ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XX INTERNATIONAL FORUM

Le Vie dei Mercanti

20th World Heritage and Ecological Transition

XX INTERNATIONAL FORUM

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Carmine Gambardella
WORLD HERITAGE and ECOLOGICAL TRANSITION
Le Vie dei Mercanti
XX International Forum

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WORLD HERITAGE and ECOLOGICAL TRANSITION

Le Vie dei Mercanti_XX International Forum

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20

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WORLD HERITAGE and ECOLOGICAL TRANSITION

Le Vie dei Mercanti

XX International Forum

Naples | Capri

8 - 9 - 10 September 2022

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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
Al 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, cosi 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.

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20th World Heritage and Ecological Transition XX INTERNATIONAL FORUM NAPLES 16 - CAPRI 17|18 JUNE 2022
WORLD HERITAGE and ECOLOGICAL TRANSITION
ARCHITECTURE|CULTURE|HEALTH|LANDSCAPE|DESIGN|ENVIRONMENT|AGRICULTURE|
ECONOMY|TERRITORIAL GOVERNANCE|ARCHEOLOGY|SURVEY|HERITAGE|e-LEARNING
Le Vie dei Mercanti XX INTERNATIONAL FORUM
Naples 16 - Capri 17 |18 June 2022

URBAN HEAT ISLAND PHENOMENON AND ECOLOGICAL INDICATORS: THE CASE STUDY OF THE HISTORICAL TOWN CENTER OF AVERSA (CE)

Salvatore LOSCO,[1] Claudia de BIASE,[2]
(1) Engineering Department, University of Campania *Luigi Vanvitelli*, Aversa, Italy
Salvatore.losco@unicampania.it
(2) Architecture and Industrial Design Department, University of Campania *Luigi Vanvitelli*, Aversa, Italy
Claudia.debiase@unicampania.it

Abstract
Climate change has reinforced the importance of the green component, especially in its thermal mitigation functions. The theme of the renaturalization of the city [1], through initiatives of structural integration of greenery with the anthropized environment, represents an important objective of urban and territorial planning. It is necessary to assign to green, functions capable of satisfying real needs; in fact, if the Grey Infrastructures constitute the built capital of our cities and are necessary for the economic development of a territory, the Green Infrastructures [2], represent its natural capital and are necessary to guarantee environmental sustainability [3]. In the case of the compact city, where the urban form is largely established, it is difficult to create significant green spaces. Green infrastructure represents a new approach to the problem: street trees, green construction along railway lines, green roofs and facades are seen as solutions that are easy to implement and suitable for building links with nearest green spaces. There is therefore a need in the drafting of urban planning instruments to plan actions aimed at counteracting the effects of climate change. To this end, it is important to analyze the experiences of cities that, through the introduction of regulations and planning indications, have succeeded in limiting effects of overbuilding and the urban heat island, and the urban heat island, identifying shared solutions between public administrations and citizens, who, synergically, contribute to the reintroduction, management and maintenance of new green areas within the city. The research methodology can be framed within the domains of literature review and the strategy of case-study and correlational research [4]. The paper proposes a reading of some ecological indicators used at the international and national level for measuring/quantifying the value of ecological performance and/or compensation of green in urban/anthropized environments. The fundamental objective is to analyze these indicators to verify their limits and potential to assess their technical transferability in urban planning regulations. Special attention will be paid to Biotope Area Factor also through the application to the historical town center of Aversa to test this indicator in a stratified urban environment characterized by a low incidence of green areas, a recurring characteristic in Mediterranean historical town centers.

Keywords: Eco-Planning, Urban Sustainability, Urban Planning Techniques

1 - Climate change and heat island phenomenon

Beginning in the 1970s, environmental protection became more relevant to issues involving the international community, which recognized its global significance. Awareness emerged that the Earth's natural resources must be protected and that nature conservation plays a fundamental role in the lives of communities. The environment is a finite resource, only partly renewable: it has a limited carrying capacity [5], ie it is able to absorb a limited amount of pollutants, compensating for the damage suffered, once a certain limit is exceeded; environmental damage [6] can no longer be reabsorbed in a reasonable time and the effect is irreversible. Sustainable development is almost an oxymoron from an etymological point of view, as sustainability refers to the idea of maintaining/preserving existing conditions over time and the ability to guarantee support, sustenance, without producing degradation, while development suggests modification/transformation of the status quo. When considered individually, these concepts prove to be in conflict, but the synthesis between the two - the goal - lies in proposing the idea of an improvement/mitigation/adaptation/evolution for a better quality of life for settled communities that is durable over time. To this end, sustainable development must integrate environmental protection, economic development and social responsibility. Environmental issues immediately appeared to be the most contradictory with sustainable development and, among these, urban and territorial greenery plays a non-marginal role; infact it is included in multiple indicators to assess urban sustainability. The balance between nature and artifice thus becomes the fundamental requirement of the ecological vision of the city, even though, until now, the city has been planned, designed and managed with nature as a marginal, if not an obstructive, element. Among the greatest environmental, as well as social and economic, threats to the life of the entire planet is climate change. Over the years, the awareness that massive anthropization influences climate change, and the perception that this can lead to harmful consequences for human wellbeing and all natural ecosystems, has become firmly established. Climate change has a strong impact in different areas of the globe and causes economic, social and environmental damage [7-8]. Analyses and research describe the changes that have occurred in ecosystems, while extreme weather phenomena are becoming more frequent in all parts of the planet with significant impacts, especially in heavily anthropized areas. The European Union has defined a strategy for adapting to climate change, which all countries are called upon to implement. It is the heavily anthropized areas that are most likely to pay the prevailing economic and social costs of global warming; for these reasons, specific attention to climate adaptation strategies appears increasingly urgent [9]. The environmental problems linked to the increasing pollution of primary environmental assets (water, air and soil) determine significant impacts in anthropized areas; the picture of weather-climate phenomena is complex and is not confined to a specific and limited area but takes on global and local aspects. Climate is influenced by humidity, winds and temperature, factors that depend, in turn, on latitude, altitude, distance from the sea and so on. The rise in average temperature, which reached considerable values in the 20th century, should be interpreted as the most obvious indicator of climate change. By dwelling on the microclimate, a climatic configuration that refers to a specific and limited site or habitat, and analyzing that which affects urban areas, it is possible to see how much the urban configuration influences both climatic and environmental factors. The thermal characteristics of the materials present in the city (cement and bituminous conglomerates, bricks, glass) differ considerably from those present in the external areas (agricultural soils, green areas pertaining to residences, bare soil), thus contributing to heat storage and determining conditions of thermal discomfort within the urban area. The average air temperature in cities is 2-3 °C higher than in rural areas, up to 5-6 °C higher in summer, generating a phenomenon known as the **U**rban **H**eat **I**sland - UHI. Cities play a decisive role in combating climate change and its consequences (Fig. 1).

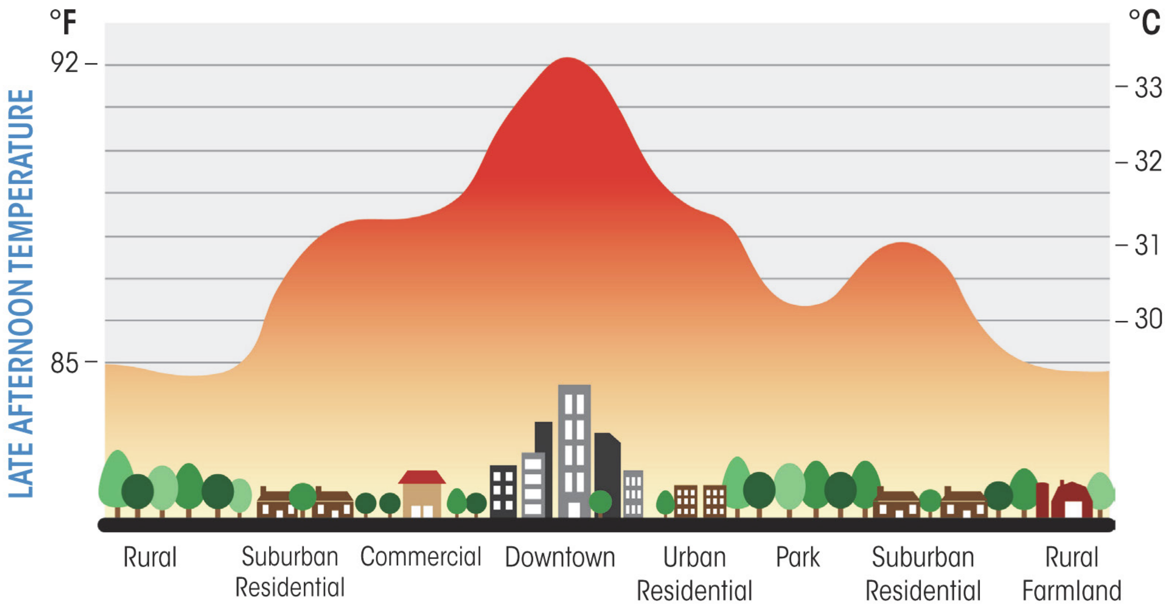

Fig. 1: Temperatures recorded in different area types - Source http://www.c3headlines.com/urban-heat-island-impact.html

2 - Ecological indexes: RBI, GSF and GF

The need to introduce into town planning and building regulations the improvement of environmental

sustainability has led, in recent years, to the development of new indexes that flank those employed by traditional town planning techniques or innovate them or replace them altogether. In this section we will discuss three ecological indicators aimed at quantifying/qualifying the ecological performance of a land transformation. In 2002 the Municipality of Bolzano commissioned a study to obtain an overview of the problems and possible environmental mitigation and compensation measures based on some landscape [10] ecology [11] indexes. In 2007, a ratio called **R**educed **B**uilding **I**mpact - RBI was defined, to be applied to the building plot to certify the quality of the building intervention (renovation or new construction) with respect to soil permeability and the presence of greenery.
The RBI is calculated as the ratio between:

$$\mathbf{RBI} = \frac{\sum_{i=1}^{n} S_{v_i} \cdot \frac{1}{\Psi_i} + (S_e)}{\sum_{i=1}^{n} S_{v_i} + \sum_{j=1}^{m} S_{i_j} \cdot \Psi_i}$$

S_v = i−th green−treated permeable, waterproofed or sealed surface (tabulated)
S_i = j-th permeable, waterproofed or sealed no green surface (tabulated)
Ψ = runoff coefficient (tabulated according to the type of surface)
S_e = tree surfaces equivalent

The weight of the different surface types is assigned by multiplying, at the numerator, the sum of the surveyed surfaces by the reciprocal of the runoff coefficient (1/ Ψ) [12] and, at the denominator, the same sum by the runoff coefficient (Ψ). The trees, divided into three size classes, are assigned an Equivalent Surface Area (S_e) to be added to the numerator. The RBI can vary from 0 to 10, it is close to zero when the lots have completely waterproofed surfaces and no greenery, while a value of ten corresponds to lots completely treated with greenery, with no waterproofed surfaces, intermediate values are found in urbanized lots characterized by built-up areas with different types of surfaces present, depending on their greater or lesser permeability, defined by the runoff coefficient and the greater or lesser presence of greenery. The higher the RBI, the better the environmental performance, both in terms of environmental well-being benefits and from the building point of view, in relation to sustainable stormwater management. In the case of partial or total renovation, the municipality has established that the RBI must be higher than the RBI of the existing state. In the case of new construction, the RBI will have to reach certain established thresholds (Fig. 2).

Fig. 2: On the left RBI = 10 corresponds to completely green-covered plots, free of waterproofed surfaces. Surfaces capable of providing maximum performance in terms of water regulation, groundwater repaving and improvement of the urban microclimate. On the right RBI = 3,95 corresponds to urbanized lots characterized by medium RBI, between the minimum and the maximum, depending on the built-up area, the type of surfaces present, their greater or lesser permeability, defined by the runoff coefficient and the greater or lesser presence of greenery.

The **G**reen **S**pace **F**actor - GSF [13] was first applied in Malmö, in an experimental form in 2001, for the competition of the European Housing Expo - Bo01 (City of Tomorrow). The area of approximately 30 ha, located west of the harbour (Västra Hamnen - Western Docks), was characterized by the presence of dormitory neighbourhoods, large industrial buildings, environmentally degraded conditions and an unfavorable local microclimate. The project envisaged the redevelopment of the area, with the preservation of the biodiversity that characterized it, to make it attractive to live, work, study and spend free time in this area and to transform it into a piece of city with diversification of uses (residences, commercial offices and services) and with considerable attention to the green system integrated into the neighbourhood and buildings. For the definition of the optimal endowment of green areas and elements to strengthen the local ecological network, the GSF is set, which can vary from 0 to 1; for the Bo01 neighbourhood redevelopment project, the target GSF is set at 0.5. The GSF is calculated by means of a ratio that presents in the numerator the sum of the product of the areas affected by the transformation by a multiplier factor and in the denominator the sum of the same areas.

$$\mathbf{GSF} = \frac{\sum_{i=1}^{n} A_i \cdot F_{A_i}}{\sum_{i=1}^{n} A_i}$$

A_i = i-th area

F_{A_i} = i-th assigned factor varying from 0 (sealed areas) to 1 (permeable areas in contact with the aquifer)

The factors associated with the different surface types range from 1 for vegetation that is in direct contact with the soil to 0 for sealed areas to values from 2 to 20 for shrubs and trees.

The Seattle **G**reen **F**actor - GF. In 2007, Seattle became the first city in the US to have a GF programme [14] aimed at green infrastructure standards. The GF is a designed landscape requirement aimed at increasing the quantity and quality of planted and permeable surfaces through the creation of extensive green areas, permeable pavements, green roofs, vegetated walls, trees and layers of vegetation along streets. Planners can introduce the different elements and calculate the GF score, which can range from 0 to 0.8 using a spreadsheet. The City of Seattle has set a minimum score that must be achieved to obtain planning permission for each type of intervention. The spreadsheet [15] requires entering the number and/or square metres of articulated landscape elements. The three GF priorities are: 1) Livability: it aims to improve not only aesthetics but also the quality of life through spaces on a human scale. 2) Eco-system services: another objective is to manage rainwater, improve air quality, increase the energy efficiency of buildings and provide habitat for birds and insects. 3) Climate change adaptation: build a more resilient city that mitigates the urban heat island phenomenon and reduces flooding. Seattle's Comprehensive Plan identifies areas for urban villages directs the growth of these areas, quantifies and frames several characteristic landscape elements through GF scoring. It includes conventional landscape elements such as green roofs and walls, permeable pavements, tree preservation and water-related characteristic elements. The GF is mandatory for new commercial districts consisting of more than four dwelling units or more than 4.000 square meters of commercial area or more than 20 new parking spaces; in these cases, it is mandatory to green 30% of the lots through the application of vertical gardens and plants that provide ecosystem benefits, such as permeable pavements, rain gardens and green roofs (Fig. 3).

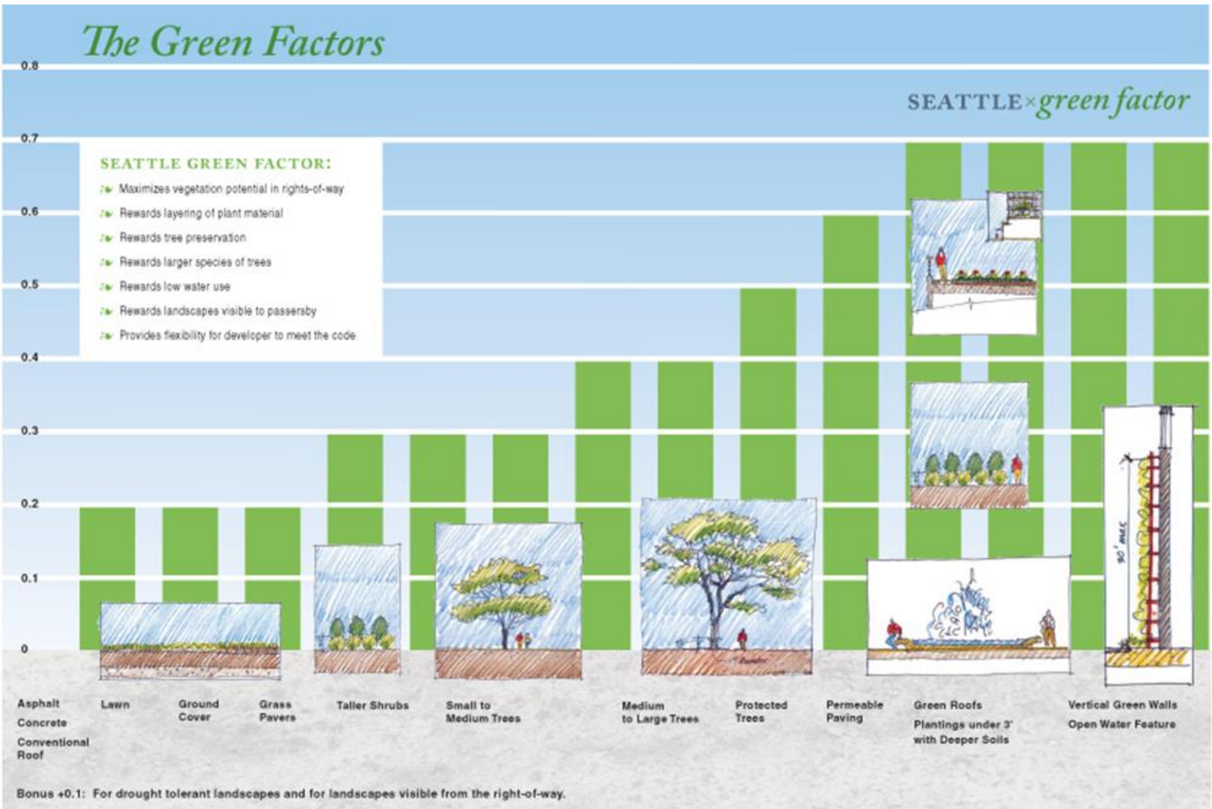

Fig. 3: Seattle's Green Factor establishes a score for different types of green infrastructure; properties must meet a minimum score tied to the lot's zoning **-** Source: https://developingresilience.uli.org/case/seattle-green-factor/

3 - The Biotope Area Factor

The BAF was first applied in Berlin (Biotopflächenfaktor - BFF) in 1994 with the aim of achieving certain levels of environmental compatibility in building activity. The BAF came into force in 2000 and sets a minimum ecological standard that new construction or redevelopment must guarantee. In contrast to other indicators, such as the level of soil sealing or the amount of private greenery, the BAF takes into account not only the areas covered exclusively by vegetation on non-sealed soil, which are indispensable for the protection of the ecosystem, but also the contribution of those surfaces that have a different permeability value, provided they at least allow water to pass through the semi-permeable surface, even if only partially; paved surfaces are also included, as well as roofs and external green walls. To calculate the BAF, it is first necessary to classify the surfaces that are present on the site in relation to their positive effect on the ecosystem. This classification is done using weighting factors, which consider the ecological potential of each type of surface. The BAF uses an abacus (Fig. 4) that considers six surface types and associates with them a coefficient ranging from 1 (total permeability) to 0 (absolute impermeability).

BIOTOPE AREA FACTOR - TARGET VALUES		
Transformation of existing built zones Construction of additional residential areas or increasing of the coverage ratio		**Project of new built zones**
Territorial Degree of Coverage	**BAF** Existing zones	**BAF** New zones
Housing Residential and mixed use only, no commercial space		
Up to 0,37	0,60	
0,38 - 0,49	0,45	0,60
More than 0,50	0,30	
Commercial Commercial and mixed-use only		
	0,30	0,30
Executive Commercial, services and administrative structures		
	0,30	0,30
Public facilities for social and cultural activities		
Up to 0,37	0,60	
0,38 - 0,49	0,45	0,60
More than 0,50	0,30	
Schools Education, Religious Centers, Multipurpose Complexes, Outdoor Sports Facilities		
	0,30	0,30
Nursing Schools and Care Centers		
Up to 0,37	0,60	
0,38 - 0,49	0,45	0,60
More than 0,50	0,30	
Technical facilities		
	0,30	0,30

Fig. 4: BAF target values abacus for existing and project areas according to land use and coverage ratio - Source: http://www.stadtentwicklung.berlin.de/umweltllandschaftsplanunglbfflindex en.shtml

Given a certain area, composed of various surface types, it must be broken down into homogeneous polygons with respect to the BAF coefficient. For each of these, the **E**cologically **E**ffective **S**urface **A**rea - EESA must be calculated, given by the product between the area understood in the geometric sense and the corresponding weighting factor. The total BAF of the area is obtained from the quotient of the summary of the various EESAs with the total area of intervention and may vary between 0 and 1.

$$\mathbf{BAF} = \frac{\sum_{i=1}^{n} \mathbf{A_i} \cdot \mathbf{W_i}}{\sum_{i=1}^{n} \mathbf{A_i}}$$

A_i = i-th surface
W_i =i-th weighting factor

The ecologically effective areas are provided for in a specific schedule and a weighting factor is fixed for each of them, ranging from 0 for waterproofed areas to 1 for areas with structured vegetation on the ground [16]. The target BAF range varies between 0.3 and 0.6 according to the settled function (residential, commercial, infrastructural), the different types of intervention and in relationship to the land or land cover ratio of the intervention area.

4 - BAF of Aversa Historical town center

The Aversa conurbation, located north-west of the city of Naples, is made up of 19 municipalities with a land area of 198.8 square kilometers and a resident population of 284.777 inhabitants in 2020 (Istat - 31/12/2020) [17]. It extends over a flat territory with densities ranging from 5.800 inhabitants per square kilometer in Aversa to 194 inhabitants per square kilometer in Villa Literno; the city of Aversa alone has 50.340 inhabitants (Istat - 31/12/2020) and a land area of 8.73 square kilometers. A reading of the configuration alone reveals a conurbation divided into a main core, a secondary core and a satellite core [18]. Only in the municipal territory of Aversa do we find a high concentration of population. Although the Aversa conurbation occupies a territorial surface area equal to 7.5 per cent of the province of Caserta, it accounts for about 29 per cent of the resident population, with 18 per cent of the total number of municipalities, more than half with a population of between 5.000 and 15.000 inhabitants. The hegemony of the city of Aversa, compared to all the centers gravitating around it, is highlighted in services to families and businesses. In the higher education sector, the city of Aversa also plays a key role with the presence of no less than 19 high schools out of a total of 22 in the conurbation. One of the relevant peculiarities of the historical town center of Aversa is represented by the permanence within it of the original urban matrix that, despite the building alterations it has undergone over about a millennium of history, still stands out clearly as a characteristic territorial mark. The radio centric model transplanted by the Norman conquerors also has the character of rarity, since there are no coeval counterparts in Campania or in the whole of Italy. In Italy, however, interesting analogies, at least as far as its overall organization is concerned, have been found with Melfi (Lucania) and Putignano (Apulia), vice versa relevant reference examples can be found in France as in the cases of the towns of Bram and Brive. Of no less value are the existing relations between the afore mentioned layout and those of the late-medieval north and south-western expansions of the 17th and 19th centuries, on the one hand, and the ancient orthogonal scheme of the Roman centuriation, recognizable in some of today's main and secondary town streets, on the other. The latter connections appear to be very significant, since the Normans chose, as a settlement area, the square of the centuriation, falling today within the Aversano countryside, of greater strategic role. This area constituted a delicate junction, located as it was at the meeting point approximately of the roads that, from Capua and S. Maria Capua Vetere, led to Naples and Pozzuoli and, precisely here, crossed the route coming from the coast through Villa Literno. Aversa has a PRG and PdR of the historic town center approved in 2004. The area considered for the BAF calculation falls within the zones A1, A2 and A3 of the municipal urban plan and has a territorial surface area of 784.000 square meters, is made up of 425.435 square meters of covered surface area, 40.840 square meters of private gardens, 87.500 square meters of courtyards, 102.291 square meters of roads and 128.334 of areas destined for urban standards (37,300 square meters of compulsory schools, 7,300 square meters of car parks, 33,894 square meters of equipped public green areas and 49,840 square meters of common interest), attributing to each area the corresponding weighting factor W_i and applying the formula shown:

$$\mathbf{BAF}\ (\text{existent}) = \frac{90.640\ \text{mq}}{784.400\ \text{mq}} = 0{,}11$$

in the top of the page, a BAF=0.11 is obtained, indicating the value of the actual state. To identify the target BAF, the abacus (Fig. 4) should be used, which requires the calculation of the Territorial Coverage Ratio.
As the Territorial Cover Ratio of the historical town center is higher than 0.50 from the reading of the BAF target values abacus (Fig. 4) it can be deduced that the target BAF value will be 0.30.

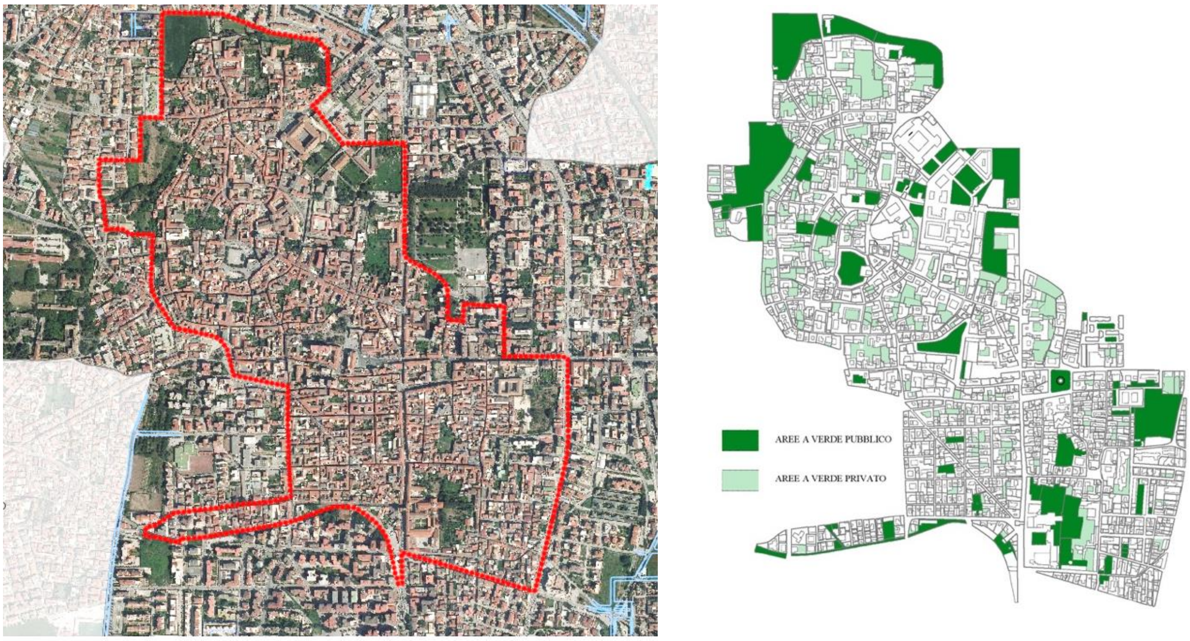

Fig. 5: On the left historical town center of Aversa boundary in red. Source: Google Earth Pro. On the right thematic map of the historical town center of Aversa tracing private and public green areas. A hypothesis for reaching the BAF target. Source: our processing

To reach this value it will be necessary to reduce the areas with a weighting factor close to zero and increase those that are close to one through the application of mitigation techniques that increase the areas with vegetation and green roofs that have proven effective in combating the heat island phenomenon. By acting on public areas and, in particular, on the areas destined for urban standards, ie schools, car parks, squares and external arrangements, on facilities of common interest by increasing their permeability and green areas (Fig. 5) and assuming that 90.000 sq meters of covered surface area out of 425.435 sq meters ie about 21% of the total, is transformed into roof gardens, with extensive and intensive coverage of the roofs with vegetation, the BAF rises to 0.30, which reaches the target value recognized as correct for this type of settlement.

5 - Concludings remarks

In urban planning, nature has almost always been introduced for decorative purposes, often underestimating the benefits it has on the city and its inhabitants. In recent years, the climate discomfort, increasingly felt in urban environments, has reinforced the importance of the green component. It is necessary to recognize the functions of greenery in meeting real needs and to include it as a priority element in the city's plans. Ensuring that grey and green infrastructures function properly, guarantees healthy and sustainable urban environments, as both play a vital role, in maintaining the quality of life, of our cities. New tools need to be developed to introduce the climate aspect into the plan design process [19], translating this information and the results into climate guides for politicians and urban planners [20]. Permeable surfaces and green roofs have a considerable absorption power of rainwater, which can reduce the load in sewers by up to eighty per cent. Increased permeability of soils also brings other numerous benefits, such as lowering the temperature in urban areas and thus mitigating the heat island, improving the microclimate and providing greater thermal insulation for homes where there is a green roof or wall. Nations such as Germany and Sweden, which have always been focused on environmental issues and the ecological, economic and social benefits that the urban landscape provides, were the first to develop urban environmental quality indicators to safeguard and improve the urban environment, natural habitats, microclimate, soils and water balance. The applicability of the BAF and its ability to adapt to different urban situations are testified by the diffusion it has had and the integration of the abacus with naturalistic and eco-systemic factors (eg the case of Seattle). It is enough to refer to the experiences of Paris with the Coefficient de Biotope par Surface - CBF, Malmö with the Green Space Factor - GSF, Southampton with the Green Area Factor - GAF and Seattle with the Seattle Green Factor - GF but also the Reduced Building Impact Ratio - RBI applied in the municipalities of Bolzano and Bologna. An effective indicator must be characterized by sufficient generality to be applied in several contexts and to leave room for the implementation/planning phase. The case of the historical town center of Aversa makes it possible to state that in most Italian historical centers, especially in the Mediterranean area, the improvement of environmental performance and the consequent reduction of the heat island effect is possible even for urban morphologies characterized by stratified, compact settlement fabrics, with high land cover ratios and low presence of green areas through the intervention on public spaces, present in non-negligible quantities in these parts of the city. The importance of green areas is recognized by the Territorial Plan of the Province of Caserta, approved in 2012, both in the structural directives referring to the Natural Landscape Elements, the Rural Open Territory and the Provincial Ecological Network, and in the programmatic provisions regulating the use of the Denied Territory with environmental potential without, however, resorting to specific environmental indicators that, in the vast area, would have encountered not a few application difficulties, but deferring to the municipal scale the implementation of the plan's provisions with the use of the most appropriate urban planning techniques.

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[5] Carrying capacity is defined as the maximum load, imposed by the population of a certain species, that a given territory can support without permanently compromising the territory's productivity. Researchers are therefore interested in investigating the relationships that exist between natural systems and the human species to understand how an equitable and sustainable society can be achieved. Over the years, various researchers from different disciplines have explored this concept and suggested ways to measure, monitor and implement sustainability (Aguirre, 2002; Kates et al, 2005; Hasna, 2007; Boulanger, 2008).

[6] The institution of compensation for environmental damage was introduced into the Italian legal system by Law 8/7/1986 no. 349, art. 18, previously jurisprudence had not referred to specific norms or had invoked the general principle sanctioned by the Italian Constitution on the right to health, considering that the environment, in its unity, guaranteed this right. Article 18 of Law 349/1986 defines environmental damage (paragraph 1): any intentional or negligent act in violation of provisions of law or measures adopted based on law that compromises the environment, now causing damage, altering it, deteriorating it, or destroying it in whole or in part, obliges the author of the act to pay compensation to the state.

[7] https://www.ipcc.ch

[8] STERN N. (2006), The *Stern Review on the Economics of Climate Change,* London, HMTreasury

[9] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0147:FIN:EN:PDF

[10] Landscape ecology studies the ecological origins and consequences of spatial patterns (distribution patterns) in the environment, highlights the ecological effects of pattern on large spatial scales (extended areas or regions) (Turner, 1989), deals with the effects of the spatial configuration of mosaics on a wide variety of ecological phenomena (Wiens et al., 1993), promotes the creation of models and theories of spatial relationships, and the collection of new types of data on spatial patterning and spatial dynamics at scales rarely considered in other branches of ecology (Pickett and Cadenasso, 1995).

[11] FORMAN, R. T., GODRON M. (1986), *Landscape Ecology*, John Wiley and Sons Inc., Hoboken - USA, ISBN: 9780471870371

[12] The runoff coefficient is given by the ratio of the volume (equal to the effective rainfall) drained from the basin in each time interval to the relative inflow consisting of the total rainfall.

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[16] http://www.stadtentwicklung.berlin.de/umwelt/landschaftsplanunglbfflindex_en.shtml

[17] LOSCO S. (2019), *Metropolitan Areas and Homogeneous Sub-Areas: A Structural Land Use Plan Proposal for Aversa Conurbation Planned as a Metropolitan Municipality* in: Laborest n. 19, Laruffa, Reggio Calabria, ISSN 2421-3187

[18] The main conurbation core consists of the municipalities of Aversa, Lusciano, Trentola-Ducenta, San Marcellino, Frignano, Casaluce, Teverola, Carinaro. The secondary conurbation core includes Villa di Briano, Parete, Gricignano d'Aversa, Cesa. The first satellite centre includes the municipalities of Villa Literno, Casal di Principe, San Cipriano d'Aversa, Casapesenna. The second satellite centre includes the municipalities of Sant'Arpino, Orta d'Atella and Succivo.

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