THE METROPOLIS IN RE-COMPOSITION: THE REGENERATION OF CONTEMPORARY METROPOLITAN MOSAICS

SUMARI

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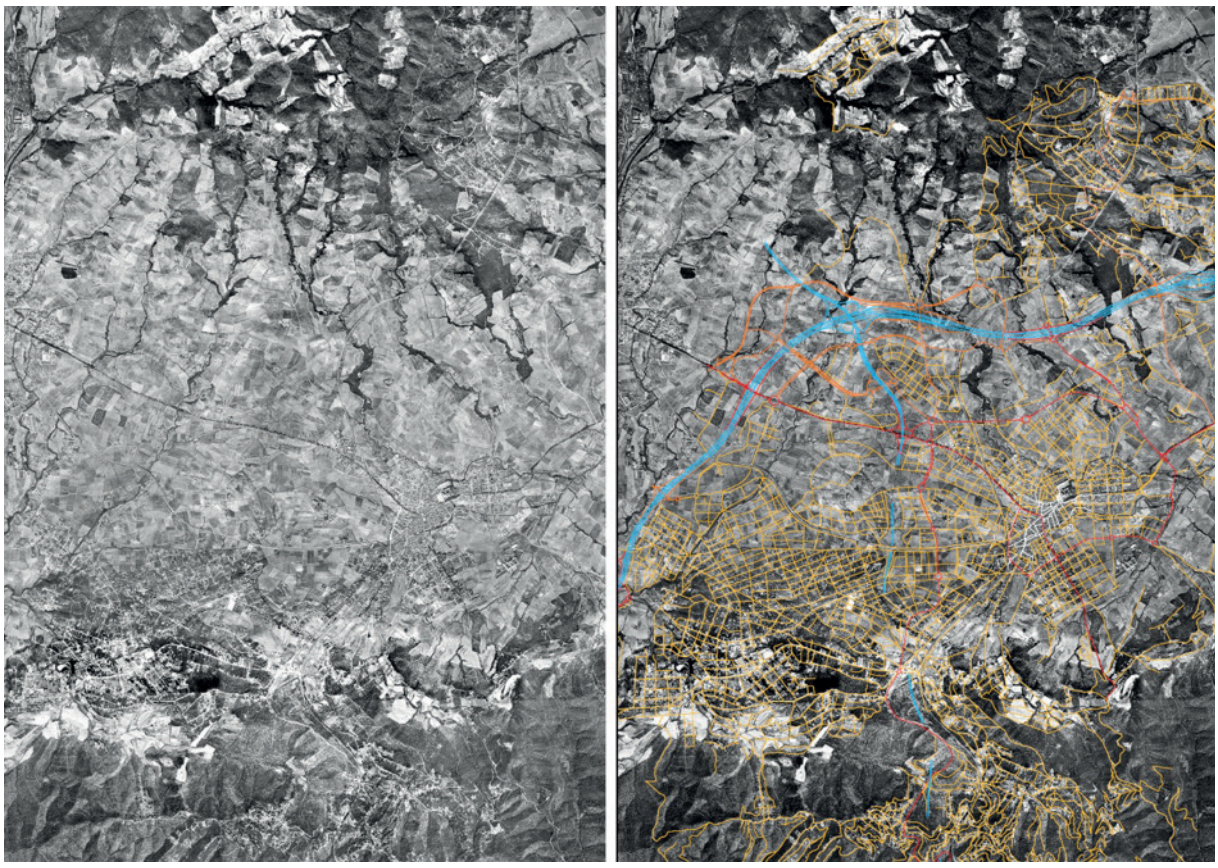
1. The metropolis in re-composition: a concept and device for confronting the challenge to improve life in cities and on the planet

Over and beyond any morphological and formal approach, the world's metropoles today require a holistic vision that attempt to comprehend their sheer complexity. The study of the metropolis (*el fet metropolità*) based on theories of dynamic systems or complexity, or via studies of network dynamics, should enable us to improve it as a habitat for the millions of people who already live there or in the extensive urban systems that extend over much of the surrounding territory. Contemporary metropoles are multi-spatial ecosystems with open, dynamic socio-economic relationships and simultaneously interconnected 'urbanities' and 'ruralities'. Thus, we need new interpretative frameworks that reflect contemporary socio-territorial realities and greater knowledge, linked by interdisciplinary approaches seeking to integrate analytically facts, dynamics and processes. Consequently, here we propose a renewed vision of urban and territorial 'facts' and some of the arguments for improving ways of management.

We thus use here the concept and device of ***re-composition*** (as it appears in the title) to:

- Act as a base for regenerating our territories and recovering degraded, damaged and underused metropolitan spaces. *The garden metropolis.*

Figure 1. Transformations of the metropolitan mosaic. Sant Cugat del Vallès.



Source: Laura Bertrán Arrufat. Final project ETSAV. Tutor: Carles Llop. Term: Autumn 2014/2015. ETSAV UPC. Photograph: Sito Alarcón

- Play a decisive role in improving the stocks of obsolete housing and its urban aggregations, both in old districts and in neighbourhoods with large housing estates. *The habitable metropolis*.

- Emphasize the importance of the relationship between socio-environmental impacts and the biocapacity of the territory. *The circular metropolis*.

- Focus actions on infrastructure to ameliorate the impact of the climate emergency, improve air quality and optimize the use of energy resources. *The post-carbon metropolis*.

- Strengthen the ecosystemic capacities of the territory (their biophysical rules and the control of the limits of territorial metabolism). *The biophilic metropolis*.

- Optimize already urbanized land resources to avoid the transformation of as-yet non-anthropized land and so create a large reservoir of natural resources. *The re-naturalized metropolis*.

- Share the analysis space between disciplines to encourage interdisciplinary flow and to update epistemologically – but above all, operationally – our knowledge of metropolitan processes, and to address the challenges that urban society presents[1]. *The consensual and concerted metropolis*.

- Renew confidence in new territorial plans and projects and control their functionality in support of functions. *The social metropolis*.

2. The Metropolitan Mosaics: designing the interface for addressing the socio-environmental quality of the Territorial Mosaic City[2]

2.1 Metaphors ('melting pots', 'mixed colloidal', 'constellations', etc.) for interpreting the multiple territorial phenomena taking place

Metropolization and urban sprawl are recurrent phenomena in recent urban development throughout almost all of Europe and, particularly, in the Mediterranean, where cities facing up to comparable territorial challenges end up by exhibiting similar traits. These phenomena often clash with the idea of environmental conservation and the respect for natural and economic equilibriums[3]. Thus, a renewal of the perspective of how we view the contemporary urbanized context is required to create the necessary metaphors for interpreting the multiple territorial phenomena taking place simultaneously.

One could say that the 'urban explosions' (Font, 2004) occurring in recent decades have characterized our demographic, urban, migratory, mobility, economic and social contemporaneity in many ways as phenomena that break with the classic paradigms of the past. It is interesting to observe how as humans we compare territories that lie within the limits of certain thresholds: the metropolis as the paradigm of maximum urban occupancy and the desert as the total absence of anthropization. This extreme duality, however, is misleading as today we observe the progressive loss of complete isolation in desert territories just as people are becoming increasingly isolated in many metropolitan areas. At the same time, nature is ever-more urbanized as the city establishes new forms of re-naturalization.

Urban explosions have caused an uncontrolled fragmentation of the physical space of the territory and today cities often resemble a broken mirror or a brittle mosaic in which each fragment still retains the meaning of the whole. This fragmentation has engendered on many occasions desolate broken landscapes where there is neither sequence nor connection between the constituent parts. In most contemporary metropoles the landscapes of the ordinary periphery have now been transformed into a multitude of incongruent and banal peripheries, polluted and noisy, dissected by roads, poorly communicated but paradoxically surrounded by a vast network of infrastructures that rarely actually provides any local service. Experience has taught us that this process of territorial heterogeneity – the result of urban dissipation and expansion dynamics – may follow very different paths depending on the parallel process of internal organization that accompanies it. In this sense, the metropolis grows following different processes of heterogenization that materialize in forms and activities and a final organization that can be improvised or uncontrolled, or, conversely, designed and meticulously connected to the rest of the urban fabric. Bearing this in mind we could and should make more demands of the landscapes that result from our territorial projects.

Another important realization is that we need to distinguish between 'city' and 'metropolis', as defined by Henri Lefebvre. However, this is an impossibility if we are unable to understand and, even less, able to identify and define the reality of the real contemporary city and the totality and plurality of the phenomena it entails. Therefore, it makes no sense to either eulogize a city that has been abandoned to the chaotic order of non-standard flexibility or normative deregulation, or to praise the periphery as a new type of modern space.

We now understand the contemporary city as a complex fourth dimensional setting in which a multiplicity of situations and landscapes arise, each with their own specific challenges. We need to be aware of some of the most relevant phenomena detected in recent research that characterize the contemporary metropolis if we are to confront the challenges of their possible transformation:

[1] Sustainability together with territorial inequalities are the two main objectives of recent territorial and sectorial policies (employment, housing, mobility, urbanization, etc). Promoting sustainability and reducing inequalities are two closely linked subjects: increased territorial inequality means more unsustainability and a more wasteful use of the territory. Furthermore unsustainability affects low-income populations and those who suffer most from spacial injustice to a greater extent (Borja, 2018).

[2] The concept of the Territorial Mosaic City, defined by Carlos Llop through research and teaching activities, is an analytical 'device' for both understanding and conceptualizing metropolitan territories, as well as a projectual approach to the transformation projects happening within.

[3] See Llop, C.; Bosc, S.. (2012). This publication, developed within the framework of the CREPUD-MED project, has allowed a group of European experts, local elected officials, academics, architects, planners, geographers, sociologists, etc. to combine their skills and to question the notion of territorial development understood as a 'project-process.' Four case studies of four European regions are presented: Val de Durance (Région Provence-Alpes-Côte d'Azur), Funo (Provincia di Bologna), Metropolitan Region of Barcelona and Eleonas (Athens). The book has the format of both an atlas (as an instrument of knowledge of the territory) and a project book (where different strategies that can lead to a contemporary and interterritorial project are proposed).

- An uncontrolled extension of the city throughout the territory with the concomitant dissipation of related functions.

- Residential dispersion over territorial environments ever further from consolidated urban centres.

- Polarization of central functions in and/or around metropolitan accessibility nodes.

- Large internal transformation processes taking place within the consolidated city fabric.

- Loss of new growth relationships based on the centrality of transportation due to the emergence of new lifestyles and their corresponding mobility patterns.

- Increase in peri-urban perimeters due to extensive growth dilation. Congestion of existing infrastructures due to the absence of new infrastructure and lack of interconnection.

- Conflicts arising from the reuse of brownfield sites due to their levels of contamination.

In this metropolitan context, our approach should accordingly be more dialectic and complex, and take into account the multiplicity of situations. It must also construct a new vision for metropolitan regions and the multiplicity and 'mixicity' of the mosaics they contain.

2.2. A new synthetical approach: from Simultaneous Territories[4] to the Territorial Mosaic City

The concept of the Territorial Mosaic City represents an attempt to integrate the multiple and simultaneous considerations present in contemporary territories spanning different hierarchical levels and geographical scales, and to integrate the interactions between the seemingly heterogeneous patches that comprise the mosaic. As a representational and scientific model, it stems from and combines two important standpoints regarding visions and analyses of territorial processes: i) ***Systems theory and complexity***, whereby systemic thinking has trespassed on territorial analysis by viewing and thinking of the territory or the metropolis as a complex system of interconnected components with distinct characteristics and functions; ii) ***Metabolic thinking*** whereby the territory/metropolis is perceived as the result of its social metabolism and the respective flows of energy, material and information that it generates internally and externally. The integration of these two perspectives in territorial planning aims to emphasize the correlation between the biophysical limits and respective biocapacity of the territory as key elements in its (territorial) metabolism and in all the interventions/projects that directly or indirectly affect it. Yet, at the same time, it aims to reinforce and restore the ecosystemic capacity of the territory by resolving the disruption and negative impact caused by human intervention provoked by the industrialization and urbanization of the territory.

[4] See (Calderón, 2016). This concept was coined and used by Arturo Calderón in his doctoral thesis presented in the Departament d'Urbanisme i Ordenació del Territori (ETSAV-UPC) under the supervision of Prof. Carlos Llop.

We now understand that cities, like natural ecosystems, have their own metabolic and systemic functions and are able to metabolize the energy resources available within their reach to maintain or even increase their levels of organization, i.e., their systemic organized complexity. Although in natural ecosystems the waste from one process becomes a resource input for another process in a circular fashion, the wasteful processes associated with city metabolism are predominantly linear in form. In other words, the city generally consumes material goods, energy and resources at high rates (often assuming an unlimited supply) and pollutes its adjacent environments with its waste and vast amounts of dissipated energy, thereby affecting the overall territorial metabolism on many levels. This is important to bear in mind, not only because of the ever-increasing urban population but also due to the fact that cities and metropolis lie at the beginning and end of many production-consumption chains and material and energy waste paths associated with territorial metabolism.

In the preindustrial context, the overall territorial metabolic pattern was controlled by natural territorial cycles, with the speed or flows dictated by the natural conversion of nutrients and energy in predominating cycles. Overall, however, the conversion of energy was too low or slow to meet the increasing needs of an urbanizing society or even the levels of contemporary societal needs in a metropolitan context. Conversely, in a contemporary industrialized and urbanized context, where all flows are linearized, we have maximized production from our territories – even to the point of creating surplus – but only by negatively affecting their global ecological carrying capacity and ecosystemic functioning. We have thus reached a stalemate.

The application of a metabolic approach for the metropolis also mirrors essentially the increase in urban complexity, which in turn can be interpreted or viewed as the continuous interaction between dissipative and homeostatic processes present and taking place within its formal limits. The contemporary definition of urban metabolism (as opposed to natural system metabolism) has come over time to embrace additional considerations regarding the social aspects of human settlements (habitability, activity, mobility = HAM) and their respective dynamics, and identified the simultaneity and multiplicity of layers present in cities and in the territory. Notwithstanding their intrinsic limitations, cities can improve their sustainable performance and functioning and should aim for territorial efficiency. Bearing in mind that, given the world's ever-increasing urban population and its future projections, there is even greater pressure to achieve these goals as soon as possible. In this sense, cities need to start generating and using available resources more efficiently by mimicking nature's capacity to do so; they should also seriously consider the projected impact of specific projects at different scales and how these could potentially improve overall territorial efficiency.

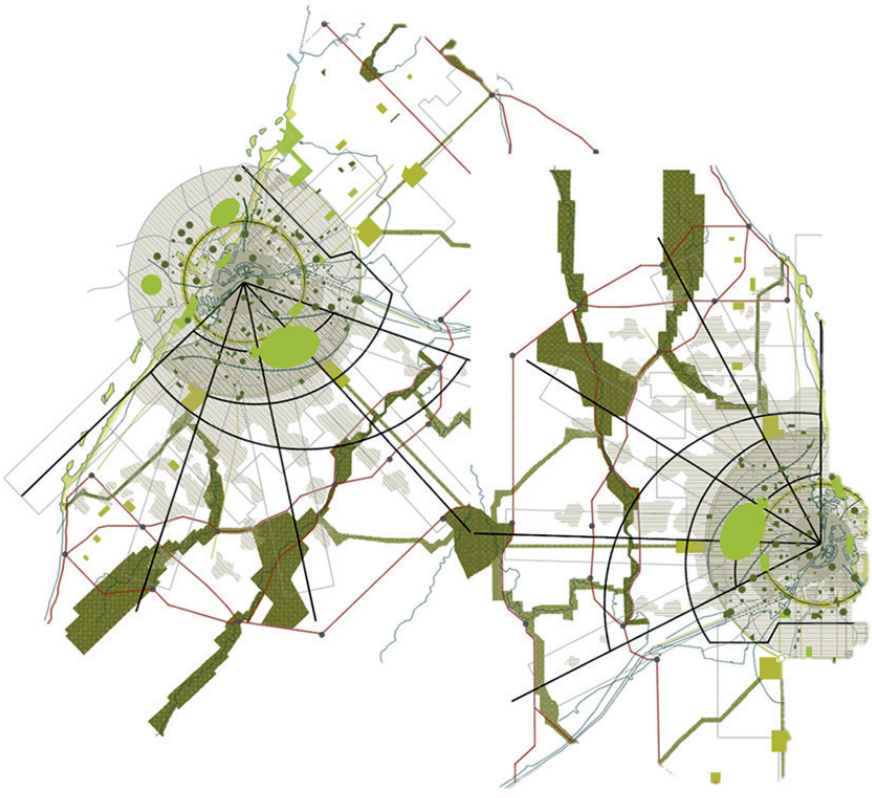
These additional characteristics and considerations attached to the metropolis when rethought as a complex socio-ecological system find their expression in the concept of the Territorial Mosaic City. This definition also encompasses the emerging complexity ap-

pearing in contemporary ideas and studies of metropolitan processes and dynamics, and stresses the importance of the concept of urban metabolism when managing and improving territorial planning, especially when trying to adapt policies and concepts such as the Circular Economy in an urban and territorial context. Trying to understand how contemporary heterogeneous territorial mosaics as complex systems implement principles of circular metabolism could help to broaden the contemporary definition of the Circular Economy and enrich it with extra complexity and contextual content.

Thus, the renewed territorial project should first address the articulation of the fragmented fabrics and flows within the metropolis and then adjust to the demands and challenges of new programs that will give form and content to the new system of physical and functional metropolitan organization. The Territorial Mosaic City is a proposal designed to understand urban realities via urban synapses, that is, the spaces of articulation and interrelation between the diverse urban fabrics as a point of departure. It aims to define a morphological and environmental structure, designed according to the mutual ecological adaptation and co-evolution of interacting urban and natural ecosystems. Its overall aim is to work toward an environmental balance and harmonization of these mutually co-existing ecosystems. The Territorial Mosaic City thus entails a seamless vision of interrelation and interfaces between the different components of the territory and the city:

- The biophysical matrix and the territory as environmental supports.
- The existing consolidated urban structures as fixed elements in the territorial structure.
- The urban patches of the dilated peripheries as elements of potential transformation.
- The peri-urban spaces in the metropolitan perimetry as potential new centralities and their respective interstices as articulation spaces. Urban ecotones: the limits, the edges, the transition strips, the urban fields.
- The new attraction nodes/poles at the intersection of major infrastructures integrated to overcome their barrier function.
- Employment, and the patterns of population settlement in the territory, from the first occupations to more evolved forms, consolidated urban forms and structures, and the urban sectors of completion of the urban occupation of the urbanization process.
- The unoccupied open spaces in the territory aimed at re-articulating the territorial system of open spaces and ecosystemic infrastructures in its multiple facets (rivers and local hydrology, cultivated fields, orchard, forests etc.).

Figure 2. Ideograms of a model of a Territorial Mosaic City.



Carles Llop (Professor) / Xavier Matilla / Montse Ferrés, doctorate students DUOT UPC 2009

The conceptualization of such a model also enables us to establish a series of operational objectives:

- Favour osmosis and the dissolution of dysfunctional boundaries between the urban and the rural.
- Plan for the permeability and interexchange between ecosystems to favour the increase in further systemic complexity.
- Regenerate and reconfigure the urban-rural ecotones to increase the contact between urban fabrics and natural spaces.
- Articulate the pieces of the mosaic through interventions in key an/or landmark urban spaces.
- Manage mobility efficiently at different scales and modes, with the ultimate aim of reducing car-dependent mobility.
- Design an increasingly articulated traffic network/ and/or a territorial mesh model, thereby promoting collective solutions for transport.
- Reactivate, regenerate and articulate open spaces in the metropolis to accommodate the development of new housing programs to meet the increasing demands of the housing crisis. In this sense, these spaces are key for structuring a renewed matrix of Open Spaces and Ecosystemic Infrastructures.

2.3. The territory seen as an infrastructure network of open spaces and ecosystemic infrastructures[5]

Open spaces and ecosystemic infrastructures are key elements in the transformation of the social metabolism of the territory. Traditionally, although nature and city have been treated as apparently dissociated areas, today we are beginning to understand that "the city is a quantic evolution of nature", as Ramon Folch has asserted, and to transform this dissociation given the desire for symbiosis.

Progressively in past decades the productive capacity of the territory has been eliminated and converted into support for different human activities and translated into a series of successive phases of abandonment that, in turn, have brought about important changes in the functional structure of the landscape. The case of the Barcelona Metropolitan Region (RMB) exemplifies this situation, whereby the further away we move from the city, the more the productivity levels of the city increase; and, given the polycentric structure of the RMB, we can see how different peaks of productivity appear.

For many years we have based our planning on and around the protection of open spaces (protected open spaces and open spaces of special protection), although we now recognize that in recent years there has been a qualitative leap forward compared to a few decades ago, when we were limited to classifying undevelopable land (*Suelo No Urbanizable* - SNU) as either agricultural or forest land, or as ecologically protected landscapes. This was a clearly an anthropic and productivist view, whereby soils were classified in terms of their potential for either direct production (agricultural) or less direct production (forest), or as non-productive; these are then protected, as many authors such as Mayor, Batlle and others have argued. Today, however, we already have much more knowledge about habitats and their respective processes and ecological value, and, when analysing them, we take into account many more factors such as habitat diversity, complexity and vertical structure, succession stages and disturbance levels.

Another key factor to bear in mind and integrate into our planning and projects is the question of Ecological Connectivity. It is a key element that can be used to achieve greater environmental sustainability and increase the mutual adaptation between urban and natural systems. Enric Batlle states, "*open spaces, understood as an environmental network, should be the backbone of the metropolitan territory. The streets, squares and parks of our cities can be renaturalized and connected with the agricultural and natural spaces that we still preserve. A new network of free spaces that must enjoy the maximum connectivity. (...) A set of green infrastructures organized as a metropolitan ecological matrix and developed at all scales. A system of connected spaces and highly equipped productive landscapes that can define strategic boundaries*". The productivity of this territory is essential and, naturally, open spaces here play a key role. Therefore, from the point of view of metropolitan ecological connectivity in RMB, Batlle describes four considerations that should define the relationship between open spaces and urban fabrics:

- Metropolitan ecological connectivity, i.e. ecological flows, must coexist in the same space as social connectivity, i.e. social flows.
- Action on the edges is the most strategic project that we can carry out to allow the mesh to work and the flows (ecological, urban and metropolitan) to flow.
- Making potential ecological connectors possible is basically an urban problem that needs to be resolved (also) from within the city.
- Metropolitan ecological connectivity must be developed at all scales.

In this context, the vision of the Territorial Mosaic City presupposes that the metropolitan project focusses on the qualitative and quantitative regeneration of metropolitan mosaics through the consolidation of the network system of Open Spaces and Ecosystemic infrastructures.

3. Territorial situations and project logics for the improvement of territorial efficiency

3.1 An extensive analysis of metropolitan projects and actions designed to detect the strategies, project bases and actions based on the efficacy and good func-

[5] A concept used in plans and projects developed by Carlos Llop in collaboration with Jornet Llop Pastor Arquitectos, above all in the context of the Territorial Master Plans carried out as part of the agreement between the Generalitat de Catalunya and the Universitat Politècnica de Catalunya, and in the Metropolitan Plan of Lima Callao 2035.

tioning of the "H.A.M. + GO" = Habitability + Activity + Mobility + Governance + Organization

In order to project changes in the form and structure of the city we need to understand the sense of order that each urban reality presents. The configuration of the contemporary city is complex, difficult to systematize and, therefore, not easy to explain in a synthetic way. Contemporary territories have multiple orders and, possibly, many disorders (formal, structural, functional, symbolic, and so forth).

'Projecting' means launching possible reference images that allow us to 'manage transformations' and provide comprehensible orders for use by the citizenship. In these moments of absolute crisis of the city, which are, to a degree, symbiotic with its territory, if we aim to create a balanced city in terms of its energy, environment and, broadly speaking, ecology, we will have to look for fresh situations.

In the research[6] presented below we have introduced an analytical system to help understand the diversity of territorial situations presented within the metropolitan reality. This system proposes observing the city as a spatial and material reality, and as a functional ecosystem, from three different conceptual visualizations identified by the acronym H.A.M.+G.O. (habitability, activity, mobility, governance and organization).

We carried out an extensive analysis of metropolitan projects and actions taking place in the Barcelona metropolis to detect the strategies, project bases and actions that have contributed to improving its functional efficiency. A great part of this effort was realized and consolidated through the execution of the research project *Efficient cities, metropolitan territories and urban regions. Strategies and project proposals for the regeneration of the Territorial Mosaic City after the explosion of the city*, financed by the Ministry of Economy and Competitivity (BIA2012-35306) in 2013–2016.

The main objectives of this research project were to:

a. Develop the theoretical and analytical framework and scope of the concept of territorial efficiency; contribute to the general knowledge of and debate on this topic; and foster its use as a benchmark for urban and territorial transformations, both existing and proposed.

b. Detect and determine the territorial situations we encounter in the Barcelona Metropolitan Region that best define the morphological and phenomenological transformations that have taken place.

c. Undertake a diagnosis of the Barcelona Metropolitan Region in relation to the morphologies of the territorial situations represented in the changes and transformations; identify, depict and study the phenomena that have produced them; analyse the urban-environmental problems via the development of an atlas of the urban and territorial transformations occurring in the Barcelona Metropolitan Region in 1977–2012.

d. Determine the strategic measures and concrete projects that have fostered regeneration and improvements in the Barcelona Metropolitan Region based on the territorial situations detected through the analyses of selected metropolitan projects highlighted as good practices (in terms of their territorial efficiency).

e. Establish criteria for a cross-sectional and systemic evaluation of metropolitan projects in terms of their efficiency in order to compose a methodological guide for analysis.

f. Advance in the conceptualization and design of data visualization systems that can accommodate more efficient management of the city and the territory. Lay the groundwork for the creation of a public viewer open and searchable by the public, which would be based on the integration of five specific metropolitan concepts: i) morphology and morphogenesis, ii) the social fabric, iii) metropolitan projects, iv) bio-productivity, and v) metabolism and energy.

In terms of methodology, the research project was developed using three parallel complementary processes:

a. The territorial situations and the urban transformations were determined whilst drafting the most recent period of the *Atlas of the Transformations of the Metropolitan Region, 1977–2000* by a research team from the Chair of Urbanism (Catedra de Urbanistica) ETSAV[7]; its update includes information for 2008–2012.

b. The drafting of a guide for analysing the efficiency of metropolitan projects by consulting existing key systems of reference indicators (LEED, Bream, the indicators developed by the Agencia de Ecología Urbana de Barcelona, among others) to identify the main concepts (index, indicators, parameters and descriptors) that can provide sufficient information about projects and their territorial efficiency.

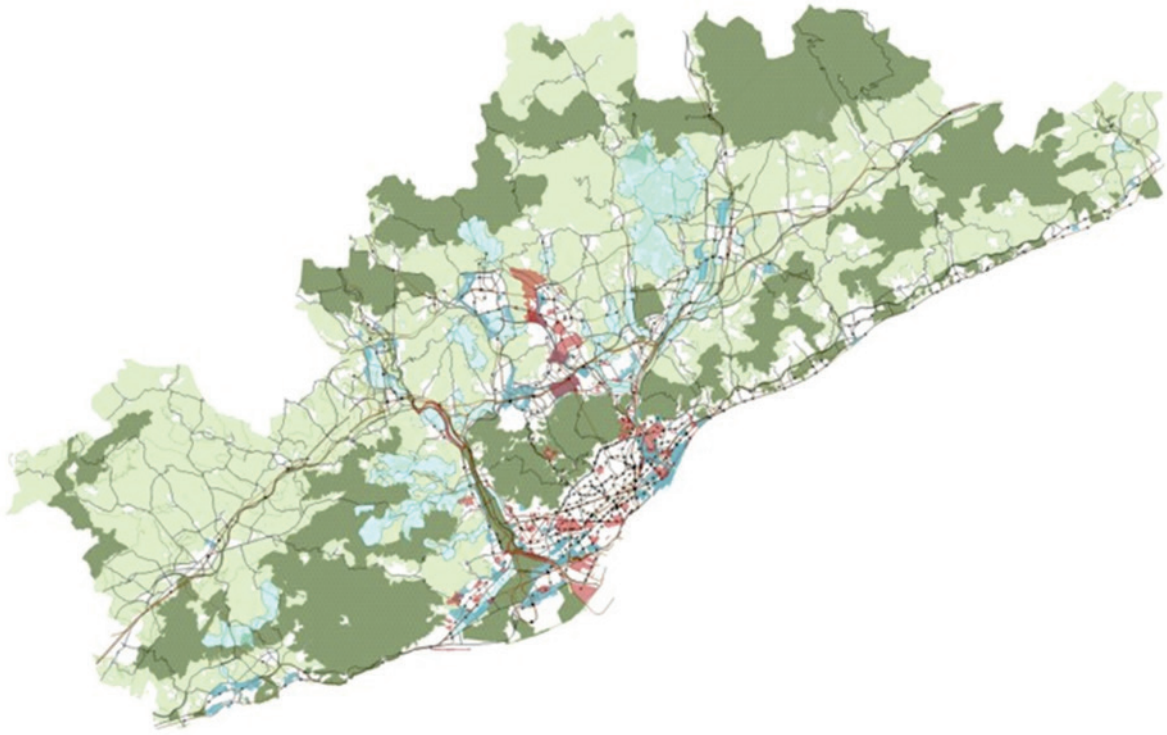
c. In order to determine the project logics and benchmarks, a GIS database of metropolitan projects developed in 1985–2014 was created.

The point of departure of this research project was the attempt to understand the metropolis and successive metropolitan transformations as a process of permanent evolution, and for this purpose it was deemed necessary to create and develop a database of projects and interventions of diverse typologies that have taken place in the Barcelona Metropolitan Region at different scales over the past 30 years. On one hand, this enables us to identify good practices, models and patterns for sustainable development and urban re-

[6] This research was carried out by researchers from the Ciutat Mosaic territorial group directed by Carles Llop and consisting of Arturo Calderon, Marta Carrasco and Konstantinos Kourkoutas from the DUOT UPC; we have used this acronym to synthesize the factors that determine the configuration of a potential territoriality.

[7] This specific study was directed by Antonio Font in collaboration with Lorena Maristany and Silvia Mas.

Figure 3. Plans and projects studied in the research *Efficient cities, metropolitan territories and urban regions. Strategies and project proposals for the regeneration of the Territorial Mosaic City after the explosion of the city.*



generation at a metropolitan level and, on the other, to identify and analyse the diverse logics behind the interventions and strategies corresponding to the specific territorial situations that have been formulated over the years. In this way – and once the global analysis was completed – the chosen interventions were not solely presented as individual good-practice case studies but also as references in relation to the project logic and strategy adapted to improve territorial efficiency at both specific and global levels.

During the research program, efforts centred on an analysis of metropolitan projects (executed, planned or debated) in 1985–2015. Principally, the projects considered were promoted by public administrations and refer mainly to documentation obtained from the Barcelona Metropolitan Area, the Generalitat de Catalunya, and a number of municipal technical offices. The final database contains more than 700 listed projects, of which 555 are mapped on the GIS. From this initial selection, an iteration selected around 200 projects for further research and in-depth analysis. The complete list from the database can be found in the publication and on the project´s website.

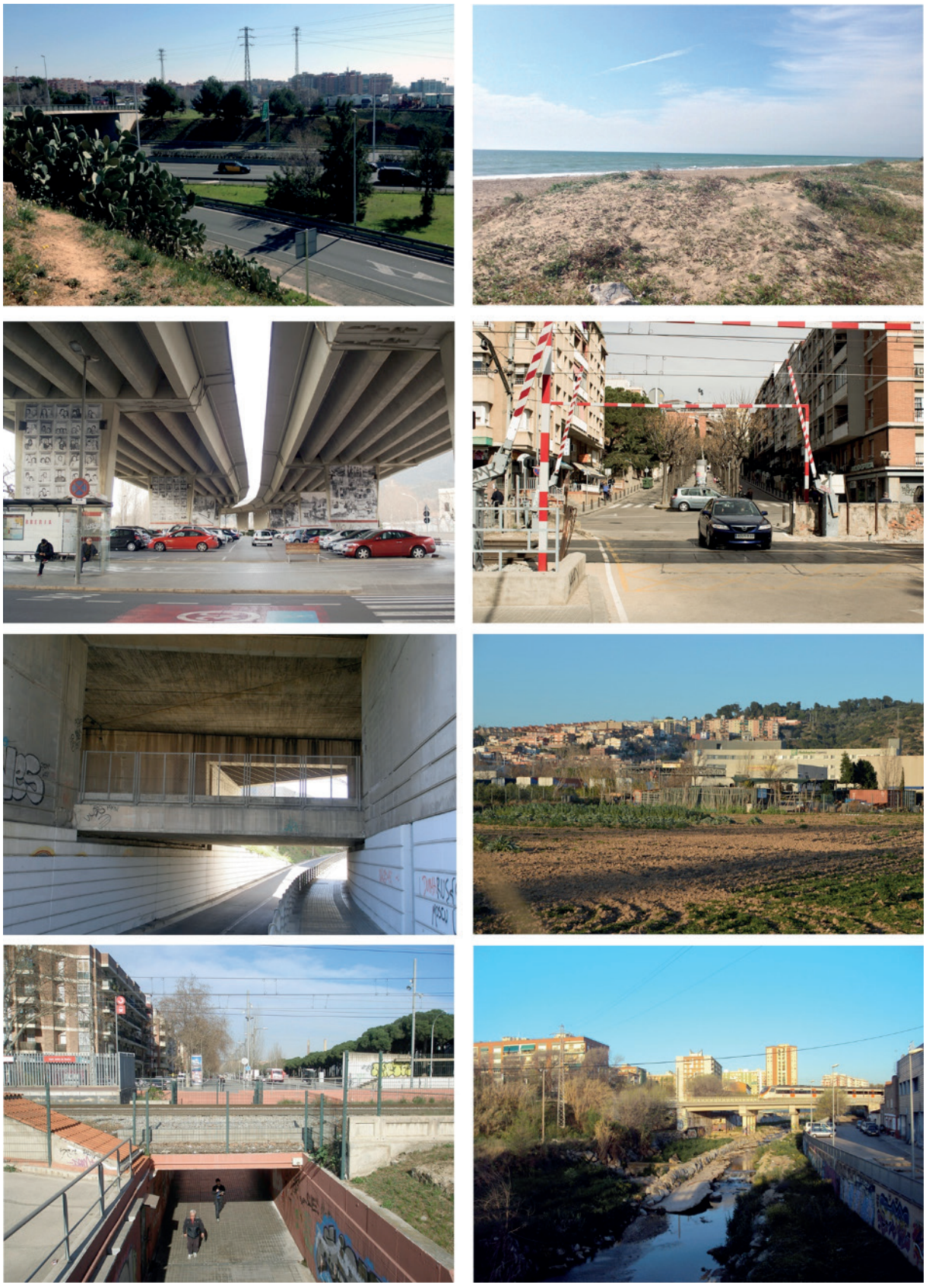
The list of the projects was eventually systematized and organized in terms of the following information:

- *Promoter*
- *Year of approval*
- *Current State* (Executed/Under construction/Under Study/Not executed/Approved)
- *Year of finalization*
- *County*
- *Municipality*
- *Type of proposal* (Plan/Project/Programme/Study)
- *Project Logic* (according to the proposed research methodology)
- *Instrument* (with reference to existing planning instruments)
- *Source* (of information)

Using the examples of historical plans and projects we extracted a series of lessons that suggest possible urban-environmental guidelines that will help make the city more sustainable. It is worth highlighting the following:

- A limit should be put to the city as a means of intensifying urban use in smaller spaces, favouring open systems in the territory, and promoting the osmosis and dissolution of borders, via the projection of spaces that will increase permeability and exchange.
- The urban ecotones project should be considered as a privileged space for the new city project.
- Underused spaces should be re-used, and edges should be requalified and regenerated to articulate the empty spaces in the city in contact with non-built-up territory;
- Urban intensity should be rethought using a polycentric perspective (much more in many more urban spaces).

Figure 4. Territorial stuacions.



Source: Students from Urbanística IV ETSAV DUOT UPC

- Barriers should be overcome and infrastructures integrated in order to articulate the pieces of the mosaic via efficient mobility management and an ever-more precise design of transport meshes.

For a renewed project in the Barcelona metropolitan region, we believe that a more open vision of the present administrative legal reality is necessary, that is, we need a vision that explores the types of places, environments and specific types of spaces that we can

Figure 5. Barriers and margins. Potential spaces for urban and territorial regeneration.

Source: Students from Urbanística IV ETSAV DUOT UPC

identify and name as territorial situations that, furthermore, we can conceive of as projectual places.

3.2 Projectual logics for improving territorial efficiency

As mentioned before, the analysis of the RMB project database for 1985–2015 enabled us to identify the logics that the different projects had adapted to solve territorial conflicts and problems and improve local and overall territorial efficiency. The research looked for exemplary projects that would serve as examples of good practices, and aimed to systematize and categorize them as a store of accumulated knowledge regarding interventions in the territory and the resolving of anthropogenic conflicts. We believe that the following strategies are relevant and representative of the logics of intervention:

1. **Consolidate open spaces and ecological infrastructure in an ecologic network.**

   The current metropolitan context is characterized by the vulnerability of metropolitan spaces due to the following factors: (i) the decline in agricultural land cover (as it is abandoned it is transformed into forest land or urbanized areas), (ii) a lack of proper and integral management and adequate instruments, and (iii) the occupancy and impermeabilization of many fluvial spaces. Thus, in light of this situation, a correct response would be to consolidate the city's open spaces and integrate them in a multi-scalar ecological network. The principal objective of any such action would be to preserve and protect the biophysical matrix and, whenever necessary, restore, revitalize and reactivate using innovative and integrated management plans.

   a. Establish instruments for the preservation and protection of metropolitan open spaces.

   b. Revitalize agriculture and re-agriculturize the metropolitan area.

   c. Use the natural hydrological network as a structuring element.

   d. Articulate and incorporate current urban spaces into the network of metropolitan open spaces to form a continuous territorial mosaic.

2. **Restore territorial continuities**

   Both territorial fragmentation and the insulation of metropolitan open spaces affect biodiversity (at local and macro levels) and its ecological functioning, and have social implications for mobility and accessibility. The proposed strategy in this case would be to recreate territorial continuities between open and urban spaces, recuperate and restore their ecological functioning, and reestablish their social functions (by restoring the age-old links between the city and its natural environment). In this case, the question of scale is fundamental and so a multi-scalar analysis is required to identify and locate the spaces that will facilitate this interrelation (both in structural and functional terms).

   a. Reconstruct the ecological corridors and landscape connectors of the biophysical matrix, and project the consolidation of the network of metropolitan green corridors and connectors.

   b. Project the heritage and landscape network in a multiscalar way, understood as an element with which to support new connections.

   c. Build new complex urban spaces with the necessary attributes and qualities that are capable of overcoming infrastructural barriers with an added value.

3. **Restore and reprogram degraded natural spaces**

   Although there are many factors behind the current degradation of many of today's metropolitan open spaces, they can be best understood if this ecological degradation and functional loss is seen as a direct consequence of the current model of social metabolism present in our territories. Although a real solution for this problematic would be to change the current management and metabolic model of the territory, this is a future scenario that will require a lot of work. Nevertheless, there are already a number of existing experiences and strategies that permit a way forward for these degraded areas to be envisaged.

   a. Recover and restore degraded natural areas using dynamic and multifunctional management models.

   b. Minimize the environmental impact of urban waste generation.

   c. Optimize metabolic cycles by re-evaluating latent infrastructures.

4. **Plan city edges and enhance the interaction within ecotones** [8]

   The question of limits is one of enormous complexity given the dynamic and ever-evolving character of city limits and their diversity. They arise in different places and at different scales in the territory and need to be handled in a strategic and structural manner. Overall, this question is still unresolved in terms of planning, and few projects have ever approached this question in an integrated manner. The principal focus is dual: (i) the reversal of negative unfavourable ecotonal characteristics that create conflicts and a loss of efficiency and (ii) the need for a limit to be put on uncontrolled expansion by restructuring ecotonal areas. The idea is to visualize ecotones not just as indicators of the territorial processes taking place but also to conceive them as reprogrammable territorial interfaces that can help resolve local conflicts and improve overall territorial efficiency.

[8] See (Kourkoutas, 2015). The concept of ecotones as territorial indicators and also as interfaces of territorial reconfiguration has been studied by Kourkoutas in his doctoral thesis presented in the Departament d'Urbanisme i Ordenació del Territori (ETSAV-UPC) under the supervision of Prof. Carlos Llop.

a. Work on urban-rural interaction to increase territorial complexity by considering each space as a dynamic and fluctuating interface.

b. Creation of new permeabilities and the enhancing of existing ones.

c. Design and restructure marginal spaces and view them as new spaces of opportunity.

5. Promote urban and territorial regeneration projects

Urban regeneration as a project logic demonstrates the need to apply strategies in a transversal and multiscalar manner when catering for neighbourhoods and urban areas of special attention. It is important to bear in mind that the problems and challenges that many urban areas face today are due to not only local conditions and restraints but also to the consequences of territorial processes operating at greater scales and scope. The opportunities for regeneration that these spaces offer also provide an opportunity for re-naturalizing urban spaces and the possibility of integrating and reconnecting them with territorial green spaces.

a. Rehabilitate existing degraded urban fabrics to improve people's quality of life.

b. Incorporate new urban morpho-typologies to encourage greater social diversity.

c. Connect neighbourhoods by improving access to mobility flows.

d. Reclassify and restore obsolete or deteriorated urban fabrics.

e. Increase and articulate local governance networks.

f. Promote the proximity project and small-scale interventions.

6. Reconfigure metropolitan streets as structural territorial axes

The context of the Barcelona Metropolitan Region offers many examples of projects of this typology that at one level provide a structure at local city level but also at the same time form an additional network of connecting axes at territorial scale. This represents a complementary mobility metropolitan infrastructure that can connect urban and open spaces, create new public spaces, and open up possibilities for re-naturalising urban fabrics.

a. Transformation of roads into metropolitan urban avenues

b. Conversion of urban boulevards into territorial boulevards

c. Conversion of street axes at territorial scale

d. Reinforce metropolitan circuits

e. Reconfigure metropolitan connectors

f. Cover railways and create public streets

7. Integrate infrastructures

The current car-dominant model prioritizes car mobility and its efficiency over other aspects and often opts for simplified solutions that generate poor quality and complex spaces that eventually degrade. As cities evolve and grow in size, new infrastructure is constructed to meet the demand, which often ends up acting as barriers, thereby affecting or obstructing social and ecological flows and fragmenting open spaces and leaving behind many disconnected, unconnected and residual spaces. The integration of these infrastructures would reverse and loosen the barrier effect, while at the same time maintaining the levels and quality of social services.

a. Overcome the infrastructural barrier and generate new spaces of connection and/or restore territorial continuities

b. Benefit from the residual spaces generated by infrastructures

c. Multiplex sections

d. Hybrid infrastructures

e. Integrate major territorial routes into the urban structure.

8. Increase the intermodality and internodality of mobility networks.

The different modes of private and collective transport have been traditionally projected and developed in a segregated manner, with few interconnections and possibilities to switch modes with ease. Overall, this engenders an inefficiency in the mobility system *per se* but also in the whole territory given the increased need for new infrastructure developments with all the corresponding impacts they entail. The form and structure of contemporary metropolitan structure requires a complex mobility model that integrates and interrelates the greatest possible number of modes and flows, and at the same time prioritizes the ones that create the fewest negative externalities.

a. Interconnect different modes of transportation

b. Connect mobility flows on and between different scales

c. Integrate bicycles as a means of transport on a metropolitan scale

d. Integrate private vehicles into the intermodal mobility system

e. Implement smart solutions to facilitate and optimize the combined use of different networks and modes of transport.

4. The metropolis community: a common shared territorial agenda

The complexity of the problems we collectively face require us to consider metropolitan issues from the perspective of a community pact. Henceforth, it should no longer be only the public institutions that offer solutions that derive from their areas of competence, which are still very sectorial. The city – and, therefore, the metropolitan city – must recover and provide answers stemming from its condition as a social structure. It is in this sense that we use the concept of 'metropolitan mosaics', which is multidimensional and embraces both territories and their inhabitants – that is, the territorials. This conjunction of space-actors-strategies can be referred to as the **Metropolis Community**.

The only way forward is to fabricate better **social organization** and **co-governance** in collaboration with the city's inhabitants. In this way we will be able to improve the social metabolism of the territories, increase the territorial efficiency of the metropolitan regions and its subparts, and work towards a more resilient future along the following lines:

- **Agreement in the analysis** and identification of **territorial challenges**, risks and impacts, and in decision-making processes. It is helpful to work on creating an initial consensus, both in the diagnosis of the current situation with all its inherent problems, restraints and opportunities, and a vision of the future, with all the ethical, practical and design questions that it may entail.

- **Social agreement in the diagnosis** of problems and opportunities. This principle means working in parallel on the strategies, plans, projects and other structural figures in metropolitan development that are usually tackled by the institutions. This also implies the need to overcome the fact that administrative boundaries act as determinants of metropolitan projects. Consequently, citizens should be incorporated into the programming of metropolitan actions not solely as participants but as active actors in the management of plans.

- **Institutional Collaboration and Co-responsibility** based on a **Shared Metropolitan Agenda** acknowledged by metropolitan institutions and all those involved in metropolitan issues. The principle of subsidiarity and the vertical and horizontal distribution of responsibilities is key. Digital transition should contribute to improving the relationship between administrations via data sharing, analysis, diagnosis and prognosis. Water management and mobility planning are two key elements that could benefit from this approach.

- The **Co-designing of proposals**: the use of the quadruple helix approach early on in the identification and definition of new solutions and proposals, based on territorial challenges, can contribute greatly to the creation of meaningful projects that will have a real impact, for example in the efficient use of resources and time. This will require a seamless and proactive institutional collaboration between different public and private institutions as well as the activation and implication of citizens and societal agents, i.e. the eventual end-users of the territory.

- **Concentrating on specific actions** so that the long list of outstanding issues and new challenges can be addressed. Energy transition is a central issue in the reprogramming of the use of metropolitan infrastructures.

- **Reach a Consensus** on urgent issues concerning urban and territorial regeneration. To do so, the list of actions to be addressed must not be dependent on possibilities for investment or their ease of implementation but, rather, must represent the collective expression of the demands of the administrations, citizens and economic sectors, and of the demands raised by the entities involved in the vindication of the eco-environmental qualities of the metropolitan territory.

The future of the city and its survival as a valid model for the sustainable management of the planet lies in the materialization of the principles envisioned and defined by the territorial mosaic city: a city linked to the territory, forming part of its biological and life cycles, and a territory that permeates the city, with a determined spatial coexistence in terms of dynamics of exchanges and systemic symbiosis. The Territorial Mosaic City conceptual model proposed here represents a shift in the paradigm and an advance towards sustainable management of the contemporary metropolitan city. This model implies a parallel morphological and environmental structure, conceived in terms of mutual ecological adaptation, and one that favours the coevolution of interacting urban and natural ecosystems. This will eventually foster an articulated mosaic that is truly environmentally balanced.

It is now time to define new concepts and imaginaries and to make urban and territorial regeneration operationally feasible. In all disciplines, political responsibilities and social-technical practices, we are now at a point where we must face up to both the challenges – but also the opportunities – to promote a truly sustainable planet and conserve it for the common good.

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