

ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XX INTERNATIONAL FORUM

Le Vie dei  
Mercanti

20<sup>th</sup>  
World Heritage and  
Ecological Transition  
XX INTERNATIONAL FORUM



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Carmine Gambardella  
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Serie founded and directed by Carmine Gambardella

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# WORLD HERITAGE and ECOLOGICAL TRANSITION

**Le Vie dei Mercanti**

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## Peer review

Scholars has been invited to submit researches on theoretical and methodological aspects related to Smart Design, Planning and Technologies, and show real applications and experiences carried out on this themes. Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected. Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

## Conference report

300 abstracts and 550 authors from 40 countries:

Albania, Arizona, Australia, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Greece, India, Italy, Japan, Jordan, Lebanon, Malta, Massachusetts, Michigan, Montenegro, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

## **From the XIX FORUM WORLD HERITAGE and DESIGN for HEALTH to the XX FORUM WORLD HERITAGE and ECOLOGICAL TRANSITION**

In 2022 the Capri International Forum 'Le Vie dei Mercanti' will reach its 20th edition.

A Story of love for the Earth and its Inhabitants, Landscapes, Architecture, Cultural and Archaeological Heritage told by over 7000 Scholars and Academics from all over the World in an interdisciplinary way, by integrating skills, experiences, good practices in order to train talented people who care about the destiny of our Planet.

If the Future is an Eternal Present, the renewal of the Forum in these twenty years has produced a wealth of knowledge to guide those who govern and administer the Public Good, and citizens in their daily activities. A future that must be prepared in this era, that cannot ignore the ongoing climate change and that should not catch future generations unprepared.

A Present that transmits to the future the values that Humanity has passed on to us and that must be protected and transmitted as regenerative sources of Humanity itself.

Not coincidentally, the First International Forum assigned the topic 'From Luca Pacioli to the Ecogeometry of the Territory' to the participants.

An invitation to submit scientific contributions and good practices based on double-entry, legitimized by the measurement of tangible and intangible assets, in order to integrate knowledge and state it like entries in an income statement.

Therefore, if Luca Pacioli, tutor of the Rompiasi Venetian merchants family, suggested the method to legitimize the results of the activities undertaken, that is, through the measurement he indicated the survey activity as managing a heritage, which as such must not only be geometrically definable but must be also discretized into batches, noted in its multidimensionality, in order to produce a result whose added value can always be quantified and is given by the difference between the value of the asset, as we have received it, and the value reached for the activity of knowledge and management of the potentialities which are identified and stated as in an income statement; Eco-geometry, intended as a technological echo of reality, feasible through the use of digital and artificial intelligence to create forecasting scenarios, a model in which it is possible to measure all the components and relationships between the parts and to restore the matter, no longer as an instrumental covering to be described only in the geometric matrices generating the forms.

Once again Leonardo point us the way, conceptually anticipating the transition from analogue to digital and to the management of big data: "io vò pigliare quella licenza ch'è comune ai matematici, cioè siccome loro, dividono il tempo a gradi e di quantità continua la fanno disscontinua, ancora io farò il simile, dando col miglio o renella nella comparazione all'acqua" (Codice Atlantico, f. 126, t.a.).

Through the topic of the next XX Forum World Heritage and Ecological Transition, I want to provide some interesting food for thought, to identify a lived place, a life

environment, as an integral of forms of organization of the elements that surround us, examined through the prism of a civilization; we will deal with an innovative project of measurement and representation of the natural and built environment that is no longer an expression of the relationships between society and the natural environment but a construction of the relationships between the future as an eternal present and the legacy of the past as an economic value. A vital commitment that binds people to the environment; an educational revolution that match skills to the new way of managing what is learned and measured; the ecological transition with the use of technological innovation shall have the aim of entering the body of the territory, of the buildings and of the objects, it analyzes all its components through a multi-criteria analysis in order to establish a rating which in itinere defines the added of the results.

Just as the rulers and merchants in the mid-15th century, on the margins of international trade, in an economy contracted for mercantile life, combined research and training in new paths, taking refuge in agricultural operations, in favour of the reclamation of uncultivated lands in relation to the search for energy and its distribution and established the reasons of the earth compared to those of the sea in a perspective of systemic response.

Prof. Carmine Gambardella  
General Chair XX Forum 'World Heritage and Ecological Transition'  
President and CEO of the Benecon University Consortium  
UNESCO Chair on Landscape, Cultural Heritage  
and Territorial Governance

## **Dal XIX FORUM WORLD HERITAGE and DESIGN for HEALTH AI XX FORUM WORLD HERITAGE and ECOLOGICAL TRANSITION**

Nel 2022 il Forum Internazionale di Capri, Le Vie dei Mercanti, raggiungerà la sua XX edizione. Una storia d'Amore per la Terra e i suoi Abitanti, i Paesaggi, l'Architettura, i Beni Culturali e Archeologici raccontata da oltre 7000 Studiosi e Docenti provenienti da tutto il Mondo in modo interdisciplinare, integrando competenze, esperienze, buone pratiche per formare Persone di Talento che abbiano a cuore il destino del nostro Pianeta.

Se il Futuro è un Eterno Presente, il rinnovarsi del Forum in questi venti anni ha prodotto un patrimonio di conoscenze per orientare coloro che governano e amministrano il bene pubblico e i cittadini nelle loro pratiche quotidiane. Un Futuro che va preparato in questa epoca che non può prescindere dal cambiamento climatico in atto e che non colga le generazioni future impreparate.

Un Presente che trasmetta al futuro valori che l'Umanità ci ha consegnato e che devono essere tutelati e trasmessi come fonti rigeneratrici della stessa Umanità. Non a caso, il Primo Forum Internazionale affidò ai partecipanti il Tema "Da Luca Pacioli all'Ecogeometria del Territorio". Un invito a presentare contributi scientifici e buone pratiche fondati sulla partita doppia, legittimati dalla misura dei beni materiali e immateriali per integrare conoscenze e per declinarle come partite di un conto economico.

Pertanto, se la figura di Luca Pacioli, l'Istitutore della famiglia dei Mercanti veneziani Rompiasi indicava il metodo per legittimare i risultati delle attività intraprese, e cioè attraverso la misura indicava l'attività di rilievo nel senso di gestire un patrimonio, che in quanto tale non solo deve essere geometricamente definibile ma deve essere discretizzato in partite, rilevato nella sua multidimensionalità, al fine di produrre un risultato il cui valore aggiunto sia sempre quantificabile e dato dalla differenza tra il valore del bene, così come ci è pervenuto, e il valore raggiunto per l'attività di conoscenza e di gestione delle potenzialità individuate e declinate come in un conto economico; l'Ecogeometria, intesa come un'eco tecnologica della realtà, attuabile con l'utilizzo del digitale, dell'intelligenza artificiale per creare scenari previsionali, un modello dove è possibile misurare tutte le componenti e le relazioni tra le parti e restituire la materia non più come strumentale involucro da descrivere nelle sole matrici geometriche generatrici delle forme. Ancora una volta Leonardo ci indica la strada, anticipando concettualmente il passaggio dall'analogico al digitale e alla gestione dei big data: "io vò pigliare quella licenza ch'è comune ai matematici, cioè siccome loro, dividono il tempo a gradi e di quantità continua la fanno discontinua, ancora io farò il simile, dando col miglio o renella nella comparazione all'acqua" (Codice Atlantico, f. 126, t.a.).

Con il Tema del prossimo XX Forum World Heritage and Ecological Transition intendo proporre spunti di riflessioni per identificare un luogo vissuto, un quadro di vita, come integrale di forme di organizzazione degli elementi che ci circondano esaminato attraverso il prisma di una civiltà; ci si dovrà confrontare con un progetto innovativo di misura e di rappresentazione dell'ambiente naturale e costruito

non più espressione delle relazioni tra la società e l'ambiente naturale ma costruzione delle relazioni tra il futuro come eterno presente e l'eredità del passato come valore economico. Un impegno imprescindibile che lega le Persone all'Ambiente; una rivoluzione formativa che omologhi le competenze al nuovo modo di gestire ciò che si apprende e si misura; la transizione ecologica con l'utilizzo dell'innovazione tecnologica deve avere il fine di entrare nel corpo del territorio, del costruito e degli oggetti, ne analizza attraverso un'analisi multicriteria tutte le componenti per stabilirne un rating che ne definisca in itinere il valore aggiunto dei risultati.

Così come i governanti e i mercanti, verso la metà del quattrocento, al margine del commercio internazionale, in un'economia contratta per la vita mercantile, saldarono ricerca e formazione in Nuove Vie, trovando rifugio in operazioni agricole, in favore delle bonifiche dei terreni incolti in rapporto alla ricerca di energia e di distribuzione della stessa e instaurarono le ragioni della terra rispetto alle ragioni del mare in una prospettiva di risposta sistemica.

Prof. Carmine Gambardella  
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**Urban regeneration, climate adaptation, and territorial governance.  
Experimentation and innovation in the Plan for an integrated strategy  
between urban planning and ecology.**

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**Abstract**

The profound changes resulting from the processes of metropolisation, which characterise the new urban question, induce significant changes in the meaning of the problems linked to town planning, the environment and the landscape, highlighting the inadequacy of certain conceptualisations and recalling, today, more than ever, in the current situation of global health emergency, the urgency of activating policies, strategies and tools which provide integrated responses to the instances of environmental regeneration, social revitalisation, cultural and economic enhancement of the city. This is done by prioritising the protection of health and the wellbeing of settled communities, in order to restore prospects of equity, urban-ecological quality and efficiency to the governance of contemporary cities and territories.

This scenario, which recalls the need for intersectoral and interinstitutional convergence between all policies affecting urban regeneration and territorial governance, is reflected in the most recent Community programs and policies and is also a transversal objective of the NRP (Mission 5 *Inclusion and Cohesion* (Urban Regeneration and Social Housing), as well as of the NRP 2021/2027 (AT 2 *Humanistic Culture, Creativity, Social Transformation, Inclusive Society* in close correlation with AT 5 *Climate* and AT 6 *Environment*).

In this context, the contribution presents some of the results of the research activities carried out by the authors that highlight, starting from the analysis of national and international planning experiences and *best practices*, the urgency of defining new perspectives and new theoretical-methodological and operational references for an innovative planning system, as a tool for a sustainable and resilient regeneration of contemporary cities and territories, at the supra-municipal, municipal and local scale, with significant impacts on mitigation of and adaptation to the effects of climate change.

**Keywords:** Urban regeneration, climate change, climate-proof urban planning, strategic plan, local plan.

**1. The contemporary city and the new urban question. For an integrated and inter-scalar regeneration strategy**

The metropolisation processes that have interested contemporary Italian and European cities and territories in recent decades have induced profound transformations in territorial assets, as well as changed the meaning of issues related to urbanism, environment and landscape [2], highlighting the inadequacy of some conceptualisations, and the need to overcome those traditional logical devices connoted in terms of *separation* and *opposition* [3].

The outcome of these processes, the contemporary city is one in which the contradictions induced by the effects of globalisation, physical degradation, socio-economic marginality [4], environmental fragility [5, 6], extreme climate change, population ageing, the increase in chronic diseases and psycho-physical stress [7], the change in household structure, and in the population's value system [8, 9], the pressure of migratory flows [10], overlap with the "genetic anomalies" that have characterised, since the 1900s, the development of Italian cities [11], highlighting the emergence of a new *urban question* [12].

An urban issue that underlines, particularly in the current situation of global health emergency, the urgency of activating policies, strategies and tools that provide integrated responses to the instances of

environmental regeneration, social revitalisation, cultural and economic enhancement of the city, according to principles of sustainability, combining quality of life and quality of the environment, and prioritising the implementation of a new *urban welfare* to guarantee local communities the right to health, education, public mobility, housing, and to the city [3, 13].

The realisation of this new *welfare* calls for and constitutes, therefore, the priority objective of an integrated and interscalar public government strategy aimed at urban regeneration and territorial rebalancing [14], which is contextualised in the EU policies for the promotion of sustainability and efficiency of cities from a *smart* perspective [13, 15, 16], finds operational references in the *Green new deal* (2019), the *Just Transition Fund* (2021) and the *Horizon Europe Programme* (2021/2027), and constitutes, at the national level, a transversal objective of the PNRR (2021), in particular for Mission 5 *Inclusion and Cohesion* (Urban regeneration and social housing), and a founding content of the six "Major Thematic Areas" of the 2021/2027 NRP, in particular TA 2 *Humanistic Culture, Creativity, Social Transformation, Inclusive Society* in close correlation with TA 5 *Climate* and TA 6 *Environment*.

In this, it fully grasps the meaning of the global guidelines sanctioned by the United Nations, with the identification of the 17 "Sustainable Development Goals", within the "2030 Agenda for Sustainable Development", adopted by the Member States in 2015, and, in particular, the need to "make cities and human settlements inclusive, safe, resilient and sustainable" [13], through the experimentation of forms of innovation for the improvement of citizens' living conditions and for the cultural, economic and social growth of communities.

Hence, the eminently social and integrating character of the strategy [15, 17, 18], which, for this reason, assumes the public city, the set of public components or components of public use relating to open spaces, green areas, services, mobility, social housing, as the framework of coherence of an overall and compensatory process of regeneration of contemporary cities and territories, physical structure of reference and supporting framework for the creation of a new *urban welfare*, through the construction of a network of material and immaterial, interactive and integrated *networks*, which guarantee a widespread territorial protection and endowment.

In this framework, new issues, such as the fallout of climate change, the role of infrastructure networks in the redesign of cities and the reorganisation of their economic base, social inclusion and public city building strategies, social *housing*, the circular economy, green infrastructure and ecosystem services, energy reconversion and replacement of the building stock, digitalisation, land use containment and sustainable mobility, represent foundational objectives of regeneration programmes launched in major European cities [3].

In Italy, on the other hand, where the traditional tools for the construction of the public city - the PRG (the General Urban Plan), expropriation for public utility, urbanisation costs- have long proved inadequate, also for the purposes of guaranteeing a fair redistribution of income in favour of the public, to substantiate urban regeneration, taking it on as an integral part of an ordinary policy for the city, and, therefore, as a significant chapter of the National Urban Agenda [12], it appears necessary to address the unresolved knot of a reform of national urban planning legislation.

A reform for the government of the territory which, in line with the integration character of the strategy, also responds to the need for a cross-sectoral and inter-institutional convergence between all the policies that refer to this issue [19], from the policies of development and reorganisation of the settlement and infrastructure system, to those of protection and enhancement of the environmental system [3], and of its ecological, landscape, historical, cultural, social and economic values; from local 'territories' policies to national and supranational ones; up to those of economic, social and territorial cohesion.

## **2. Integrating urbanism and ecology into the Plan. For an environmental perspective of regeneration**

This need for convergence requires, more generally, the implementation of a new concept, which, through an experimental approach, characterised by high levels of interdisciplinarity, inter-scalarity, iterativity and integration, acknowledges the new demands of the contemporary city, responding both to the need for an overall vision, capable of interpreting the outcomes and potential for regeneration after the phase of urban explosion, and to the need for a renewed relationship with the planning and design processes.

This objective includes research and experience conducted at national and international level which, through concrete experimentation in plans, programmes and projects, has produced new points of view and practised new approaches, in any case characterised by a tendency to practice thematic and interdisciplinary sharing.

These approaches are reflected in new perspectives and new theoretical-methodological and operational references, which use the physical-territorial dimension as a structural reference for integration and interaction, grasping "*the direct link between the productive and social transformations of the country and the effects on the cities and the territory*" [20], also recovering significant relations between understanding and proposal.

Among these, in particular, this contribution places the accent on some planning experiences, at the level of vast areas and at the local level, conceptually ascribable to an ecological-environmental perspective of urban regeneration, examined in the research context carried out by the authors [21].

These research experiences, show the search for a transcalar continuity of objectives and actions, in the dual strategic and regulatory form of plans, and take on and operationally decline crucial issues at the heart of EU policies for sustainable development (Europe 2020 Strategy) and *climate change*, for the improvement of territorial connectivity and the harmonisation of ecological, landscape and cultural values (EU, 2011), the promotion of city efficiency in a *smart and green* perspective, concretely pursuing an integration between urban planning and ecology.

With these aims, the plans direct urban transformations towards redevelopment and modernisation of the existing city, triggering virtuous processes of environmental regeneration, based on the concepts of *compensation* and *ecological-environmental potential*, linking each intervention to actions to improve the fundamental resources air, water and soil; highlighting the role of environmental components to provide integrated responses to the instances of anthropic development and preservation of natural capital, combining morphological, cultural and social redevelopment interventions with actions of an ecological and landscape nature [18].

The interventions are therefore aimed at implementing new strategies for adapting to and mitigating the effects of climate change and settlement pressures, which take the form of integrated actions to reconfigure the environmental components; reducing soil consumption, environmental regeneration and soil renaturalisation; the protection and enhancement of biodiversity, through the creation of green infrastructures, hierarchical ecological networks, *green ways*, as true "regeneration matrices", united by indicators/requirements/standards, including ecosystem services, soil permeability, water management, social inclusion, tree and shrub density, and the promotion of new environmental values; to hydraulic invariance through sustainable stormwater management, water saving and sustainable urban drainage; to the reduction of sealing levels, energy saving and safety of existing buildings, favouring the formation of an urban environment with high climate adaptation performance; the mitigation of the 'heat island' effect by reducing the energy used in cooling and heating buildings; the reconversion, adaptation and implementation of sustainable and non-polluting collective mobility systems; the reclamation of contaminated soils in abandoned areas; the regeneration of the existing building stock [22].

Starting from these experiences, it is therefore possible to outline new theoretical-methodological and operational references for an innovative planning system, able to support urban regeneration strategies according to the specificities of territorial contexts and to pursue, through urban planning instruments, actions that have significant effects on mitigation and adaptation to the effects of climate change.

New references that, in a perspective of reform of the national urban legislation, allow to integrate the tools' contents, answering to that need, already present in the reformist plans of the nineties, of a wide and organic "dilatation" in the field of competence of the urban and territorial planning, that reaches the ecological-environmental contents, developing a model of urban sustainability centred on the ecological regeneration of the city, and therefore on the set of actions for the qualitative improvement of environmental resources activated directly by the plan, in the awareness that "*modern urban planning discipline was born rigidly linked to the city asset, but progressively involved (also by force of laws) the territory and then the landscape, the environment and today it involves the entire ecosystem*" [23].

Therefore, new references to innovate operationally, paradigms, legislative and regulatory apparatuses; programmes; forms and contents of instruments; implementation mechanisms, parameters and *performance* indicators; prototyping; levels of governance, as well as practices of the urban plan as a tool for a sustainable and resilient regeneration of contemporary cities and territories, on a supra-municipal, municipal and local scale, in order to substantiate the notion of urban regeneration, build the public city and realise the new *welfare*, implementing a concrete policy of planning and production of services [24].

### **3. Planning and climate adaptation: strategic and regulatory dimensions**

The need to identify new references for a sustainable transformation of the territories affected by the risks and degenerative processes related to climate change [25, 26, 6, 27], has solicited, therefore, in the last decades the scientific and disciplinary debate on the key role of urban and territorial planning, as well as on the urgency of an update of the planner's competences and of the instruments of territorial government in the elaboration of possible strategies of regeneration [14] and resilience to climate change [28].

Strategies that imply, as we have seen, an overcoming of the traditionally sectoral approach on these issues, in favour of an integrated approach to urban complexity [29, 30]) ascribable to the *Ecosystem Based Approach* [31], as also advocated by the document *Guidelines for Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction* [32], placing, in particular, emphasis on the need to define the elements of a knowledge process [33] aimed at a spatial definition of the vulnerability of territories to climate change, with specific reference to the possible impacts on the landscape-

environmental system, settlement-morphological, infrastructural and territorial endowments, and on the system of socio-economic relations.

Process capable of introducing and accompanying the construction of integrated strategies of *climate-proof* regeneration, in coherence with the objectives of the *European Strategy on adaptation to climate change* [34], combining the emergency dimension with a perspective of design and transformation of the territory in a sustainable key, in which all the elements of the built environment adapt to the new balances with efficiency and high performance levels [35].

In the general framework of the research activities carried out by the authors, the contribution gives back part of the results of a work of analysis and critical evaluation of some planning experiences carried out at national and European level, which allowed, through an inductive method, to identify two different approaches of the tools promoted by the Local Authorities and Territorial Agencies in a *climate-proof* perspective [36].

A first approach refers to a strategic dimension, related to the supra-municipal planning level (metropolitan or regional area), which identifies the main strategies for adaptive and resilient cities to climate change.

A second one recalls a regulatory dimension, mainly referred to the municipal planning level, which highlights a gradual process of integration of the plan contents, both in terms of implementation of the cognitive framework of the vulnerability of the territories, with the preparation of management drawings that give the consistency of the areas affected by the risk phenomenon, differentiated by level of hazard and in relation to possible time horizons analysed (heat islands, floods, alluvial phenomena, subsidence, etc.); both in terms of identifying possible mitigation and adaptation project actions on "target" areas identified by the Plan, from which to identify quantitative and qualitative indicators/requirements/standards, referring to the measures adopted [37].

The research activities focused on a selection of six case studies referring to the European context [38] and six case studies referring to the national context [39], favouring those experiences in which it was possible to find a *multilevel governance* and *downscaling* planning approach [40] between the *strategic* and *regulatory* dimensions of the instruments implemented by Local Authorities and Territorial Agencies at regional/metropolitan and municipal level.

In particular, the activity of analysis and critical analysis was based, on the one hand, on the study of dossiers and reports prepared by public administrations (PAs) and published on institutional websites, articles and scientific *proceedings*, and, on the other, on interviews and meetings with representatives of the PAs concerned.

#### **4. The national context. A multilevel governance and downscaling planning approach**

With reference to the national context, in coherence with the *European Strategy for Adaptation to Climate Change* (2021), the Ministry of Ecological Transition (MITE) (formerly the Ministry of the Environment, Land and Sea) has defined the *National Strategy for Adaptation to Climate Change* (SNACC, 2015), delegating the implementation of adaptation measures and actions to subsequent *Action Plans*. In this, however, it did not provide specific objectives or obligations for the local government bodies to adopt an ad hoc planning tool.

Following the SNACC, MITE undertook the process of preparing the *National Climate Change Adaptation Plan* (2018), which was then submitted for consultation to regional and local administrative levels, and is still in the process of approval.

From this, *Regional Adaptation Strategies* and *Metropolitan City Adaptation Strategies* will be developed, as well as *Local Adaptation Plans of Unions of Municipalities/Municipalities*.

In this context, the analysis of the two case studies of the "*LIFE16 Veneto Adapt*" strategy and of the "*Guidelines for the construction of the Climate Adaptation Plan*" of the Municipality of Padua was of particular interest for the purposes of this research.

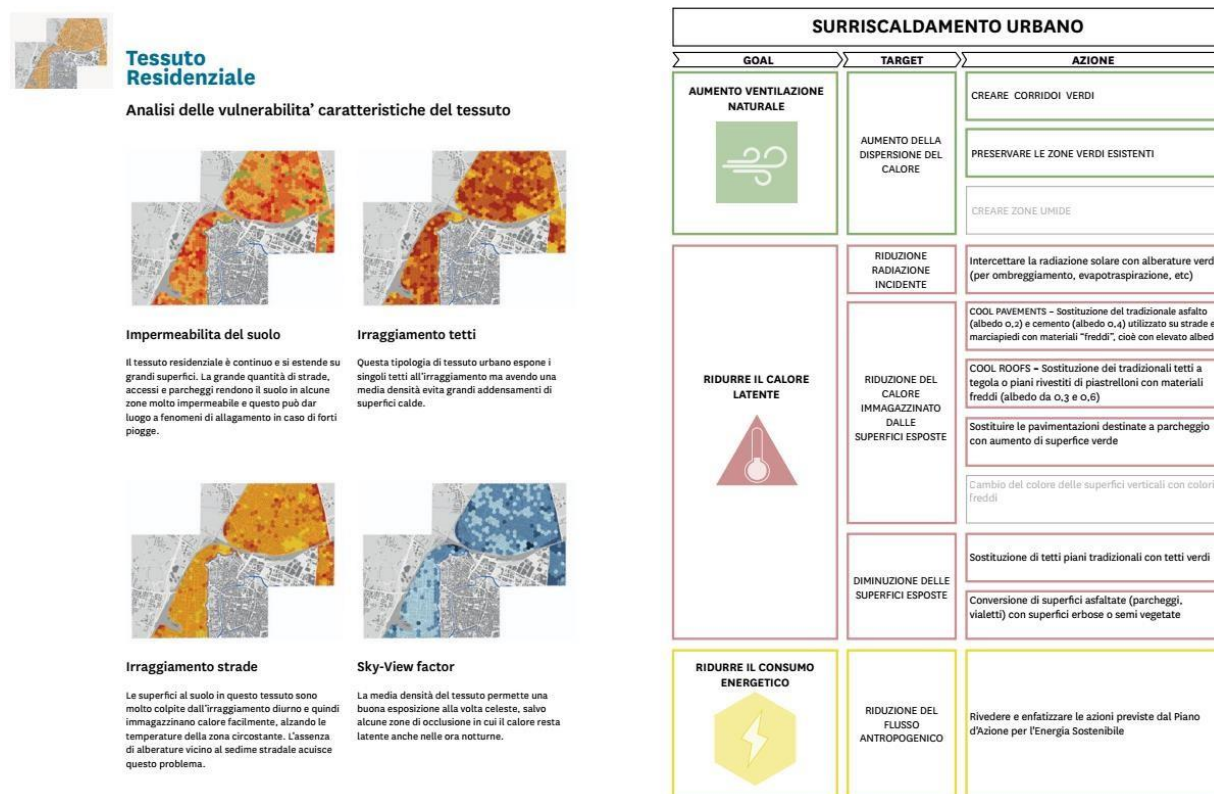
The Strategy "*LIFE16 Veneto Adapt*" [41] is driven by the objective of reducing exposure to risk phenomena and improving resilience to climate change, especially those related to hydrogeological risk and heat waves, of a conurbation of about 3.5 million inhabitants, consisting of the territories of the Metropolitan City of Venice and the municipalities of Padua, Treviso, Vicenza, Cadoneghe, Curtarolo and Vigodarzere.

In order to implement these objectives, the Strategy identifies a methodology of intervention consisting of:

- *structural or guiding actions* to avoid or reduce exposure to climate risks (building standards, green roofs to protect against overheating in summer and lamination of water in winter, construction of flood defences, provision of *green infrastructure*, etc.);
- *actions deriving from the use of ICT technologies*, useful to increase the capacity to find, analyse and disseminate information concerning the relationship between territory and climate change.

The Strategy also foresees that, for each action identified in the individual *Local Adaptation Plans*, to be prepared by the municipalities concerned, a sheet will be drawn up containing:

1. the reference to the sector or planning instruments concerned by the individual action, in order to ensure more effective coordination between the contents of the individual instruments;
  2. the cataloguing of actions to be tested within the strategy in relation:
    - (a) the time horizon of implementation;
    - (b) the scope of its application;
    - (c) the level of effectiveness (payback time).
- (a) with regard to the time horizon for implementation, actions are divided into three categories:
- . "coping" (action taken in response to the emergency, aimed at managing the event and then recovering/rebuilding the previous state);
  - . "incremental" (adaptive actions aimed at curbing the phenomenon, quick to implement, with short or medium payback periods);
  - . "transformative" (systemic actions of territorial transformation, which require a substantial financial investment in the immediate future, but which allow a reduction of economic and social costs in the long term);
- (b) with regard to their scope, the actions are divided into three categories:
- . "physical" (adaptation measures that act directly on the urban structure, at any scale);
  - . "organisational" (measures which, while not interacting with the built environment, propose policies and methods of governance or intervention capable of promoting adaptation: permanent working tables, agreements with monitoring bodies, etc.);
  - . "economic" (adaptation proposals based on local taxation or detaxation of behaviour that is more or less helpful in reducing the impact of climate change).
- (c) with regard to the level of effectiveness (payback time), the actions are divided into four categories:
- . "ordinary" (a measure useful for managing events that are not particularly intense, occurring every year or over a period of a few years);
  - . between 5 and 10 years (a measure capable of dealing with non-routine but nevertheless frequent events);
  - . between 30 and 50 years (measures designed for extraordinary events);
  - . between 100 and 300 years (measures capable of coping with extreme events).



**Fig. 1** Prontuario azioni "Guidelines for the construction of the Climate Adaptation Plan of the Municipality of Padua"

The "Guidelines for the construction of the Climate Adaptation Plan" [42] of the Municipality of Padua, preliminary to the preparation of the *local Adaptation Plan*, acknowledge the objectives of sustainability and resilience to climate change of the "LIFE16 Veneto Adapt" Strategy and decline the *regulatory* dimension with reference to the:






- identification of the actions necessary for the environmental and landscape regeneration, and for the functionality of the settlement and production system, identifying, where necessary, setting bands, in order to mitigate or compensate the impacts on the surrounding territory and environment;
- verification of the morphological and functional structure of settlements, with the definition, for the areas at risk, of regeneration and possible functional reconversion interventions and, for the most compromised parts, of possible strips or mitigation elements;
- regeneration of the public space system and improvement of the overall ecological functionality of open spaces.

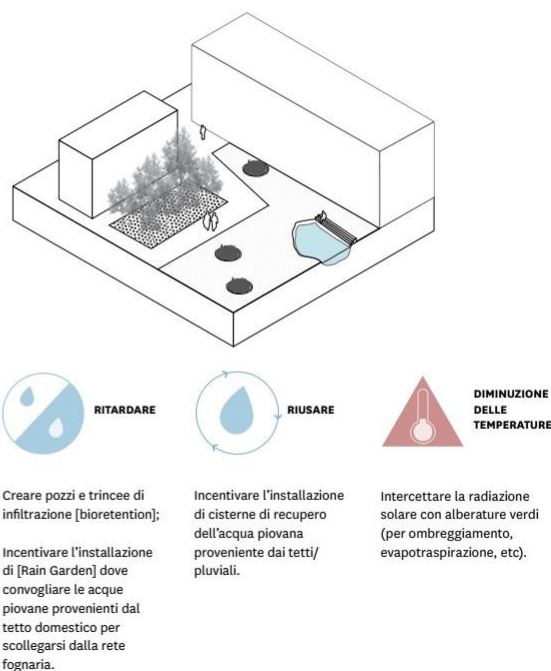
Starting from the explication of these general objectives, the *Guidelines* identify a methodology for the definition of the abacus of *site-specific* adaptation actions for the municipal territory that foresees, with reference to the *target* area identified for the experimentation, a preliminary mapping of the territory by fabrics, referable to the zoning of the local urban planning instrument in force (PAT Territorial Planning Programme).

With respect to this typification, the "*Prontuario delle azioni*" was finalised, organised according to the *vulnerability/goal/target and site-specific action* structure, which takes into account the impacts and vulnerabilities present on the territory, returned in specific integrative elaborations of the cognitive framework, and which allows the Administration to recognise the most suitable measures in relation to the specific characteristics of the municipal territory and the criticalities identified.

By way of example, in relation to an area classified as "*Residential fabric*" for which vulnerability to the heat island phenomenon has been highlighted, with consequent urban overheating, the map identifies as goals *the increase of natural ventilation*, the reduction of *latent heat* and the *reduction of energy consumption*, to which correspond specific targets, such as, for example, the *increase of heat dispersion*, the *reduction of heat stored by exposed surfaces* etc., which can be achieved through specific actions such as *creating green corridors*, *intercepting solar radiation with green trees*, *cool pavements* and *cool roofs*, *converting asphalted surfaces with grass surfaces* etc.

DEFLUSSO DIFFICOLTOSO		
GOAL	TARGET	AZIONE
<b>STIVARE</b> 	<b>RIDUZIONE DELLA PORTATA DI PICCO</b>	Creare depressioni verdi per accumuli superficiali Creare depressioni pavimentate negli spazi pubblici Creare vasche di laminazione in corrispondenza di grandi superfici pavimentate per l'invarianza idraulica (viadotti, rotonde, tangenziale) Incentivare l'installazione di cisterne di recupero dell'acqua piovana proveniente dai tetti/pluviali
		Sostituire le pavimentazioni impermeabili (es. parcheggi) con materiali/tecniche che le rendano permeabili Creare pozzi e trincee di infiltrazione [bioretention] Aree verdi Creare depressioni vegetate a bordo strada di infiltrazione delle acque piovane [Bioswale] Creare/installare vasi/fioriere dove convogliare le acque piovane provenienti dai tetti [Planter box] Incentivare l'uso/l'installazione di tetti verdi Incentivare l'installazione di [Rain Garden] dove convogliare le acque piovane provenienti dal tetto domestico per scollegarsi dalla rete fognaria. Oppure [Dry wells] (vasche sotterranee con fondo di sassi)
		Permeabilizzare (copertura ad erba) dei fossi
<b>RITARDARE</b> 	<b>RIDUZIONE DEL DEFLUSSO A VALLE</b>	Incentivare l'uso/l'installazione di tetti verdi Incentivare l'installazione di [Rain Garden] dove convogliare le acque piovane provenienti dal tetto domestico per scollegarsi dalla rete fognaria. Oppure [Dry wells] (vasche sotterranee con fondo di sassi)
	<b>AUMENTO DEL TEMPO DI CORRIVAZIONE DEL BACINO</b>	Permeabilizzare (copertura ad erba) dei fossi
<b>RIUSARE</b> 	<b>DEPURAZIONE DELLE ACQUE DI PRIMA PIOGGIA + RIUSO PER IRRIGAZIONE E USI CIVILI</b>	Incentivare l'installazione di cisterne di recupero dell'acqua piovana proveniente dai tetti/pluviali Filtrare/intercettare le acque di prima pioggia provenienti dalla rete stradale

Esempi di azioni per l'adattamento al deflusso difficoltoso e al fenomeno di isola di calore



**Fig. 2** Prontuario azioni "*Guidelines for the construction of the Climate Adaptation Plan of the Municipality of Padua*"

Monitoring of actions is a very important aspect of a successful *adaptation plan*, as is the case for any spatial planning tool.

The main difficulty in monitoring urban adaptation to climate change arises, in fact, when trying to measure (in quantitative terms through indicators) the effects of an action defined by the plan and its contribution to increasing the resilience of the area targeted by that action.

In this sense, the need is highlighted for a constant updating of the *cognitive framework of the territory*, through innovative elaborations and databases able to manage and share environmental, climatic, urban and economic information and a periodical evaluation of the results obtained through the

implementation of strategies and *site-specific climate-proof* actions, which allows, in relation to new instances and monitoring results, to start a constant process of updating and adjustment of the Plan.

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