

Coevolution through Metropolitan Cartography. An epistemology approach to understand the metropolitan complexity

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ABSTRACT

The image of the city, its morphology, territories, and biography, concerning spatial, social, and economic dimensions, have radically changed in recent years, determining a new idea of urbanity spaces. Today, metropolitan areas have an incommensurable dimension compared to human measures. New rules and paths of knowledge are needed to manage the impact of human development on regions and landscapes and to create new relationships with the natural world. For the authors, the culture/nature linkage is a cultural change. 'Natural' is opposed to 'artificial', 'conventional': what do they mean for mass phenomena? It is a matter of how interpreting the city image changes in its dichotomous and interdependent relations with new technologies, throwing a new light on landscape and its values.

Through 'Metropolitan Cartography', the construction of information spatialisation competences for transitioning metropolitan systems can be envisaged, to provide a multidisciplinary and vivid knowledge synthesis of the physical space. In this framework, coevolution becomes a cultural factor, involving territorial transformations and the ability to evolve traditional tools to analyse, understand and design the complexity of metropolises in the second modernity. The result is a new informational ecology to produce 'sensible' images that activate landscape knowledge in the interweaving of different scales.

1. CULTURE AND NATURE LINKAGE AS RECONCILIATION FOR A NEW CULTURAL SHIFT

In the Myth of Sisyphus, Albert Camus (2013) investigated the existence of the novel Sisyphus, who is convinced of the exclusively human origin of all that is human and does not consider the universe as sterile or futile. Every grain of that stone, every mineral glow of that mountain, cloaked in the night, creates by itself a world. Even the struggle to the top is enough to fill the heart of a human being. So, we must assume that Sisyphus was happy. Sisyphus is happy even though he knows that every human intent is catastrophic and can never be natural.

This paper states, then, that Nature and human beings cannot coevolve (Foucault, 1967). Human beings are not capable of coevolving with Nature: they certainly try to perform actions that could help them survive or safeguard their settlements from the dangers caused by climate change. However, human beings cannot change the rules of Nature: they can only assimilate them and orient them to their goals, preserving their creations. E.g., we know the laws of a magnetic field, but when we reproduce it, we cannot say it is a natural phenomenon. In parallel, speaking of natural landscapes, we implicitly refer to an “*area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*” (Council of Europe, 2000), implying the interdependence of an observer, that is inevitably human, which becomes the factor that determines the nature of landscapes themselves.

Nevertheless, in the age of the Anthropocene, we are witnessing an epistemological catastrophe (Foucault, 1967): what human beings used to believe is no longer credible. Therefore, new rules and knowledge paths are needed (Indovina, 2022) to manage the impact of human development on the land and create new relationships with the natural world, specifically with natural and cultural heritage.

We prefer to debate the Culture/Nature reconciliation as a cultural shift. “*The concept of ‘natural’ contrasts with that of ‘artificial’, of ‘conventional’. But what do ‘artificial’ and ‘conventional’ mean when referring to mass phenomena? It simply means ‘historical’, acquired through historical development, and in vain attempts are made to give a deterrent sense to it since it has penetrated even into the common consciousness of ‘second nature’*” (Gramsci, 1975).

For the authors, the culture/nature linkage is a cultural change. ‘natural’ is opposed to ‘artificial’ and/or ‘conventional’. But what do ‘artificial’ and ‘conventional’ mean when referring to mass phenomena? The question asked here, then, is how the interpretation of the image of the city and its landscapes changes in its dichotomous and interdependent relations with new technologies, throwing a new light on landscape and its values.

The problem is misplaced because, regardless of the behaviour of the animal world, the Nature of human beings is ruled by the set of social relations that contribute to

forming a historical consciousness, so what is considered ‘natural’. The cultural models, lifestyles and customs condensed in social relations are not fixed and homogeneous for every person, place, and time; they are in a contradictory relationship and constantly changing. The economic civilization determines what is affirmed as necessary and universal in a historical period. It defines objectivity and the necessity of a specific tool for production and establishes rules of conduct, morals, educational styles, and the rules of coexistence in society. The last three decades radically changed the urbanity rules, completely transforming the socio-economic and demographic dimensions of metropolitan areas (Rodwell et al., 2018; Pandolfi, 2019). As Popper (1978) used to say, three worlds can influence the ever-changing nature of the landscape, the third of which is the realm of the ‘products of thought’, which can impact not only the way the world of natural elements evolve, and how we perceive them, but also the way that communities can consider natural cycles in their space and time.

We are confidently in need of a catastrophic discontinuity while continuing the tradition (Contin, 2021). We read the capacity to withdraw/contract and create a space and time for our nowadays human capabilities, where social action pursuit is social justice across the two kabbalistic qualities of Tikkun (Shatz et al., 1997), that today is intended as work for the improvement of society doing acts of loving kindness, not strictly falling into the category of ‘acts which help individuals’, and Tzimtzum (Kaplan et al., 1991), as the infinity of space and time. It is a process of constriction and expansion that continues several times until the entire Vacated Space is filled with numerous universes within the other.

Following the meaning of the word dominion, from the Latin ‘*Domus*’, which is related to domicile, dame, and madam (*domina*), all words related to the household, we do not conflate dominion with the domination of the earth. Moreover, the duty of human beings as heads of their homes is to serve the family. Dominion means, then, perpetuating the good of all creatures and preserving the wholeness of creation. As Genesis states (I:26), God said: “Let us make the human creature in our image, after our likeness. They shall have dominion over the fish of the sea, the birds of the sky, the cattle, the whole earth, and all the creeping things that creep on earth.” It means recomposing humanity through a different vision, the place of our new origin (Rilke, 1956) as inhabitants of more liveable cities, ensuring that all species (humans, mammals, birds, and insects) can survive. Therefore, this text will highlight the role of responsibility and human action, enlightening the concepts of recombinant urbanism (Shane, 2005) and new urban morphotypes as sites (Contin et al., 2022). The tool that allows us, then, to acquire back our competence to build (Choay, 2004) new spaces where different species can live together is the Metropolitan Cartography (Contin et al., 2021).

2. THE INTERMEDIATE SCALE OF METROPOLITAN CITIES TO FACE ENVIRONMENTAL ISSUES

The metropolitanisation (Cherry et al., 2022) of metropolitan systems settle incumbent changes on landscapes, that can generate complex architectures, wavering spatial overlaps and recurring transcalar issues, that recall the need to daze the dichotomous relationship between global-local, culture-nature, productive-neglected, urban-rural. In Italy, on the 8th February 2022, for the first time since 1948, Article 9 of Constitution was amended. It introduces among the essential principles the environment protection, biodiversity, and ecosystems, also in the interest of future generations. It also establishes that the law of the State regulates the ways and forms of animal protection. Therefore, the amended Italian Constitution finally protects the Landscapes and the Environment, including biodiversity and ecosystems. The conflict between Health and the Environment cannot be explored just through the private economic initiative. However, doubts regarding the interpretation of the law concerning the concepts of Environment, ecosystems and biodiversity still need to be solved entirely. We are interested in undermining the Constitution's ambiguity concerning the division of competencies between the State and Regional Administrations. Moreover, concerning the Environment, biodiversity, ecosystem services, and related landscapes issue, we propose to consider a crucial role at the intermediate scale, as the Metropolitan Regions could represent the first level we must consider protecting and correctly developing the Landscapes and the Environment, including biodiversity and ecosystems.

Our field of action is, therefore, the context where the metropolitanisation process occurs and where, with conflict, it is possible to develop suitable projects. Specifically, good urban development projects should involve the identification and comparison of different alternatives based on multiple objectives and criteria. The complexity of similar decision-making procedures calls for an evaluation framework that integrates information on the effects and impacts of possible design alternatives, with values and preferences elicited by stakeholders. Therefore, it is fundamental that someone does not gain something in the metropolis construction process, recodifying the word interest to pursue the public good, even when it is not profitable (Bruni et al., 2019). According to Saint Augustin, we promote a cultural resistance project, where the Soul is conceived as the Culture of a population. It can make an XXI century Metropolis out of the exploding city, not only increasing its Power.

The urban development strategies (UDS) at the Metropolitan scale (European Commission, 2020) in the actual scenario are strongly influenced by the Sustainability movement, which has been recently repurposed by the UN SDGs (Department of Economic and Social Affairs of the United Nations, 2015), addressing the UDSs toward sustainable goals to be reached at least by 2030. The most recent approaches to the topic try to focus on a new methodology (Nilsson et al., 2014), which starts from

general goals and a territorial focus, to build governance models in a strategic dimension (Detlef, 2020), based on the generalization of best practices and case studies with a high cross-sectoral integration level, with specific attention to the life quality needs and parameters (Turkoglu, 2015). Considering the actual situation (Gola, 2021) and the investments that are continuously renovated in sustainable urban systems (Vanhuyse et al., 2022), the need for a different method for building and managing knowledge is widely proven, also in the light of the speed that characterizes changes in recent habits (Long et al., 2020). It needs city users highlighted during and after pandemic lockdowns (Barbarossa, 2020).

Defining a new field of action occurs when a new need is identified: integrating the local points of the urban network with the new metropolitan epicentres. Then, the metropolitan city becomes attractive to different communities (Segovia et al., 2018). It faces the need to elevate the technical competence of the past, which characterizes the local populations, to make it suitable for the definition and organization of: 1) New patterns of urban growth; 2) The conduct of new populations replying to those models. The first issue concerns the timing representing the different phases of the construction of the actual metropolitan city, to be described through Metropolitan Cartography tools (Contin et al., 2021). The second issue concerns a radical revision of the disciplinary framework of urban and architectural studies to understand how the typical model we extract from the past is converted by the impact of metropolitan projects that define a significant discontinuity with the practices and techniques of the past. This part implies the new research mission within the Practice of Metropolitan Discipline framework.

The issue recently introduced by the New Urban Agenda and the Sustainable Development Goals is contributing to this change: it should not be interpreted only through project performance indicators but using principles and targets for the impact of metropolitan projects on territories that are increasingly vulnerable due to their: Exposure, Sensitivity, and Capability to react. Vulnerability is a multifaceted concept linked to the dominion of risks, conceived as the composition of hazard, vulnerability, and exposure (Birkmann et al., 2015). It is also significantly related to resilience (Pickett et al. 2013), which has become of primary importance in linking the theory and practice of Urban Design and Environmental Economics Theories for Sustainable cities and metropolitan areas. This is why we propose a metropolitan vision, aiming to improve the Practice of the Metropolitan Disciplines with new competencies of shaping and re-shaping the metropolis, reconsidering territory as an architectural construct (Salgueiro Barrio, 2022). A similar approach promotes an interdisciplinary vision, integrating different disciplinary knowledge sources and transversal management skills, dealing with metropolitan complexity and fragmentation. It also intends to bridge the gap between theory and practice by stating the metropolitan needs and gaps in the method and defining the intellectual tools to overcome them.

3. THE METROPOLITAN LANDSCAPES ISSUE

The maps of Metropolitan Cartography and Metropolitan Architecture projects act on Landscapes using a specific technique for structuring and intervening on a big scale. In addition, they deal with the specialization of the different methodologies related to the shape issue at different scales. Due to the Bigness issue, as spatial extension and temporal acceleration, specific techniques for structuring and intervening at a big scale related to a formal definition are needed because Maps can be plans (Salgueiro Barrio, 2022).

Landscapes are potential grounds for Architecture that gets, therefore, a new and vast meaning. In the past, Baroque Architecture used Landscapes as a constructive material. However, for the Baroque city, Nature was a dialectic element concerning the production of buildings and not a background only. Understanding the role of Architectural design means, therefore, facing the proper complexity of its process. Contextual, typological, functional, constructive, expressive, and formal issues of the architectural design process should be explored in their mutual relationship and interaction. The design is challenged to critically appreciate ongoing transformations in authentic contexts and propose appropriate solutions (Torisson, 2022). To achieve this goal, in the first phase, Metropolitan Architecture projects should start with the comprehension of their context, the evaluation of the possible alternative approaches, and the appreciation of the relations between buildings and the local urban structure. In the second phase, Metropolitan Architecture projects should research experimental building types and shapes that could combine compositional questions with design and technical aspects of buildings. The aim of a similar process is the elaboration of the design of a building facing the questions referring to the urban scale as to the detail scale, considering formal, technical, material, and functional issues in their mutual relations.

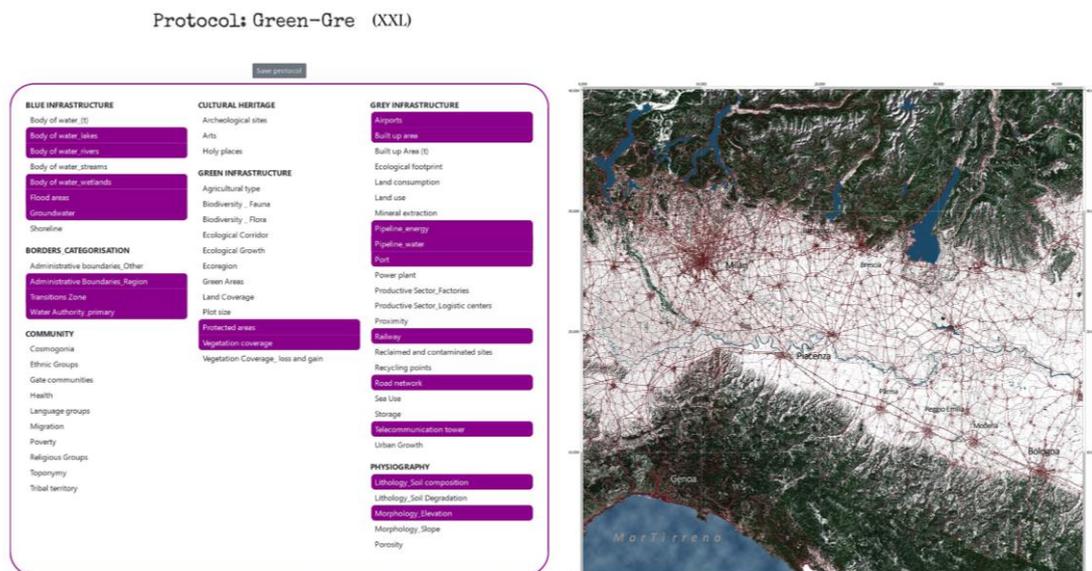
According to Gregotti (1966), the environmental question concerns the most significant and different problems. If so, the territory of the Architecture discipline becomes more extended, dealing with environmental sets at all scales. An audit of the Architecture discipline is mandatory, therefore, to consider it as a process of transformation at the territorial scale. Consequently, the metropolitan discipline (Contin et al., 2020) becomes the reply to this audit, promoting a technique and a tool for defining metropolitan anthropic-geographical Landscapes (Gregotti, 1966). Gregotti describes Architecture as the technical description and related project of the ‘surrounding’, becoming a synthetic way to define a place constituted by built and natural environment together (Focillon, 1934; Lawrence et al., 1990).

Metropolitan Architecture and Metropolitan Cartography projects are tools for mapping landscapes, passing through a meaningful articulation of Green and Grey Infrastructure networks (Contin et al., 2022) to shape a robust metropolitan civic

image, such as a collective memory methodology, technique, and deposit of values, local and global at the same time. A Nature/city pact is more than possible. Therefore, it is necessary. Most Metropolitan cities could benefit from the great opportunities in their territory given by Green Infrastructures that could be developed and improved to enhance this balance, providing many essential ecological services, and improving life quality in the Metropolitan systems.

A balanced Green and Grey Infrastructure network can even reduce disaster risks, mainly floods, within cities, with multi-functional nature-based solutions for human security goals in climate change scenarios. The idea is to let Green Infrastructures enter the Metropolitan city fabric, regenerating portions of Metropolitan areas through Urban development projects for a common or public space based on green networks shaping the urban space. Due to the nature/city pact, is it possible that the wedges of Green Infrastructures penetrate the city, acting as regulatory services for the health of Metropolitan systems? Can a pact be defined between Metropolitan systems and Green Infrastructures through the definition of ecological services? Can the Grey Networks grow within Green Infrastructures? Can Gray Infrastructures protect ecosystems and their services so that Green Networks can help essential metropolitan functions to become sustainable?

Figure 1 - Green-Grey Infrastructure XXL Protocol Map (Galiulo, 2021)



The Metropolitan Architecture mission becomes, then, developing a project that considers the value of each element, built or not, at different scales and their interactions. The Metropolitan Architecture project is about one kilometre by one kilometre in size, and in this case, it involves a new centrality between the edge of the city and nature. It is, in all respects, a rural-urban linkage project, but in a metropolitan context that may include (or not) agriculture as a buffer zone.

Nevertheless, Landscapes are not only the results of the production process but also significant elements for a Metropolitan city project at a more extensive scale. It produces the quality of the Figural Landscape Unit (Contin, 2021) of a specific metropolitan landscape as its identity (Lynch, 1960).

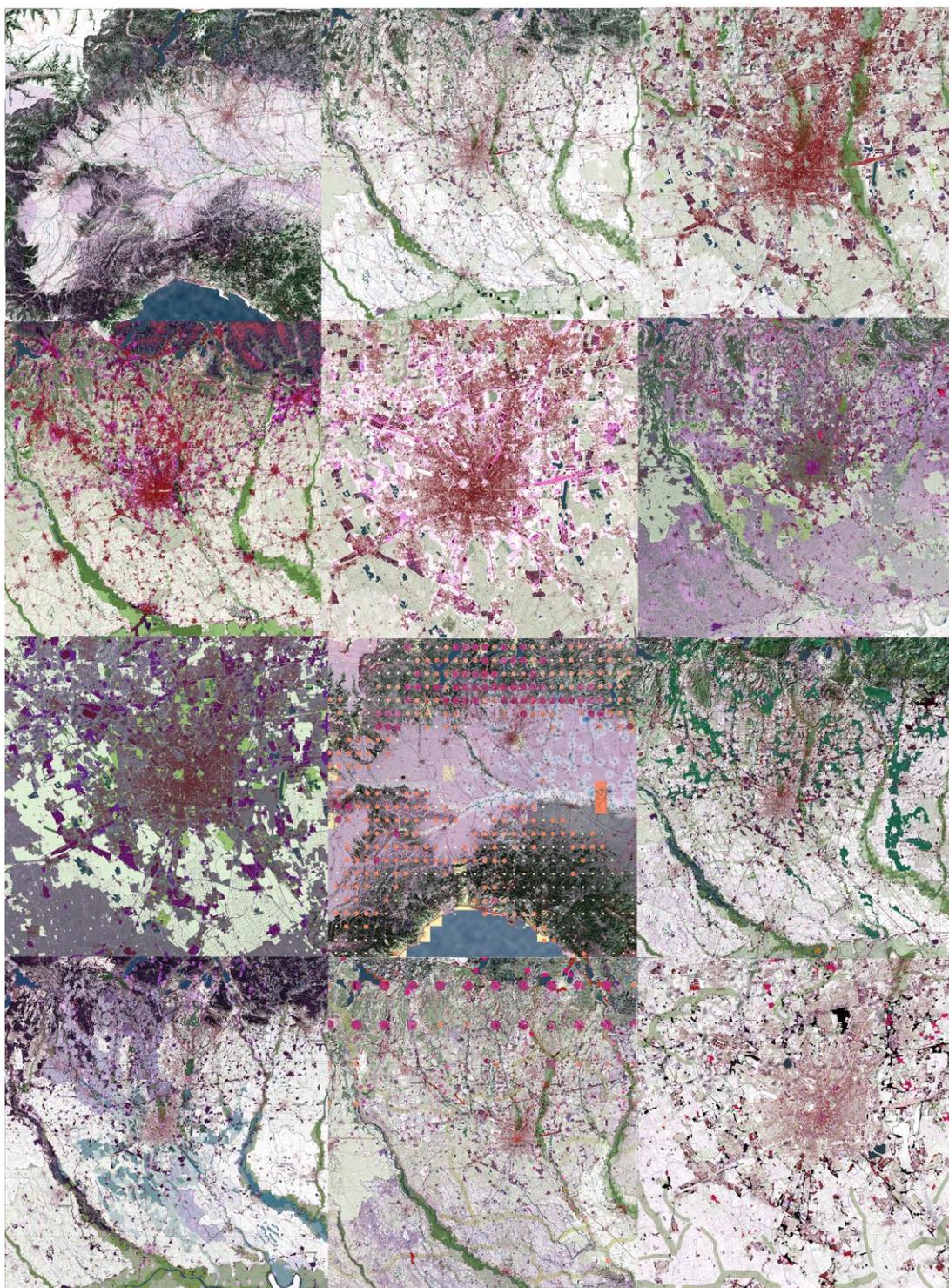
Metropolitan Architecture projects developed considering landscape issues introduce not only a technical language for a small group of technicians but also a linguistic structure within its syntax, grammar, and vocabulary: it would coincide with the total physical environment that got visible (Lynch, 1960). That is why landscapes, produced by physical elements marked into the ground by every historic period, will forever shape the collective memory of metropolitan citizens.

Moreover, a new Metropolitan Landscapes structure is needed, and this issue involves a sensitive reshaping of an already existing environment (Lynch, 1960). Nowadays, the whole technology approach to landscape reduces the local value of the characteristics of a place since they are more connected to suprascalar dimensions (Contin et al., 2022). The economies, and the progressive globalization of values system, considers Nature and Cultures as a heritage to exploit mainly economically (Gregotti, 1966).

However, the metropolitan dimension, considering the metropolitan continuity of eco-armatures and their articulation with the Grey Infrastructures, can be the engine for constructing a new relational non-static identity that evaluates, once again, the local characters of a place but connects them to the net of the cities in the world. Metropolitan Architecture projects will have, then, to shape the debate between cultural goods and economic-social assets.

On the one hand, they will have to highlight the complex patrimonial dimension, which focuses on the cultural value of historical and natural territories as a quality factor and, therefore, as a possible driving force for the development of the entire area. If it still seems real today that the engine for the reactivation of the natural and historical heritage can be tourism, the mechanisms linked to real estate capital preferably concentrate investments on renowned landscapes and consolidated areas.

Figure 2 - Synoptic map of the Milan case study (Galiulo, 2022)



In addition, Frampton (1999) distinguished the grid and the pathway so that the rationality of the universal grid versus the autochthonous path, or the rationality of normative technique versus the rationality of idiosyncratic form. Finally, Frampton promoted interaction between the ‘wet’ landscape place-form and the ‘dry’ rationally assembled product form.

According to Pollak, “identity is grounded in space geographically and historically specific” (2006). That is true at the metropolitan scale dimension, too. However, the contemporary relational identity depends on articulation in a sociological sense (Pollak, 2006). We know that the expression of the different spaces (collective and private), or among net infrastructural elements and built form types (Secchi, 1986), is the fundamental support for a multiplicity of spatial identities, which are the main Bigness result (Pollak, 2006).

The term ‘resonance’, opposite to dichotomy, used by Pollak, enlightens the need for a unity of different disciplines rather than a sectorial a priori assumption. In addition, for Lynch, manipulating the world can reinforce a robust civic image at strategic points. He proposed introducing a visual plan within the analysis and proposal of urban design, whose goal is not physical shaping and remodelling per se but the image quality in mind.

The quality of the image reveals the quality of living, which is the main objective of Metropolitan Architecture projects. According to Lynch, human modification must be done with an awareness of the interconnectedness of natural resources and human purposes while respecting their individuality. To design metropolitan landscapes, we must conceive them as complicated patterns, like plastic, open-ended and receptive to the formation of new imagery.

Nevertheless, the density, extent, and elaborate technology of the modern Metropolitan systems all tend to obscure the underlying topography and the pre-existing natural setting. It is increasingly evident that, as a city expands, the significant ‘natural’ factors become the larger, more fundamental ones (Lynch, 1960). Therefore, Topography is essential in reinforcing the strength of urban elements. The current high-seed path is an excellent viewpoint to grasp topographic structure at an extensive scale in 1960. Thus, Lynch introduced the Green-Grey Infrastructures interactions in Landscapes.

So, according to McGee (1991), we need to consider two main layers: the metropolitan off-site grid, which we organize through the Metro-Matrix geometrical model (Ortiz, 2014), and the inside archipelago, which we take into consideration to maintain some exceptional common shapes or to build a richness of possible structures and clues within the environmental riches.

4. METROPOLITAN CARTOGRAPHY FOR COEVOLUTION

Coevolution through technological tools can help build a deep understanding of the interrelated changes between man and the environment over time. This would reinforce the meaning of the interdependencies between culture-nature, city-country local-global. The coevolution with the Metropolitan Cartography maps occurs through the design phases for their construction since it is a cyclic process and verification between analysis, interpretation, and design. This awareness allows designers to acquire perception, sensitivity, and know-how on landscape issues, triggering knowledge to action strategies from which all its living species can benefit.

The process concentrated on Metropolitan systems conceived as Evolutionary cities. Our vision and approach are focused, first, on clarifying the issues and the processes - occurring at different scales - that concurred to determine the evolutionary nature of Metropolitan cities. Then, we pass to the proposals of developments not on the question directly but on the factors that could determine the challenge (as circular and non-linear causes, according to our vision of complexity). This method differentiates from today's typical development practices, aimed at manipulating the identity of historical places without producing sustainable long-term projects, generally replaced by private and not collective developments (Planning gentrification and risk). This complexity level can only be managed, then, through an evaluation framework that can define helpful information on the effects and impacts of the design alternatives, integrating it with values and preferences elicited by stakeholders and shareholders.

That is why we propose to identify processes of knowledge and coevolution through new technological tools that allow the framing of landscapes according to their plastic consistency, as they are transitional spaces that alternate the Nature and structure of the urban dimension according to transcultural visions. Through Metropolitan Cartography maps, it is possible, then, to define the interphases from forests to nature reserves, countryside to parks, productive districts to historical centres and neighbourhoods. Thus, the scales of Metropolitan Landscapes within Metropolitan Cartography experimentation underline sudden changes: the semantic relationships between 'local/global/hybrid', 'urban/rural', 'culture/nature', and 'traditional/contemporary'. Therefore, a practical understanding of metropolitan landscapes issues through tools of knowledge, interpretation, and representation is needed.

Therefore, Metropolitan Cartography is grounded on the relationship between Glossary, a common language, and the Metropolitan General Principles and Issues, the shared purposes, such as the maps' conceptual structure (fig. 1; Contin et al., 2021). It defines a landscape epistemology investigation and multidisciplinary and interscalar cartographic research. Metropolitan Cartography becomes, then, the systematic methodology to analyse and interpret the hybrid dynamics of Metropolitan Landscapes that are mirrored on cartographic grounds (Waldheim, 2016).

Metropolitan Cartography (MC) allows an orientation of thoughts through its articulation that considers urban, metropolitan, natural, and rural facts (Contin et al., 2021). Furthermore, Metropolitan Cartography allows choosing a direction concerning a project action through a set of maps, which we call Protocol Maps (Contin et al., 2022; fig.1-2). In our Metropolitan Cartography, Protocol Maps are linked to the reading of the evolutionary process of a metropolitan system. The purpose of the synoptic map is, then, to highlight the sequence of the set of metropolitan landscapes in the Milan case study (fig. 2). It is a systemic representation of cartographic grounds that aims at emphasizing the need to represent metropolitan landscapes through different scales and levels of spatial and cultural information (Galiulo, 2022).

Through MC Protocol Maps, we can assess the health and neglect of our territories and cities. From the Green-Grey Infrastructure map, we can deduce the continuity and discontinuity of the green and blue infrastructure; from the Risk Metropolitan DNA, we can identify the historical traces of the local construction that have determined its natural and cultural evolution. The Ecosystem Services map identifies the spaces that could perform systemically with the water structure and biodiversity in the territory. Finally, the Environmental Justice and Urban Metabolism maps highlight and explain the vulnerability, precariousness and uncertainties of our local systems and their societies (Contin et al., 2022). Speaking of Green-Grey Infrastructure, the XXL Protocol Map defines the necessary relationship between Glossary and Map Image to represent the spatial categories and components of the Green-Grey Infrastructure.

In conclusion, such Metropolitan Cartography research stems from the need to explore the quality of metropolitan interphase spaces, specifically between infrastructure and agricultural ecosystems, that are now subject to the accelerating dynamics of Urban-Rural Linkages (URLs). These are obsolete spaces defined as spheres of hybrid territorial interaction; discontinuous urban-rural territories are places straddling the local and the global, space and time, city and countryside (Sieverts, 2003). In narratives of similar areas, multiple landscapes at different scales overlap. This determines the need to define a new language of hybrid spaces representation. It is through the identification of spatial information to represent the transitional urban-rural dross-capes (Berger, 2007) using cartographic projects that, together with the terminology included in the Glossary, can enlighten processes of modification of public, private, and private-public spaces (fig. 3). Metropolitan Landscapes of Exchanges Protocol Map are representing, then, eligible landscapes for the Rearticulation (Lyster, 2006) of the interstitial space between the infrastructure network and Ecosystem services from the metropolitan, regional scale up to the landscape unit scale. These are the spaces where Nature and the city can coexist again for a joint evolution (Galiulo, 2022).

Figure 3 - Metropolitan Landscapes of Exchanges Protocol Map (Galiulo, 2022)



Specifically, the research aims to set up open-data and open-source Maps (Galiulo, 2021) in a dynamic process to make them interoperable, combinable, and scalable through modelling Urban-Rural Linkage interdependences (fig. 4). Metropolitan Cartography arises from the need to investigate the quality of metropolitan urban-rural interface spaces, specifically between agricultural ecosystems and infrastructures that are now subject to the accelerated dynamics of Urban-Rural Linkage (URL) transformation. Regarding relationships, scales, and temporality, the urban-rural interphase areas are Spatial-temporal expressions whose hybrid configuration admits different approaches of analysis and interpretation given their complexity in the physical, social, economic and land management dimensions (Galiulo, 2022). Anyway, we must consider that the modern industrial metropolis is not the same as the actual metropolitan systems. Diverging from the idea that the metropolis of the early modern era would be a ‘vertical city’ propelled by science, technology, and progress, what we really see is a more intricate ‘horizontal system of patterns’ (Contin et al., 2021). These dynamics have a wide range of intricately linked underlying causes. However, we concentrate on the three challenges of data, size, and quality of life within the context of our initiative. A collection of maps illustrating the essential connections between the many components is consequently elaborated, describing the metropolitan system. By combining geometric, historical, and geographic data with physical features, these maps can identify the urban structure and its dynamics. The foundation for talking about the dynamics during the problem-finding stage is provided by protocol maps, a set of cartographical tools that could be reproduced in any place by using the same semantic package and semiology (Contin et al., 2023).

5. CONCLUSIONS

As Metropolitan Landscapes are a complex system of time-space networks, Metropolitan Cartography contributes to the rethinking of the time phases and spatial shape of specific hybrid urban-rural metropolitan contexts, as well as their ecology and public space provision according to the land-use patterns of URLs (UN-Habitat, 2019). Furthermore, these new temporal and spatial interactions could generate sustainable design scenarios capable of standing for spatial pressures caused by physical and social uncertainty and vulnerability phenomena related to the metropolitan scale (Irajpour et al., 2023).

Comparing Metropolitan Cartography to other territorial analysis methodologies, like traditional maps of socio-economic statistical applications, it emerges that this method can create the roles necessary to organize the procedure pertaining to competency training (Contin et al., 2023). Through this procedure, the urban frames are oriented for decisions that are based on each system agent's cultural code (the values that guide the choices). By doing this, it is feasible to prevent pressure from conventions, routines, and individual traits when making decisions. Though it has a significant potential, the issues that emerged through its application are related mostly to the problem of collecting enough data to prepare explicatory protocol maps and to keep the consistency through the different scales in terms of reliability and update of the information represented.

Fig. 4 Quality of metropolitan urban-rural interface spaces between agricultural ecosystems and infrastructures (Galiulo, 2022)



This qualitative metropolitan mapping project, through a powerful evocative image, will offer a new map conception that can critically analyse the physical and temporal complexity of new metropolitan spaces, according to a translation of stratified knowledge, the reasons for the unfairness of the living conditions of metropolitan citizenships.

Metropolitan Cartography maps help to communicate the need for a new metropolitan vision with a multidisciplinary perspective that moves away from the traditional goal of functional efficiency and prosperity of the city and its landscapes. Therefore, Metropolitan Cartography maps support the evolution of the Spatiotemporal image of fragile territories so that they can be understood as new possible spaces to achieve the equitable well-being of the metropolitan area's inhabitants, both human and non-human. The maps support a qualitative assessment not limited to the construction of functional efficiency parameters of the urban-rural structure. Our perspective interpolates different levels of discretised information according to the equivalence of physical, social, and economic dimensions for contemporary metropolitan well-being, including its evolving landscapes and territories.

The care of our territories towards new linkages between Culture and Nature, therefore, is not only the result of social and economic evolutionary processes but can be understood as the enthusiastic reaction to a system of social and environmental inequalities in an urban-rural context is an integral ecology approach (Papa Francesco 2020). Suppose the society of the future cities organises itself according to a new awareness of caring for the anthropic and non-anthropic components of the city. Then it would be possible to operationally redefine the concept of sustainability and evolution, no longer linked only to the metabolic evolution of the city but, above all, to the knowledge of the environment in which it is rooted. Therefore, research on landscapes and coevolution, explained through Metropolitan Cartography, could be supported and implemented through new spatial information connections. That could involve the field according to a design forecast linked to the theme of the future habitability of hybrid spaces (Contin et al., 2022) in highly vulnerable metropolitan territories.

Metropolitan Cartography becomes the tool to enable the cultural shift that allows understanding of Culture and Nature as fields of territory knowledge. It is the bearer of a collective and participatory trans-urban and trans-architectural expertise for a new operational perspective attentive to equality and democratic participation. Finally, Metropolitan Cartography is the tool for identifying landscapes and places that are emergent to activate qualitative operations determined through geographic, social, and economic factors supporting architectural design strategies.

REFERENCES

- Barbarossa, L. (2020). The Post Pandemic City: Challenges and Opportunities for a Non-Motorized Urban Environment. An Overview of Italian Cases. *Sustainability*. <https://doi.org/10.3390/su12177172>.
- Berger, A. (2007). *Drosscape: Wasting Land in Urban America*. Princeton: Princeton Architectural Press.
- Birkmann, J., Welle, T. (2015). Assessing the risk of loss and damage: exposure, vulnerability, and risk to climate-related hazards for different country classifications. *Int. J. Global Warming*, Vol. 8. https://www.ireus.uni-stuttgart.de/forschung/publikationen/Birkmann_Welle_2015.pdf.
- Bruni, L., Becchetti, L., Zamagni, S. (2019). *Civil economy and sustainable development*. Ecra, Roma.
- Camus, A. (2013). *The Myth of Sisyphus: And Other Essays*. Penguin Classic, London.
- Cherry, N.M., Kayanan, C.M., Tomaney, J., Pike, A. (2022). Governing the Metropolis: An International Review of Metropolitanisation, Metropolitan Governance and the Relationship with Sustainable Land Management. *Land*, vol. 11(5), 761; <https://doi.org/10.3390/land11050761>.
- Choay, F. (2004). *Espacements, figure di spazi urbani nel tempo*. Skira, Milano.
- Contin, A., Galiulo, V., Pandolfi, A., Koike, R., Yang, D., de Chavez, K (2023). Metropolitan Architecture and Sustainable Habitats in the Indo-Pacific Region to Reinforce the Megacity System Through Urban–Rural Patterns. In: Vinod Kumar, T.M. (eds), *Indo-Pacific Smart Megacity System*. Springer, pp. 261-347, https://dx.doi.org/10.1007/978-981-99-6218-1_4.
- Contin, A., Galiulo, V., Sanchez Fuentes, D. (2022). Metropolitan Cartography: An Inventive Practice Tool for Caring Metropolitan Landscapes. *ARCC-EEA2022 International Conference Miami Proceeding*, March 2-5, 2022, Florida International University.
- Contin, A., Galiulo, V. (2022). METRO-SCAPES: Metropolitan Cartography for mapping Hybrid Landscapes. TESTING-GROUND. *Landscape, cities and territories*, vol. 04.
- Contin, A., Galiulo, V. (2022). Metropolitan Enchantment and Disenchantment. Metropolitan anthropology for the contemporary living map construction. *AMPS Tangible and Intangible Heritage conference*.
- Contin, A., Galiulo, V. (2021). The memorable image of Metropolitan Cartography as a symbolic trigger for Metropolitan Landscape. In: Contin, A. (eds.) *Metropolitan Landscapes: Towards a shared construction of the resilient city of the future*. Springer Landscape, Berlin, pp. 111-119.
- Contin, A. (2021). *E.N. Rogers al Politecnico di Milano: ripercorrere un'eredità/E.N. Rogers at Politecnico di Milano: retracing a legacy*. Alinea, Firenze.
- Contin, A., Giordano, P., Nacke, M. (2021). *Training for education, learning and leadership towards a new metropolitan discipline*. CIPPEC, Buenos Aires.
- Council of Europe (2000). Council of Europe Landscape Convention. <https://rm.coe.int/16807b6bc7>.

- D'Alfonso, E. (1987). Rappresentazione cartografica e veduta: l'opposizione fra ordinamento e immagine. *Quaderni del Dipartimento di progettazione dell'architettura del Politecnico di Milano*. Politecnico di Milano, Milano.
- Department of Economic and Social Affairs of the United Nations (2015). Sustainable Development Goals. <https://sdgs.un.org/goals>.
- Detlef, K. (2020). Urban Development Strategies for Resilient and Sustainable European Cities: Concluding Remarks to the Special Issue. *DISP*, 2020-10-01, vol. 56 (4), p. 122-124.
- European Commission (2020). *Handbook of Sustainable Urban Development Strategies*. <https://urban.jrc.ec.europa.eu/urbanstrategies/>.
- Focillon, H. (1934). *La vie des formes: Physiologic Landscape of Art concept*. Einaudi Editore, Torino.
- Focillon, H. (1967). *Vita delle Forme. Elogio della Mano*. Einaudi Editore, Torino.
- Frampton, K. (1999). Megaform as Urban Landscape. In: Carter, B. (eds). *The University of Michigan*, Michigan.
- Galiulo, V. (2023). *Metropolitan Landscapes Knowledge. Metropolitan Cartography as Methodological tool for Urban-Rural Morphotypes Project*. Unpublished PhD dissertation. ETSA Escuelas Técnica Superior de Sevilla, Seville.
- Galiulo, V. (2021). Envisioning Metropolitan Landscape Through Metropolitan Cartography. Metropolitan Landscape Dynamic Interactions in the Milan Case Study. In: Contin, A. (eds). *Metropolitan Landscapes. Towards a Shared Construction of the Resilient City of the Future*. Springer Landscape, Berlin, pp. 161-171.
- Gola, M., Botta, M., Capolongo, S., D'Aniello, A.L. (2021). Influence of Nature at the Time of the Pandemic: An Experience-Based Survey at the Time of SARS-CoV-2 to Demonstrate How Even a Short Break in Nature Can Reduce Stress for Healthcare Staff. *HERD: Health Environments Research & Design Journal*. <https://doi.org/10.1177/1937586721991111>.
- Gramsci, A. (1975). *Quaderni del carcere*. Einaudi, Torino.
- Gregotti, V. (1966). *Il Territorio dell'Architettura*. Feltrinelli, Milano.
- Indovina, F. (2022). Citizenship and new urban realities. *City, Territory, Architecture*, vol. 9, 8 (2022). <https://doi.org/10.1186/s40410-022-00149-2>.
- Irajpour, A., Pandolfi, A. (2023). The Value of Social Integration Tools. A Psychological Intervention on Urban Design in the City of Piacenza. *Italian Journal of Planning Practice*. ISSN 2239-267X.
- Kaplan, A., Sutton, A. (1991). *Inner Space Introduction To Kabbalah, Meditation And Prophecy*. Moznaim Publishing Corporation, Providence USA.
- Long, Z., Alharthi, R., El Saddik, A. (2020). NeedFull - a Tweet Analysis Platform to Study Human Needs During the COVID-19 Pandemic in New York State. *IEEE Access*. <https://doi.org/10.1109/ACCESS.2020.3011123>.
- Lyster, C. (2019). *Disciplinary Hybrid. Retail Landscapes of the Post-Human City*. John Wiley & Sons, Hoboken.
- McGee, T. (1991). The emergence of desakota regions in Asia: expanding a hypothesis. In: Ginsburg, N., Koppel, B., McGee, T. G. (eds). *The Extended Metropolis: Settlement Transition in Asia*. University of Hawaii Press, Honolulu, pp. 3-25.

- Lawrence, D.L., Low, S.M. (1990). The Built Environment and Spatial Form. *Annual Review of Anthropology*, vol. 19, pp. 453-505.
- Nilsson, K., Sick Nielsen, T., Aalbers, C., Bell, S., Boitier, B., et al. (2014). Strategies for sustainable urban development and urban-rural linkages. *European Journal of Spatial Development*. <https://hal.archives-ouvertes.fr/hal-01528698/document>.
- Papa Francesco (2020). *L'ecologia integrale porta a una nuova economia*. <https://greenreport.it/news/comunicazione/papa-francesco-lecologia-integrale-porta-a-una-nuova-economia-video/>.
- Pandolfi, A. (2019) The Importance of Including the Value of Soil in Metropolitan Planning Strategies. *International Journal of Engineering and Technical Research*, vol. 8. <https://doi.org/10.17577/IJERTV8IS120359>.
- Pickett, STA., Cadenasso, M. L., McGrath, B. (2013). *Resilience in Ecology and Urban Design*. Springer.
- Pollak, L. (2006). Constructed Ground: Questions of Scale. In: Waldehim, C. (eds). *The landscape Urbanism reader*. Princeton Architectural press, New York.
- Popper, K. (1978). *Three Worlds. The Tanner Lectures on human values*. https://tannerlectures.utah.edu/_resources/documents/a-to-z/p/popper80.pdf.
- Rilke, R. M. (1956). *Lettres milanaises, 1921-1926*. Plon, Paris.
- Sieverts, T. (2003). *Cities Without Cities: An Interpretation of the Zwischenstadt*. Routledge, London.
- Rodwell, D., Turner, M. (2018). Impact Assessments for Urban World Heritage: European Experiences under Scrutiny. *Built Heritage*. <https://doi.org/10.1186/BF03545684>.
- Salgueiro Barrio, R. (2022). Maps are plans: re-evaluating territorial hermeneutics through Manuel de Solà-Morales' project of description. *City, Territory, Architecture*, vol. 9, 22 (2022). <https://doi.org/10.1186/s40410-022-00167-0>.
- Segovia, C., Hervé, J. (2022). The creative city approach: origins, construction and prospects in a scenario of transition. *City, Territory, Architecture*, vol. 9, 29 (2022). <https://doi.org/10.1186/s40410-022-00178-x>.
- Shane, D. G. (2005). *Recombinant Urbanism. Conceptual Modelling in Architecture, Urban Design and City Theory*. John Wiley & Sons, Hoboken.
- Shatz, D., Waxman, C. I., Diamant, N. J. (1997). *Tikkun Olam: Social Responsibility in Jewish Thought and Law (The Orthodox Forum Series)*. Jason Aronson., London.
- Torisson, F. (2022). Strategies of visibility in the smart city. *City, Territory, Architecture*, vol. 9, 15 (2022). <https://doi.org/10.1186/s40410-022-00161-6>.
- Turkoglu, H. (2015). Sustainable Development and Quality of Urban Life. *Procedia - Social and Behavioral Sciences*, volume 202, 22 August 2015, pp. 10-14 Elsevier. <https://www.sciencedirect.com/science/article/pii/S187704281504851X>.
- Un-Habitat (2019). *Urban Rural Linkage: Guiding Principles*. Framework for Action to Advance Integrated Territorial Development, Un-Habitat, Nairobi. <https://unhabitat.org/sites/default/files/2020/03/url-gp-1.pdf>.
- Vanhuyse, F., Piseddu, S., Arra, V. (2022). *Financial instruments for investing in sustainable cities*. Stockholm Environment Institute. <https://www.sei.org/featured/financial-instruments-for-investing-in-sustainable-cities/>.

Waldehim, C. (2006). *The landscape urbanism reader*. Princeton Architectural Press, New York.

Waldheim, C. (2016). *Cartographic Grounds: Projecting the Landscape Imaginary*. Princeton Architectural Press, New York.

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