MEDITERRANEAN METABOLISM. A GLOBAL NOTION ADAPTED TO LOCAL CONDITIONS OF SOUTHERN EUROPEAN CITY

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Abstract

The development of the contemporary city produces deep changes in the organ
settlements and causes dramatic consequences on the natural environment. The re
the concept of Urban Metabolism as a model which considers cities as open syste
flows of material and energy as inputs and waste as outputs. A more efficient u
study with more effectiveness the relationship between urbanization phenomena
environmental contexts. The research approach is finalized to understand the c
European cities and extend the basic metabolism concept to specific mo
anthropological peculiarities of territories such as alteration of landscape, l
and their socio-economic behaviours, in a multi-layered framework, embracin
palimpsest and historical pre-existences. The research project focuses on per
Naples and Caserta in South Italy that was investigated through the lens of UM
in which flows go through this territory modifying its spatial configuration an
alteration of land use. The aim of this paper is to propose a multidisciplinary
the construction of an interpretative analysis of the local conditions, throu
design solutions that should support a more aware and appropriate urban plan
Mediterranean cities. This approach is based on the idea that metabolism is
transferable notion, rather it is an interpretation of specific relationshi
ecological context, which should be applied at a local scale.

1. The notion of Urban Metabolism

The development of the contemporary city produces deep changes in the organiz
settlements and causes dramatic consequences for the natural environment. The
adopts the concept of Urban Metabolism (UM) as a model which considers cities a
characterised by input flows of material and energy and waste outputs, and th
development of management systems that increase resource use efficiencies an
wastes. This allows to study with more effectiveness the relationship betw
phenomena and environmental contexts.
The paper is organized into two parts: the first one outlines a frame of
characteristics and potentialities, the second one analyses a case study, inte
the notion of UM.
Cities are characterized by huge flows of materials and energy in constant evol
constituted through dense networks of interwoven socio-ecological proces
simultaneously human, physical, discursive, cultural, material, and organic. Ci
water, foodstuffs, cars, fumes, money, labour, etc., move in and out of the cit
and produce the urban as a continuously changing socio-ecological landscape.
2006, pp. 20). These flows interact with one another producing spatial
transformations of morphological patterns at multiple scales. The UM proposes a
and characterize the quality and intensity of these flows starting from the an
processes of biological organisms. Indeed, the analogy assumes a powerful e
because both systems are organized on a livingnetwork.

The analysis of flows and the relationship between anthropogenic activity and urban areas aims to define the city s behaviour and its process of production flows. In particular, Kennedy and colleagues define UM as the sum total of socio-economic processes that occur in cities, resulting in growth, producti elimination of waste (Kennedy et al., 2007, pp.44).
This analogy has deep historical roots and emerged during the middle of the nir relation to the quantification of material exchanges between natural and human explicit application of the concept of UM to the city (Broto et al., 2011) was the engineer and geographer Abel Wolman wrote an innovative article "The Metabo in which he proposed for the first time the application of the concept of hypothetical U.S. city of one million people and calculated the inputs of mate waste using UM as a quantitative instrument to measure them. He defined the met as all materials and commodities needed to sustain the city s inhabitants at play . It is useful to underline that this consideration emerged in an era in problems were arising connected to the pressures of expanding urban populat natural environment and the question of the limit of resources essential for urb
Most recent reflections on the ecological aspect of UM suggest a more holi considers the analogy of the city as an ecosystem (Golubiewski, 2012; Pataki, by a sum of more metabolisms (not merely as an individual biological organism). emphasis on the exchange process and on the relationship among different parts better understanding of the complex and dynamic functioning of the city.
One of the criticisms to the basic original notion of UM is that the data snapshot of the resources and energy used by the city, that appears insuffic complexity of urban processes related to socio-economic activities, policie geographical data, historical palimpsest. The sustainable vision of the urba interdisciplinary and multi-level approach to understand the behaviour of a c urban metabolism method into a more comprehensive framework that both an biophysical material and energy parameters of cities as well as the human, economic, and related systems that both structure and govern specific urban m (Pinctel et al., 2012, pp. 200). For this reason, the biggest challenge to expe planning tool became the integration in this issue of a set of variables re considering together biophysical, energy, social and political parameters. colleagues described: The metabolism approach to cities is a purely biological much more than a mechanism for processing resources and producing wastes, th creating human opportunity (...) basic metabolism concept has been extended to in these settlements so that the economic and social aspects of sustainability environmental. (Newmann, 1999, pp. 222)

1.1 The UM: a sustainable approach to urban development processes

UM is a notion that inspires a new models to describe the city and that we urbanization process as a useful sustainable planning tool. Indeed, it is a tr involves very different disciplines (both environmental and sociological fie ecology, political ecology, industrial ecology, ecological economy) using it therefore noting the need of an interdisciplinary approach to understand the c phenomena. Each disciplinary approach adds and contributes to the understanding and interactions between social and natural processes in shaping urban phenom 2011). Nevertheless, different disciplines, spacing from social aspects to natu the concept in a different way, revealing the complexity and multiplicity of di urban system and underlining the need for interdisciplinary dialogue to devel practical approaches to urban metabolism with the aim of making progresses in u planning and research.
According to ecological economists and political ecologists, one of the contem that is useful to highlight here and that emerges from an enlargement of the socio-economic system, is that it can be considered as an useful tool for a

economic growth, urbanization and the environmental resources depletion. introduced here as an integrative concept for identifying areas of potenti decoupling at a city level, and the need for investment and capacity to reshape function (Hodson et al., 2012, pp. 796).
As a matter of fact, the study of stocks and flows entering the city, cross exchanged with the environment in which the city is embedded, is a necessary wa sustainable management and equitable distribution of resources without a growth consumption.
In an era of limited resources and of reduction due to the extractions, of lar production such as landfill, of climate change and uneven rapid urban growth, global impact and therefore they play a fundamental role in the challenge to growth. In this matter, the UM can be a useful tool to recognize the crisis p exchanges (transformation of resources and production of waste), to manag interrelations inside/outside of the borders and to understand how to interven promoting more effective urban planning policies. Beyond apocalyptic visions, i future will be played in urban areas, it means that the solutions lies in the c to assume an active role (Van Timmeren, Henriquez, Reynolds, 2015).
The review of the planning paradigms, no longer in terms of growth but of th monitoring of the resources use, and the redefinition of the interactions am and economic systems, means to intervene on the potentiality of existing resourc
In a sustainable approach, one of the recurring issues is to simulate the e behaviour of natural ecosystems to switch from the city s linear metabolism which wastes are recycled and return into the system as input (Girardet, 200 induce more efficient cities metabolic behaviours and to make cities less de resources and more self-sufficient.

2. Focusing on the local scale: land use as a metabolic indicator

This approach is based on the idea that metabolism is not a global and transfer is an interpretation of specific relationships between city and its ecological be applied at a local scale.
UM proposes a multiscale approach that puts in tension the global scale of me their pragmatic effects at the local scale, underlining the importance of the g in which these flows are embedded (Ibaæez, Katsikis 2014).
In this matter, the metabolism is a tool to understand the site s peculiaritie which are involved in a complex process of uneven growth that generate urban stimulate to study them with a new accurate methodology including all the contradictions of these settlements.
Emphasizing the importance, both theoretical and practical, of the geographic metabolism, the research aims to analyse the relationship between dynamic flow of geographical features at local scale in a relationship of mutual causality.

2.1 The periurban area of Casaluce

The research project focuses on periurban area of Casaluce[1], a town in the province of Caserta, with a population of 10,000 inhabitants. The municipal territory is mainly flat circa 9 square km. It is an area with homogeneous characteristics as part of between Naples and Caserta and it is composed of residual rural elements and m systems, often distinguished by low quality and a low level of infrastructures
The urban system of Casaluce is engraved by two important phenomena: on on abandonment and transformation of agricultural area and on the other the s

[1] The case study refers to the elaboration of preliminary studies for the new urban plan the Department of Architecture (DiArc) of University of Naples on behalf of the local ad

settlements and the depletion of the ancient urban centre, due to the underdev
areas.
The modern settlement has arisen in the last 40 years surrounding the historic
is possible to highlight three main morphological construction models based on
processes: a first growth led to a settlement of courtyard and multi-storey
related to the productive agricultural cycle. Isolated middle size buildings cl
phase of the urban growth. In the last 20 30 years, there was an urban sprawl t
building, especially houses, with low percentage of shops and offices, losing
with the ancient settlement related to the rural partition of the territory.
The complex structure of Casaluce was investigated through the lens of UM to un
in which flows going through territory, modified its spatial configuration pr
(Berger, 2006) and urban blight.
Periurban zones are fringe areas of consolidated settlements which includ
agricultural fields, trailer parks, landfills and few productive areas (some il
landscape of denied areas (De Lucia et all, 2012) is the result of a sick
generate a dramatic scenario of natural elements and anthropic activities at
cycle.
The analysed territory exceeds administrative boundaries pursuing a broad stra
connection of historic polarities and ecosystem networks between them. The a
North-South road that links the Reggia di Carditello in the North side and t
Aversa in the South area. In the middle there is the compact settlement of
Norman Castle and the archaeological site of Castle of Popone located in the pe
historic and cultural emergencies combined with the Regi Lagni water system and
fields represent the land use layers of this Mediterranean area that have to re
stimulating a sustainable UM.
The historic palimpsest of the case study s area includes several significant
abandon. The Reggia di Carditello is a royal palace, built in the XVIII centu
big park that was the ancient hunting area but that is now a wild green land.
space, there is also the ruin of the Castle of Popone, an archaeological site
manor farm which is accessible by a neglected path through the country. Other
Norman Castle and the San Lorenzo burg are instead located in the historic cent
the border with Aversa) and represent the cultural points of an interrupted
contemporary settlements.
The water cycle is the Regi Lagni system: a network of water channels built in
the architect Domenico Fontana to reclaim marshes of Campania felix . The mai
North boundary of Casaluce and the water network serves the surrounding agricu
urbanization phenomena and the intensification of agricultural activities com
habitat because of the overbuilding of concrete riverbanks and the increasingly
water, due to the deterioration of groundwater.
The effect of the urban sprawl is land consumption and the fragmentation of r
process has modified the historic structure of the XVIII century system of co
outside the urban settlement. Nowadays the periurban area is a patchwork of ag
that are threaten by the urban and industrial activities, risen around them. T
decrease of agricultural economy due to the poor productivity of lands and the
of rurban landscape, not completely rural but not yet urban.
In this compromised landscape, productive and industrial areas emerge as spatia
relations with the context, but they rather damage the environmental ecosystem
the productive cycle era, lead to phenomena of partial disposal that generate di
that could be useful for the reuse.
The reading of the landscape through the land use geography tries to interla
metabolic process with the potentiality of the historic palimpsest of Casaluce
to highlight underdeveloped areas as a resource in reactivating processes of
whole town through a circular metabolic framework, according to the common wish
main elements which made this area a rich and attractive territory such as agr
infrastructures and historic and architectural heritage (Figure 2).

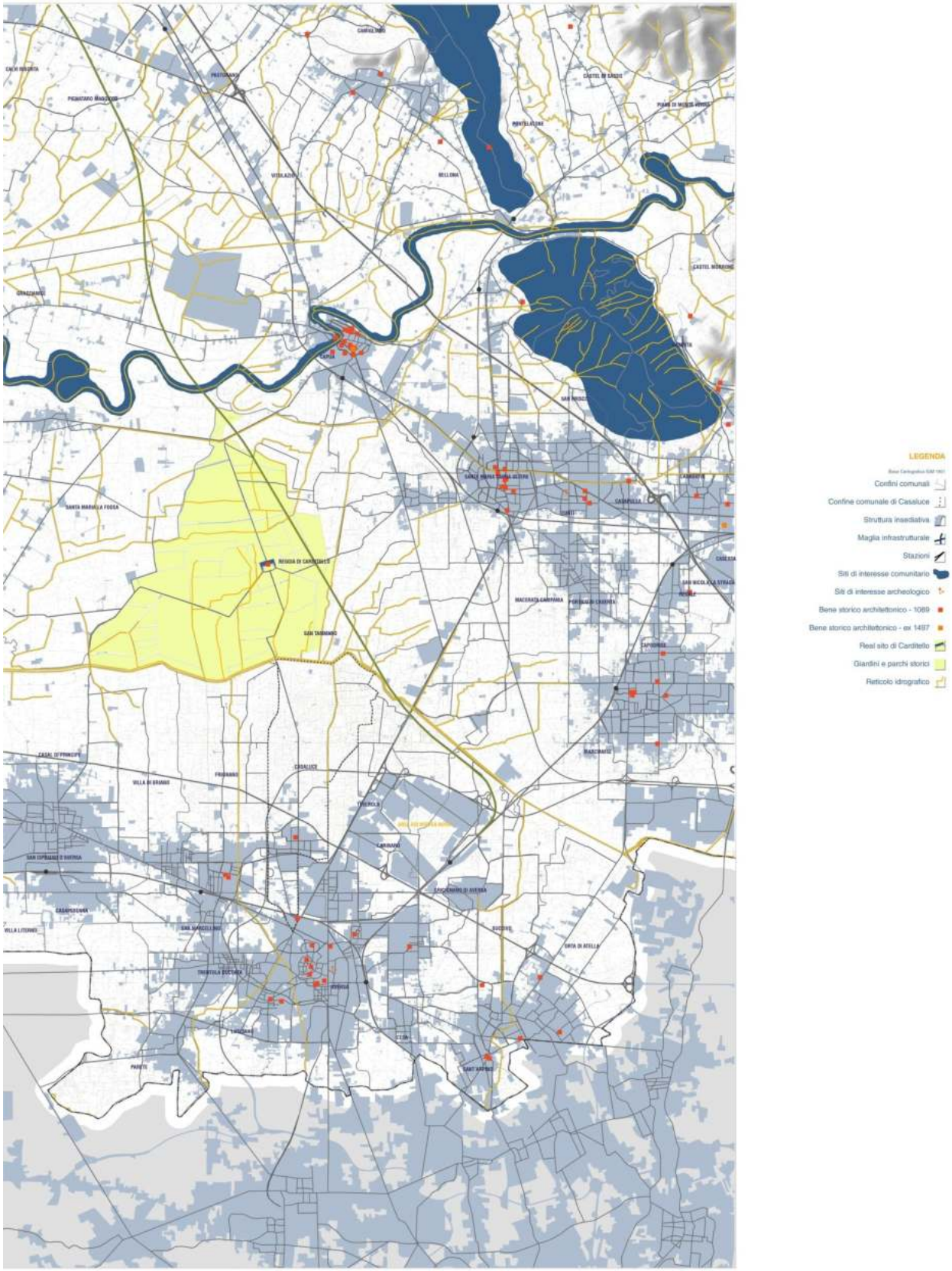

Figure 1. Territorial Framework
Elaboration: Libera Amenta, PhD in Urban Design and Planning, DiARC, Universit

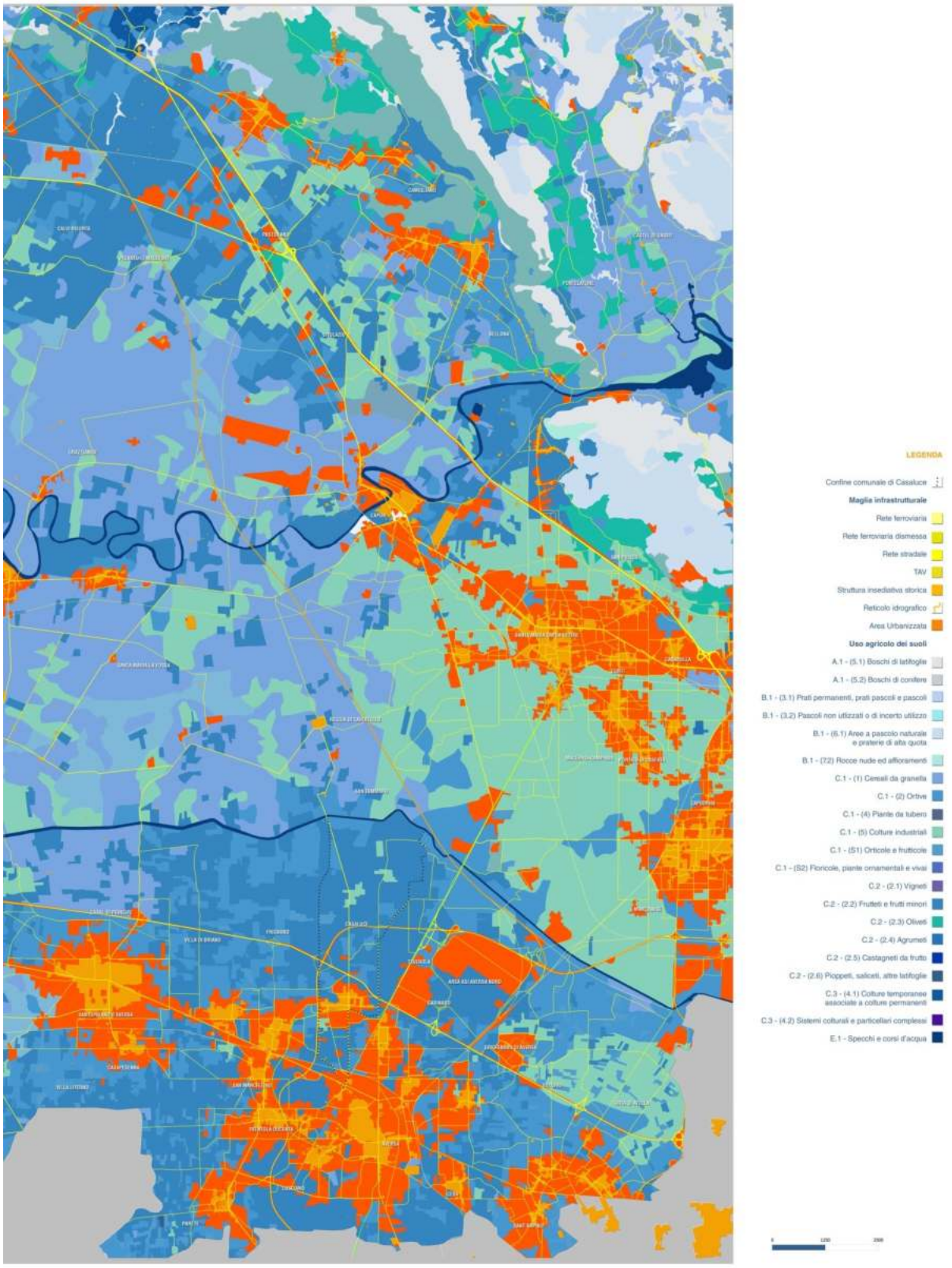

Figure 2. Land use

Elaboration: Libera Amenta, , PhD in Urban Design and Planning, DiARC, Univers

2.2 Applied UM to Urban Planning

The proposed multi-layered framework aims to link the notion of metabolis
morphological and anthropological peculiarities of territories.
The layers of historic pre-existences, water system and rural fields have bee
their condition concerning the time variable that is their state in the life cy
that their effects in the environment comes from socio-economic behaviours of
organizes the land use features as metabolic flow constantly evolving an
morphologies. In this matter the land use has to be considered as one of the me
anthropogenic activities on the ecosystem. Thereby the notion of UM is related t
uses the data flows to understand how they shape the territory and influence its
If the territory is conceived in terms of metabolic flows, it is possible to i
and the reactivation of declined, interrupted or ended land use cycles through
strategic renewal and regenerative chain mechanisms of specific actions.
It requires a systemic view and a new conception of the time variable. The time
for planning since it generates adaptive design scenarios and mechanisms of
which the outcome is not assumed in advance and appears flexibles to external
conditions. This point of view considers the project as a process that comes
influences among all the urban features in a dynamic way constituted by succ
phases.
Another concept related to the city as a product of metabolic processes, is th
physical and biological processes of resources conversion in goods and waste
time, the transformation of waste into useful products to be re-inserted into t
based on the laws of thermodynamics. It is similar to what happens in the human
process. These explain that the metabolic process requires energy for its
everything that comes out of the system depends on the amount of incoming m
physical and biological processes of converting resources into useful products
the human body's metabolic processes or that of an ecosystem. They are based
thermodynamics (...) (Newmann, 99, pp. 221).This means that it is necessary to
of resources putted into the system, by proposing a balance of input and output
it poses an important issue related to the power of the territory to activate m
in triggering changes: so the focus becomes the individuation of regenerative ac
to the reactivation of abandoned or declining life cycles (Formato, 2014).
Through this framework, the plan proposal is to intervene on the life cycle of
water, agriculture and historic-artistic heritage (Figure 3).

The restoration of water channels system s continuity needs a set of actio
riverbank vegetation and canals naturalization, the planning of wetlands
groundwater aquifer and to reduce contamination of water, the building
phytopurification. These interventions, based on the local impact of water chan
wide effect in the whole ecological network of Regi Lagni embracing the periur
Naples and Caserta. The water cycle is an adaptive system that changes due to ou
conditions so it is a potential device to produce new morphologies such as equi
to both agricultural and urban frameworks. Intervening on the process of ecolog
reduce the environmental contamination and catalyse public activities and tempor

The reactivation of the agricultural cycle results from a strategy based
developed from the system of denied areas which represent a wide strategic po
to reconnect different land s fragments. The proposal encourages the inte
activities promoting agricultural economy such as farms, farmhouses and other a
of agricultural production activities. The park aims to restore ecological cont
fragmented periurban areas and at the same time assumes a strong evocative powe
of this land. Denied areas follow the configuration of rural traces, creating
pedestrians and bicycles, emphasizing the use of typical natural essences
eucalyptus, vine, etc.). Therefore the network of denied areas constitutes a ke
high environmental value and increasing the liveability of places.

The historic emergencies life cycle induces to reuse spaces with new con activities. The cultural network links historic town centres and decentraliz periurban area generating a double cultural path: the archaeological path that architectural heritage as Reggia di Carditello , Castles and San Lorenzo burg mainly rural and generates a new relation among the manor farms of the ancient This planned approach enables to preserve historic buildings and to promote spaces, enhancing the establishment of new compatible functions.

Figure 3. Reactivation of life cycles.
Elaboration: Libera Amenta, , PhD in Urban Design and Planning, DiARC, Univers

3. Towards a Mediterranean metabolism

The research output is the application of a project device that use the UM as
changing of the contemporary city and to understand which system layers are dir
urban decay and represent the main elements for a future urban design project.
The applied methodology started to observe the territory in its material compon
them in their dynamic organization gathering from the assumption that the UM r
the city as a network of ecosystems.
The case study of Casaluce was analysed through site visits and public shared
data were georeferenced using GIS technologies to elaborate thematic maps. Thi
areas characterized by environmental decline, pollution, illegal buildings a
settlements.
The purpose was to interpret places conditions and to construct planning s
concept of metabolism as a key to identify the environmental decline and the co
degradation and social marginalization, extending the notion of UM to urban and
perspective, environmental remediation appears an important strategy to transfo
and to encourage new actions for the economic and social development.
The emerging issues could represent an emblematic framework generally diffused
areas of Mediterranean cities. Therefore, it is possible to propose a broade
Mediterranean metabolism as a lens trough which studing periurban areas of M
territories. The research approach, indeed, tried to apply the global notion
dimension characterised by settlements morphologies, socio-economic beh
emergencies and compromised ecosystems. The local scale induces to search a
problems that could be solved by a strategic urban plan.
The preliminary plan proposal of Casaluce, which is the pragmatic output of thi
result of a wider research aimed to perceive a different model of growth for
different design solutions relating to rural-urban linkage with the usual featur
The metaphor of UM is useful to increase the understanding of the cities wor
find a balance between input and output. Rehabilitated environments, ecologi
permeable lands for agriculture, are signs of a regeneration of commons, of
coincides with the whole territory and its nature, promoting smart and ambitio
city s spaces. The paper highlights that the aim of the urban planning is the t
UM from a metaphoric means to a pragmatic vision of city s flows as sets of
could generate new way to shape the city.

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