for example, providing guidelines and outlining public address policies) and financial (for example, providing financial support). However, interventions that promote climate change adaptation actions or that focus on vulnerable social groups (marginalized groups, the elderly or children) have been limited (Berrang-Ford et al., 2011; Ford et al., 2011).

The need for effective climate adaptation actions, both in urban areas and in large areas of the territory, is a widely recognized issue, as it is shown that its critical effects on social and natural systems increase. However, efforts to adapt to climate change, as reported in the literature of the last decade, have not produced processes and actions that address planning strategies and environmental policies on the local scale with continuity of the "safe" territories despite considerable investments in adaptation sciences. Furthermore, the actions implemented were mostly focussed on interventions that address sectoral aspects; more systemic and transformative long-term actions are less frequent.

Recent decision-making processes aim to overcome this situation and are framed as "adaptation paths" to emphasise the need for a solid decision-making process within adaptive processes in the face of uncertainty and intertemporal complexity. However, to date, these paths have focused mainly on contexts with clearly identified decision-makers and unambiguous objectives; consequently, they generally assume that prevailing governance regimes are conducive to adaptation and therefore limit responses to the causes of vulnerability.

Responding to global change is a challenge for society. The theoretical developments and the operative researches of some authors in relation to the models of "adaptive governance" allow to

highlight that one particularly difficult and challenging reason are the top-down processes that control systems (Gorddard, Colloff et al., 2016). In Ostrom's reflections, it is pointed out that "the complexity of social-ecological systems precludes policy and management panaceas and requires decentralized knowledge (Ostrom et al., 2007; Norgaard, 2010, quoted by Gorddard et al., 2016).

Adaptive governance needs to focus not only on the role of institutions: they "may provide a focus for leadership, but institutional change requires coordinated efforts by people with agency in diverse roles at different levels within a social-ecological system" (Stirling, 2014 quoted by Gorddard et al 2016). Still Gorddard, Colloff et al. underline that "the required reflexive analysis of the societal context in which these actors are embedded is innately difficult. Decision makers may be unaware of the influence of societal structures such as norms, practices, cultural regimes, technologies and regulations (Ostrom, 2010, 2011; Leith et al., 2014), especially if such structures have been stable and thus taken for granted" (Gorddard, Colloff et al., 2016 p. 62).

Achieving greater effectiveness of planning actions and *adaptive governance models* to implement urban transformations of adaptation to the climate can be investigated through the study of decision-making processes defined according to two perspectives (Gorddard, Colloff et al. 2016). They highlight and question the fact that adaptation should not be addressed as a decision problem, which provides answers to the impacts of climate change within government processes centered on decision-making perspectives, "it is therefore unsuitable for addressing complex, contested, cross-scale problems". The reflections of Australian researchers broadening the *decision-making perspectives* according to a broader perspective that define *decision-context perspective* that focusses on an interconnected system of values, rules and knowledge that creates and limits the set of practical and admissible decisions

Decision-context perspective and project for new "urban alliances"

Adaptive governance refers to the need to understand how the social contexts of a decision-making process can influence choices and how the inhabitants of a territory can intentionally influence these contexts to plan the future of cities. Adaptation projects that focus on *decision-context perspective* represent a pragmatic alternative to the current *decision-making perspective* adaptation. The latter is a perspective based on a top-down approach that is based on the logic of control and has shown over time its ineffectiveness, both in relation to the different time constraints imposed by the actors and to the institutional resources made available. In this perspective, the choices for implementing adaptation actions are based on processes, values and knowledge treated as independently defined variables, which implies that "a decision maker can incorporate any relevant knowledge and values in order to reach a decision within the bounds of the societal rules that enable the decision process" (Gorddard, Colloff et al., 2016, p. 62).

We exemplify the decision-making perspective according to two project areas. In the first case, there are approaches of "sustainable architectures" that promote punctual transformative actions in the city. In this case, the adaptive capacity of the project is measured through the improvement of the building's characteristics, its durability; adaptability is understood as the improvement of the user's well-being in relation to comfort, health, safety and the quality of the internal environment; the sustainable building counteracts the effects of climate change by becoming more efficient by reducing the consumption of resources and energy, also in relation to the exploitation of technological innovations (Kronenburg, 2007; Schmidt, Austing, 2016). In the field of urban planning, adaptation brings in crucial aspects for the evolution of settlements, especially in relation to fragile environments (such as wetlands, river

corridors or coastal areas). However, the actions implemented are still sectoral and attempt to counter the vulnerability of environmental systems through plans and programmes, to study their susceptibility to change, their capacity to absorb the stresses imposed by the city's infrastructure, while maintaining their ecological functioning and dynamics.

In both cases, it is a process governed by public stakeholders (agency focussed perspectives) and experts from the different sectors who formulate values, knowledge systems, rules and application guidelines to make choices within and within the limits imposed by the context.

The implementation of projects and policies based on decision-context perspective shifts the focus to societal structures and the influences they exert in the decision-making process: they define the role of the actors and whether these roles allow effective and legitimate actions. From the *decision-context perspective*, values, rules and knowledge are "interdependent conceptual systems that represent a particular way of viewing and framing the world" (Gorddard, Colloff et al., p. 62). In this second approach, our research experiments with territorial projects that attempt to develop responses to climate change adaptation at the local level to contribute to the complex problems of global change.

The durability of urban transformations is proposed in the two experiences illustrated in this article, in Sardinia and Tunisia, through the study of the interdependence between knowledge, values and rules that govern the spatial organization and socio-ecological functioning of the urban territories explored. The environmental regions in which these relations are expressed are defined by us as territorial ecologies of water, "situations in which the forms and processes of the environment contribute to achieving a spatial structure and a structural economy oriented in an environmental sense". These regions recall the territorial relations with which any transformation project will have to deal at different scales to respond to the need to avoid sectoral approaches that simplify the relational importance of water.

Territorial ecologies do not derive from an a priori perimeter of ecosystems and are not pre-defined by decision makers: it is the project that reveals the structural genesis of physical space and establishes the limits and levels of degradation below which that specific ecosystem cannot be modified without the loss of certain vital functions and attributes (Sechi, 2003). For this reason, transformative choices are the result of a process of co-design and responsible action by all the actors involved, public and private, who assume reciprocal commitments to activate effective actions that are legitimized by the context in which they operate. This "structural perspective", defined in the studies of Gorddard, Colloff et al., shows that the actors who enter the process build a sort of "new alliance", a pact to implement adaptive management strategies, sharing project objectives and future visions for the territory they live in.

The experiences

The experiences pertain to what we illustrate try to highlight how it is possible to open "structural perspectives", from recognition to the selective representation of environmental matrices of a city. The trend scenarios at both extremes highlight forms of physical and social desertification (Mahmoud, 2017; Spooner and Mann, 1982), which are at the base of an urban regeneration project. In particular, we have concentrated on both in Sardinia, with the city of Oristano as a case study, and in Tunisia in reference to the Grand Tunis – on the water dynamics and related ecologies for developing proposals

for the “reconstruction” of a relationship between fragile lagoon environments and settlements that have progressively invaded natural strategic areas.

The project hypotheses, both in the high-density settlement areas of Tunis and in the low-density areas of Oristano, use *territory-structure* (Maciocco, Sanna and Serreli, 2011). This tool pertains to projects that connect spaces and resources that can create interdependencies between ecological dynamics and settlement spaces. They create new spatial configurations, by selecting resources present in the territory: the project action builds new relationships starting from reality, organising the universe of elements placed in the field by the environment and by the history that resists the succession of transformation processes as seen in Figure 1. This encourages the relational evolution of urban and environmental fragments, even in places obscured by intensive settlement and city infrastructure, reconfiguring them within a common project, thus participating in a single transformation movement.

The adaptive capacity of the project in fragile areas such as coastal and lagoon environments is understood as an ability to “structure”[1] the settlement’s resources and the environment by first interpreting the constituent components of the geo-environmental systems and their interrelated connections between continental processes and marine-coastal processes, dominated by the morphodynamics of river systems, by the wave regime, through the currents coastlines (Costa, 2013).

The urban regeneration project for Oristano and Tunis, albeit with due differences, starts from these premises.

1 It refers to the definition Anglo Saxon structure to “arrange according to a plan [and provides] give a pattern or organisation”.

Figure 1: *Tendential scenario lagoon strategic areas of Oristano and Tunis.*

Regeneration of the terrain vague in the low density of settlements in Sardinia

The meaning of the territories-structure as generative spaces of the urban project and architecture is interpreted through the design process of *Oristano Est*, a project recently financed by the Presidency of the Council of Ministers in Italy and approved by the Municipal Administrations in the city of Oristano, a small city located in the centre of the west coast of Sardinia[2].

The project addresses the issue of urban regeneration by extending the field of action to a wider territory than places defined as "peripheral", as per the criteria of the competition announcement. The urban area taken into consideration extends beyond the compact structure of the city to be refocused with respect to its constituent environmental elements: the river environment to the north and the lagoon area to the south. Thus, the project extends the concept of a centre to several spaces of the urban territory, compared to the "historical" perspective usually recognised as the only place from where to derive the peripheral gradient of the different contexts of Oristano as seen in Figure 2.

Figure 2: *The territory-structure recovers various areas along the compact urban edge of the city and selects and organises the sequence of spaces that create an extended urban and infrastructure corridor placed on the east side and the south of the city. 1) Oristano-Santa Giusta lagoon; 2) agricultural park dedicated to rice production; 3) area returned to the lagoon environmental processes and intended for urban park; 4) Oristano; 5) Santa Giusta*

In the project for Oristano, the territory-structure incorporates the role of an urban director able to relate and interact with areas affected by different phenomena of peripheralisation and degradation: derelict public areas affected by the progressive abandonment by the inhabitants, areas that are no longer discontinued functional in the current urban organisation, connection spaces no longer accessible and areas subjected to flooding processes. Their succession defines three urban directions: western, eastern and southern, configuring three new urban parks that have been termed as "generative contact spaces" (Choay, 2003). These include interstitial spaces that are *terrain vague*, in areas of the

[2] The project was proposed by the LEAP research group of the Department of Architecture, Design and Urban Planning of the University of Sassari, responding to the need for a global approach to the problems of the territory and, in particular, to the theme proposed by the notice on the redevelopment of the peripheries of the capital cities of Province in Italy. Through the project, the Municipality of Oristano received a loan of 17 million euros. It is currently under construction.

residual agricultural network and set in the current settlement plots. They incorporate punctual elements, such as ancient villas, recent industrial archaeologies, disused areas of the railway network and obsolete areas awaiting new functions. The selection of the fields defines for this or a new urban arrangement, including them in a new spatial organisation. Thus, the park's territory-structure is a catalyst for the relations of spaces and functions, both different actors. Additionally, the generative device that can accommodate both the economic and productive demands of the inhabitants, places of residence and leisure, simultaneously making the city's environmental resources central (river and lagoon), which are currently obscured by the settlement structure that has relegated them to a mere background.

Private subjects and public partners have been called on to participate and present proposals, to share the strategies of the design device. Participation, given the modest size of the city, received a response beyond expectations, both in quantitative and qualitative terms. Thus, the project has to begin an unprecedented evolutionary process involving the city's strategic geographical areas, as an alternative to the logic of current urban evolution with different critical issues related to the environment. The attractiveness of the spatial device of the park and of the areas incorporated by it has had precise feedback owed to multiple requests for participation received from private subjects who, interested in taking an active part in the realisation of this project, have highlighted the potential of reinterpretation and the re-signification of existing settlement assets operated by the park.

The territory-structure of the park for this project can include pre-placing a connection structure that welcomes the public and the private bodies of the city. Furthermore, this could operationally launch a public works program aimed at achieving its feasibility.

The park guidelines initiated by the general project are in this sense new strategic centralities:

- places open to public enjoyment that recall different collective services for recreational, educational and social housing activities;

- attractors of new urban economies, resulting from the location of new services for the city and private individuals;

- places of cultural integration, as welcoming spaces that can trigger processes of social innovation as Oristano recalls different profiles of inhabitants (permanent and temporary residents, stable and occasional workers, different types of tourists, and new migrant citizens); and

- spaces that favour safety conditions, allowing inhabitants to experience public spaces without risk to their physical integrity, often induced by forms of inaccessibility. Additionally, urban security is understood as environmental security, favoured by an awareness of some places that call for a greater sensitivity to the environmental protection of public areas by inhabitants.

The Oristano's territory-structure project symbolises potential spaces still able to accommodate a regeneration process in spaces obscured by incoherent spatial organisations: "spaces in which to act, in which to create new local economies, new stories, new ways of belonging" (Sassen, 2015, p. 238).

The urban directions involved in the project that continuously involve different areas of marginality and peripherality – currently fragmented spaces adrift – have assumed the role of priority and strategic

places from which to start again for a re-foundation of the city as well as for places of re-territorialisation and re-signification.

High density in Grand Tunis and the environmental issue after the "Arab Spring"

The complexity of the Grand Tunis has seen a long process of metropolitan construction over the years. The phenomenon of high urban density has been transformed into a critical reality, with which the city has existed for almost 30 years. The search for new models has been increasingly in line with foreign real estate investments, exposing the city to new forms of spatial and social vulnerability and producing urban approval processes that have involved strategic resources, such as lagoon environments.

The urban lagoons represent the strategic spaces of the city, the places of safeguards necessary to address regeneration interventions: they recall the demolition of solid pollution forms, the mitigation of risks of flooding of neighbouring urban spaces, the creation of public areas for environmental use, the achievement of a quality of residence and related/other services. These are essential questions to start a sustainable regeneration process.

Tunis and its inhabitants, rooted in their territory with an identity, historical and cultural structure, have protected the codes of their civilization through multiple historical periods. However, the political and economic changes, increasingly influential in Tunisian society in recent decades, are the basis for the search for new models increasingly in line with the canons of a contemporary European city. Is a different future possible for the Tunisian metropolis starting from a regeneration scenario based on the historical matrices of the settlement and on urban policies capable of countering the physical and social desertification of the territories?

Starting from recognising ecological dynamics that characterise the lagoon environments of the city being explored, in collaboration with the University of Carthage, evolutionary scenarios based on adaptation strategies with particular reference to the residual areas that are yet unaffected by the progressive consumption of soil are the focus of recent infrastructure investments. Considering factors that can influence urban policies, we have experimented with the spatial nature of the territory-structure to outline alternative settlement models.

As it emerges from the images, Tunis highlights an urban growth where urbanisation and the environment are entities that seem to have been mutually ignored over time. The city's evolution towards areas subtracted from the lagoon has given rise to residual spaces where settlement and environmental dynamics often conflict. These are where settlement forms have generated spatial imbalances, loss of content and pre-existing meanings.

Moreover, around the coastal and lagoon areas, the environment becomes fragile – the level of degradation is increasingly evident. The environmental criticalities are particularly derived from the settlement pressure exerted on the ecosystems of the wetlands, from the proliferation of solid pollution and from the vulnerability of the territory to hydrogeological risks (Chouari, Belarem, 2017).

The popular uprising has fostered the emergence of different and contradictory strategies. In this transitional phase, the environmental and ecological question has assumed a high level of criticality, that remains ignored by the social movements that arose during the revolution[3].

The futuristic projects of the new infrastructural investments aim to raise the level of the Tunisian economy, while reducing the unemployment rate. Therefore, proposing different research and strategies to current situations, to look at how to preserve the integrity of the historical landscape and the entire ecosystem of the territory under study, by combating the proliferation of urban density is a good means for change.

Such a scenario would have several serious consequences for the new planning for Tunis, involving different aspects, such as the environmental considerations, identity, social concerns and the landscape dimension of the city. The ecology of the lagoon is explored. The processes governing the integrity of the system has been compromised by the complete cementation of the coastline for the intensification of urban density, with significant modifications associated with the removal of water spaces, without excluding the increased importance of eutrophication phenomena, caused by the increased concentration of pollutants and suspended sediments in the water. Such environmental degradation is already present due to urban expansion on Lake Tunis.

Furthermore, the expansion of the coastline would lead to the alteration and elimination of aquatic vegetation, leading to a reduction in primary production, accompanied by significant changes in microclimates and the impossibility of maintaining the lagoon banks naturally. Therefore, besides the practices of new building expansions, the phenomenon of increasing urban density would not be limited to the alteration and degradation of the ecological processes that govern the lagoon system. Instead, this would extend to problems of identity related to the historical image of the city, since the planned construction dedicated to the entire coastline would permanently disfigure the landscape of Tunis, supported over time by its dominating position on the lagoon.

These new urban projects are influenced by foreign models, where the Tunisian population is practically excluded from this territory, due to the socio-economic contrast and physical and social separation. These future financial centres and high technology elements will be a kind of refuge for Tunisians and the foreign rich, while generating neighbourhoods that are “monosocial”4. The would create a road network barrier against Tunis because of their isolation and their confinement on themselves.

[3] Tunisia was the driving force behind the so-called “Arab Spring”. The country is faced with important demands for change and renewal by large sections of the population. The social and economic issue is at the centre of the concerns of the Tunisian government and society that triggered the “Arab Spring” until the fall of the regime of former President. The citizens’ revolt concerned in particular the crisis of the social pact that materialised in the request for more employment (see De Facci, 2014), equal rights, social equality and access to housing for the poorer classes. What matters is not the movement itself, but the direct and indirect impact that the “Arab Spring” has had on society (see Mahmoud, 2015). “The environment is the first victim of the revolution”, says environmental activists. The natural environment of Tunisia seems more vulnerable, as Prime Minister states that the environmental situation has deteriorated sharply in recent years, with “negative consequences on the quality of life” of Tunisians.

[4] Bahri Maroonian, Tunis marine. Une « métropole » au bord de l’eau. EPFL. www.archivesma.epfl.ch

Environmental and urban regeneration of Lac de Tunis

The spatial device of the territory-structure selects, within the problematic urban environments, elements that can be regenerated in the lagoon context of Lac de Tunis. In the tendential scenario, the environmental dimension of the lake is considered as a backdrop for infrastructural actions that saturate the lagoon edge areas, distorting them and irreversibly inhibiting their dynamics and processes.

The size and extension of the Tunisian metropolitan territory, the continuous saturation of spaces apparently without a role, pose countless questions related to the survival of ecologies of the natural environment, which, due to the action of densification by the settlement system, show areas of high criticality and are often characterised by situations of irreversibility. The design of a new spatial organisation reverses the figure-background relationship (Kanizsa, 1993), involving and highlighting vulnerable natural environments, historical pre-existing features, soils taken from their original uses and derelict areas.

In the inversion between the figure and background, the territory-structure changes the connotations of some places that have remained at the edge of the urban organisation as well as the perception that inhabitants have of the same. Its representation, and therefore the selection of the elements of the city, highlights areas of possible connections that can encourage unprecedented relations between pre-existing settlement areas with high criticality and the areas of regeneration of the lagoon. In this manner, the lagoon and its feeding system are taken as a strategic area of the city. The project being proposed for the Grande Tunis restores to the lagoon its spaces of belonging, the seats of dynamics and the vital processes for the lagoon's survival. Thus, large infrastructure investments for residential purposes proposed as the primary figure of the actions of transformation in the trend scenario are placed outside the sensitive areas. The objective of regeneration is the implementation of the most-favourable conditions for creating a lagoon park, interpreted by the territory as a structure of environmental centrality for the entire urban system. Its dimension is not limited to the water mirror, but extends to the whole proximity territory, the seat of dynamics and related processes.

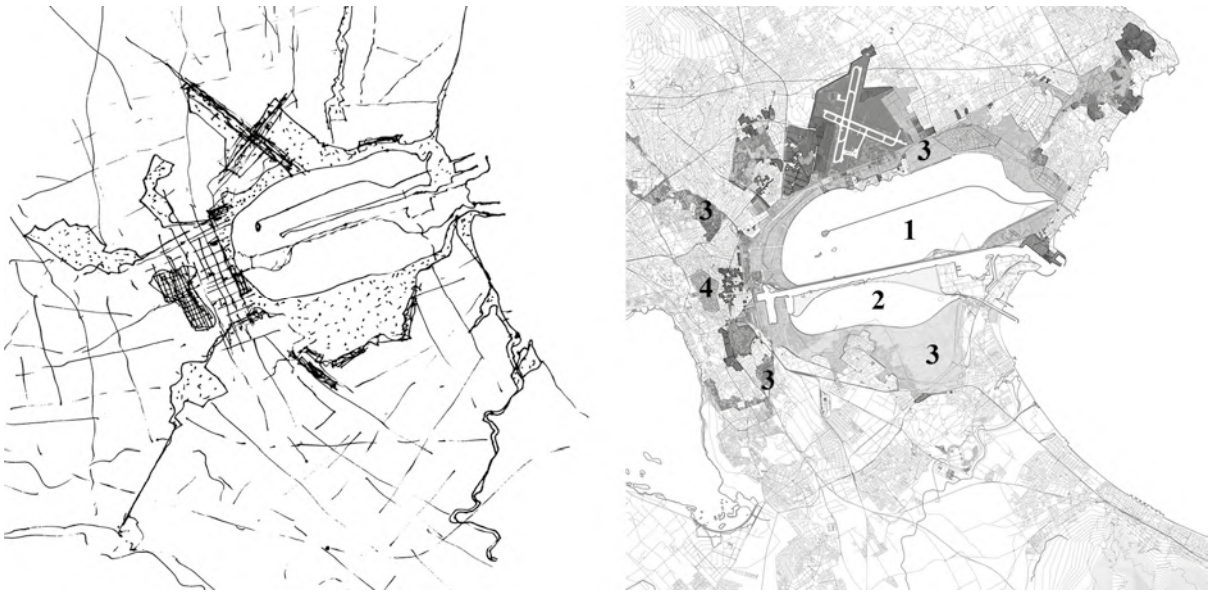

Figure 3: *The territory-structure the lagoon city of Tunis.*
1) North saltworks, Sabkhet Ariana; 2) South saltworks, Sabkhet Essijoumi; 3) Area returned to environmental processes in the lagoon and destined to be an urban park and 4) The Medina.

A possible future scenario, which can be the basis of any reasoning that pursues climate adaptation objectives, makes the lagoon the primary figure of the urban organisation. Thus, it can assume the role of environmental centrality in the city. This possible scenario contributes to orient any future transformation action that pursues the maintenance of the lagoon as a public urban space to be defended.

The adaptive actions of the territory-structure in the strategic areas identified can create the following conditions:

- requalifying spaces that favour the conditions of reorientation of the pre-existing scenario, characterised by areas of fringe marked by significant forms of abuse;
- giving meaning to open spaces and to the components obscured by the prevaricating action of real estate investments;
- favouring the anchoring to environmental elements that can assume the role of a public space, open to the relationships and to different ways of use by various types of inhabitants and
- regenerating the environmental spaces where natural dynamics take place to activate forms of sustainability: thermoregulation, the absorption of CO_2, evapotranspiration, purification, reuse and lamination of rainwater and the improvement of the hydrological response of soils.

The territory structure thus outlined lays the foundations for future planning processes, trying to counteract settlement methods inspired by expansive practices and anchored to the logic of arbitrary occupation of land, regardless of any form of process and dynamics of environmental schedule present within the territory. The project hypotheses reveal the need for a reflection, allowing to arrive at alternative and urgent solutions to put a stop to the phenomena of desertification and de-territorialisation.

Urban generative structures and resilient societies

In our research, we have explored the themes of adaptation in relation to fragile areas, such as the lagoon, in two different contexts. The need for interdependence between conceptual and design devices, such as territories-structure and the implementation of adaptive governance models, continues to fuel our questions.

If, on one side, the *territories-structures* expose explicit urban regeneration projects in certain places to the extent of desertification and deterritorialisation, we try to experiment the methods of implementation of projects through subjects that often have opposing interests, different roles and skills, on the other. In contrast to the current planning and design devices that are based on predefined analysis scales as well as standardised government models, often coming from sectorial disciplinary approaches, the territory-structure offers the possibility to recognise and select the dynamics of a territory using the project as an “exploratory sensor”. It represents a scheme to take action that is anchored to the historical and environmental dimensions of the city, implementing a novel connection between the different urban fragments, to begin forming perspectives of resilient development.

The search for “new urban alliances” puts in the foreground, according to our reflections and experiences, the crucial role played by the “project” and, consequently, “the importance of identifying values, aims, tools and, most importantly, actors in this challenge within structures of government that are changing themselves” (Gambino, 2015).

The protection of vulnerable contexts, such as the lagoon settlement areas of Sardinia or Tunisia, push the research to deepen the ways in which *governance* as an adaptive practice can be addressed on open and flexible approaches to contributing to change attitudes and aspirations as well as to advance a different idea of the city. The territory-structure selects *process-oriented* actions, enhancing the educational quality of the environment and creating the premises for new alliances between subjects (as is the case with the Oristano project), and it favours new learning processes that intensify relations between different actors.

Regardless, the project action arises, therefore, as a learning tool that can contribute significantly to the increase in the level of knowledge and awareness of the subjects that are in focus: "a self-training process that becomes a new socio-political and cultural model of recognition of the established structures of ecological-urban control of the territory" (Clement,1974, p. 35).

The adaptive capacity is also understood as the ability to *give space* to the term: we believe that the territories-structure are able to counter the rigidity of the canons of functionalism, formalism and standardisation to find new perspectives for the urban project. The adaptation understood in these terms recalls the requirement of interscalarity, a correspondence between micro and macro, a reference to the value of small transformations with respect to their reference context, an anchoring to the reasons of the territory, even when it appears more fragile (Serreli, 2013).

The concept of "adaptation" and "coevolution" requires, as various authors have explained, a process of continuous and reciprocal learning, the overcoming of sectorial disciplinary glances, the affirmation of interdependencies between different configurations of reality, to bring a territorial and urban context towards new evolutionary states. The reconstruction of the vulnerable places in our cities can be triggered by "adaptive architectures" that the territories-structures select: they are projects that have the ability to contextualise themselves with respect to the environmental, settlement and ecological dynamics to modify the space and its functions homologating through minimal transformations to meet the needs of the evolving context. Adaptations subsequent to the different conditions of reality also allow the territories to evolve through small modifications that record variations and changes not only of proximity. In this sense, even existing settlements subjected to multiple pressures, and thereby apparently unfit to innovate the city, may have new opportunities for regeneration. In the urban territories of the lagoon landscapes, the modifications are actions "enzymatic" (Boeri and Gregotti, 2006), which favour the ability to use unusual energies present in the territory to make the context evolve even in situations of fragility and vulnerability. Additionally, they can also develop in normally unsuitable settlement environments (confined, commodified, standardised, and so on), reworking the different components of contextual reality but simultaneously interacting with new rules that arise from the context.

The two experiences of Oristano and Tunis illustrate that the capacity for resilience is the capacity for resistance and recovery (Odum, 1988) of values, rules and knowledge, as described in the "decision-context perspective". The need for adaptation to the new conditions that the lagoon settlements of the two cities are subjected to have higher priority and will have to be part of a wider design that starts from the "local" dimension and aims to build "resilient societies", just as many require of the political agenda of all countries. The new alliances between institutions and between institutions and citizens engaging differently in the reorganisation of one's living spaces are possible thanks to the sharing of a future project to initiate processes of change and lasting learning.

Contributors

The paper is the result of a common research made by the authors. The paragraphs "Introduction. Climate adaptation and place-based proximity" and "Urban generative structures and resilient societies" is edited by Silvia Serreli. The paragraph "Climate change and adaptive governance" is edited by Pier Paolo Spanedda. The paragraph "Decision-context perspective and project for new "urban alliances"" is edited by Giovanni Maria Biddau. The paragraph "The experiences" is edited by all contributors. The paragraphs "Regeneration of the terrain vague in the low density of settlements in Sardinia" and "Environmental and urban regeneration of Lac de Tunis" is edited by Gianfranco Sanna. The paragraph "High density in Grand Tunis and the environmental issue after the "Arab Spring"" is edited by Nesrine Chemli.

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Figures references

Figure 1a_drone image of lagoon Santa Giusta. Photo by Emilio Canu.

Figure 1b_Plane image of quarter of Lac in Tunis. Photo by Citizen59, CC BY-SA 2.0. https://www.flickr.com/photos/t_abdelmoumen/2921193842

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