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Sessone Speciale Nature-based solutions: new eu topic to renature cities

Roberto De Lotto

Introduzione

The European Community recently defined the Nature-Based Solutions (NBS) in its Research and Innovation policy agenda with reference to re-naturing cities and societal challenges. More than one Horizon 2020 research calls fo-cused on the multidimensional, cross-disciplinary, inter-scalar aspects that NBS involve. With general reference to the urban studies and specific orientation toward sustainability in cities and human settlements, NBS are defined as a se-ries of actions aimed to provide sustainable, cost-effective, multi-purpose and flexible alternatives for various objec-tives.

In the proposed Special Session, authors are called first to develop the concept and the description of NBS; then to highlight the role of NBS with the actual state of the art in sustainability issues about urban settlements and in green solutions for cities and territories. A further objective is to compare this European policy with other significative wide scale orientation in particular contexts in which urban development is creating high pressure (i.e. China and Central America). A last objective is the description of NBS applications in worldwide urban settlements.

The Initial Exploration of Adaptedness in Chinese Traditional Settlements

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Abstract

This study analyzes the adaptedness of Chinese traditional settlements using the two aspects of site selection and construction forms. This paper shows how traditional settlement methods could be better adapted when a transformation in a settlement is caused by factors such as natural or socio-economic conditions, etc. During the agricultural period in China when use of technical skills was limited, a relatively ideal human environment was developed. The present study shows how the traditional method of adaptation had to employ deep wisdom that today involves the difficulties that need to be addressed in constructing today's cities, so that the quality of human living environments can be improved.

Key Words

adaptedness, Chinese traditional settlement, courtyard construction, resilience, site selection.

Acknowledgement

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The word "adaptation," is a noun often used in biology and refers to the phenomenon of how an organism and the environment interact or the organism transforms itself to live in a particular environment. Adaptation is generally defined as the evolutionary process whereby an organism becomes very well suited to live in its habitat(s) or niche. *Adaptedness* is the state of being adapted, that is, the degree to which an organism is able to live and reproduce in a given set of habitats. [1] "Adaptation" is an important idea in the field of biology. In fact, biology is not the field that exhibits adaptability and related phenomena; adaptation is also seen in the construction of structures by humans and in human settlements, e.g. a Chinese traditional settlement reflects a simple *adaptation* strategy and features very good *adaptedness*. Nevertheless, this essay only briefly discusses the aspect of site selection for traditional settlements and construction forms.

Site Selection of Settlements for Environmental Adaptation

Many countries, including China, have more people are land available for use. Many areas of the globe are not suitable for human habitation. Those areas that are suitable human life are not very large. Therefore, when selecting a habitat, people often prefer to use flat land beside a river, with a second choice on building houses nearby mountains. Obviously, this represents a widely held human mindset related to adapting and using nature.

Settlements and Water

All living organism require water and terrestrial organism often must have consume fresh water frequently. Similarly, water also serves as an important a resource needed for the daily lives of humans, who use it for crop and for transportation needs. South China features abundant water resources. The local residents take full this advantage of this by digging aqueducts, ditches and canals connected to natural rivers in a way that allows human settlements to be crowded together. People who built houses and live near rivers and canals end up creating waterfront villages. The river channel satisfies multiple demands of resident by serving many functions; therefore, rivers and canals end up driving the creation of special settlements and environments. (Figure 1)

Well water provides an important source for potable water used by humans. In both the rainy area of southern China and the northern area that receives limited amount of rainfall, potable well water is generally used for drinking, washing and cleaning foods. In contrast, rivers are mostly used to carry waste water away and for traffic and transportation. In some traditional Chinese settlements, people used water based on the direction of flow — up-, mid-, and down-stream areas were used for washing rice, vegetables, and clothing, respectively, to strictly assure stream water remained sanitary for various uses.

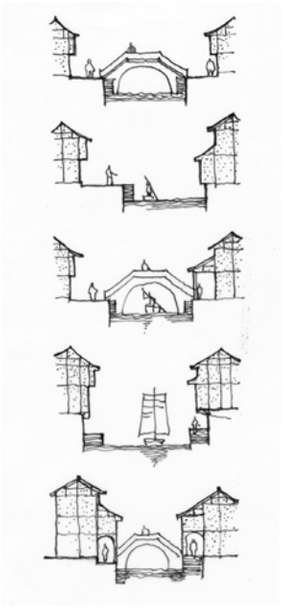
Water also serves a function of modifying microclimate scale weather conditions. Scientific research has shown that humid or rainy weather may lower the air temperature to make people feel cooler. Therefore, like river channels, pools, etc. airflow from bodies of water may benefit people by lowering the temperature of airflow and helps with the circulation of air.

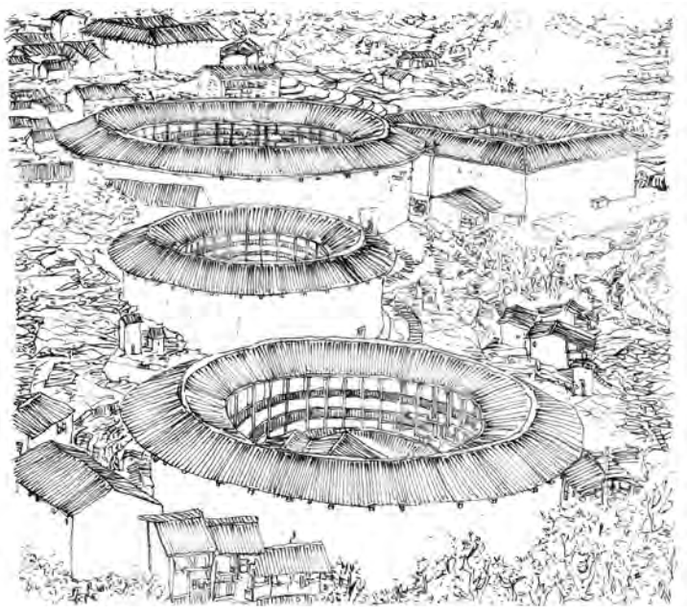
In addition, people enjoy scenic locations with open water. Water can also be used as a natural firebreak to stop the spread of wildfires. The Chinese have an old saying: *wise men enjoy waters, kind men enjoy mountains.* Water serves not only just an aesthetic addition to the landscape, but can also help us feel alive and understand truth. Actually, fires often threaten the wooden buildings used in traditional Chinese constructions, so living alongside a river or in a location with easy access to water many help people to reduce losses to fires and to avoid the effects or to mitigate destructive fires.

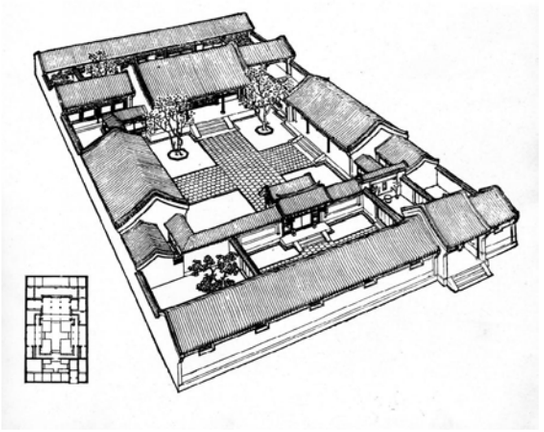
In order to drain waste water (especially for rain and gray water), traditional settlements have also employed a set of mature waste water management systems. Roofs drain rainwater toward courtyards and open channels surrounding buildings from where this water continues to flow away to outdoor ditches that follow streets, from where it finally will flow into a river. This method using open ditches, street ditches, and a rivers in urbanized areas results in a three-grade drainage system. Based on this type of system, a series of infrastructure has been well developed, e.g. tiles, trench covers, grates, etc. formed the complete drain infrastructure. However, black water that contains human excrement needs to be treated before it is reclaimed and collected for used another system where it is applied to fertilize agricultural crops.

Settlements and Landforms

Traditional settlements were located and developed across different types of countryside in China. In mountainous areas, a site for settlement was often selected at the foot of a mountain to allow convenient access. People paid considerable attention to geological security. Thus, they tried to avoid building houses on sites that might be affected by natural disasters such as mud-rock flows and landslides, mountain torrents and flooding, etc. If necessary, some mitigation measures were employed such as simple retaining walls and levees or flood-control drainage ditches were adopted to ensure the safety of people and







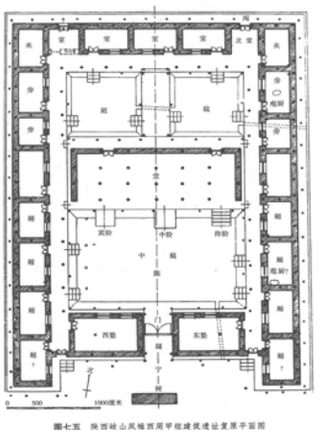


Figure 1 Human riverside settlements in Yangtze River Region in Southern China.
Figure 2 Buildings constructed in a circle or a square of land in Fujian Province that had a strong defensive function.
Figure 3 A square courtyard is the most typical form in traditional Chinese buildings.
Figure 4 The recovering flat plan of A-group construction site for the Western Zhou Dynasty in Young Phoenix Village of Qi Mountain, Shanxi Province.

Definition	Square	Copy of traditional courtyard development in depth	The form of a Three-Section Compound	The Form of Front and Rear Buildings with Two Side of Walls	Type L Layout of a Construction, with a Courtyard Located to One Side	A Building is Located in One Side with the Other Three Sides Bounded by Walls
Diagrammatic Presentation						
Features	Typical construction of a courtyard for the spread of an extensive layout	More common view where persons of high social rank in large populations have good conditions and areas of occupation are usually large	The layout is relatively symmetrical, and usage scopes are also more extensive	A common view that was used in some special situations	More flexible layout that adapts to various landforms	More simple and crude development

Source: formulated by authors

Table 1 List for Common Type of Developed Courtyards
Source: formulated by authors

animals. In order to conserve land resources, sometimes houses are built on sloping land. Currently, the layout is often adjusted to follow contour lines to reduce the quantity of earthwork required. If necessary, houses can be built on stilts, such as using upright columns to match the landforms, in order to facilitate construction adaptedness and reduce the extensive modification of landforms.

On level ground, the selection of a location for a settlement was influenced by fewer natural factors. Generally, a layout method would be adopted based on requirements related to weather, society, culture, customs, security protection, and etc. For example, some settlements will consider the location of a business street, river, temple, or memorial temple as the most important layout factors. Other settlements will adopt geometrically arranged patterns. However, some others will emphasize the defensive function such as using a round or a square earth building in Fujian (Figure 2). These are all done based on responses to some external requirements used by traditional human settlements and will reflect traditional adaptedness and flexibility based on to outside influences.

Settlement and Weather

Since China is located in northern hemisphere, the windows of homes typically open towards the south to help gather adequate sunshine. Meanwhile, because winter winds mainly come from the west on the Chinese mainland, the eastern site of building may have larger windows to draw cool air into houses to lower the indoor temperature in summer. Nevertheless, the northwest side of buildings generally had no windows or relatively small windows to reduce the effects of cold wind coming from the northwest.

In addition, it could adapt to climatic requirements of plants and water, e.g. on the northwest side of towns and houses, tall plants are often cultivated as windbreaks to block the cold winds of winter. In the east, short plants and water may be used, because they not only draw in cool air in summer, but they are helpful in lowering the temperature of the wind to provide a more comfortable feeling.

Adapt to Environmentally-sound Construction Forms

The square is most typical type of construction for traditional Chinese buildings (Figure 3). Actually, the Chinese had built courtyards since very early times in China. Figure 4 shows an archaeological site in Young Phoenix Village of Qi Mountain (currently in western Xi'an) in the Western Zhou Dynasty (1064--771 BC). The building has a completely square-style construction comprised of two courtyards. [2] Obviously, the view of

such a long history of developed courtyard spaces, this reflects the main feature in Chinese develop similar to this. Courtyards have a lot of strengths, and adaptedness to environments is one of them.

Adaption to Size

The development of courtyards has strong adaptedness; the design of a courtyard may change based on the transformation of landform conditions, roadway density, demographic size, economic level, etc. The way peopled adapted to actual situations can been seen Table 1. The size and depth of courtyards could be adjusted to adapt to the actual demands for use. For example, because spacious lands are available in the countryside, generally, the courtyard areas were usually larger in these areas. This not only satisfied the needs of daily life, it could also involve increased activity in courtyards, so that courtyards developed a small fundamental site of production.

Adaptation to Weather

Courtyard size is highly related to weather, because sunshine only infrequently lights a courtyard in the northern part of China in winter; as a result, courtyards are generally expanded with more depth in order to obtain more sunshine. The opposite occurs in southern China where sunshine becomes very hot, so courtyards would commonly be designed to be narrow to reduce direct sunshine that generated heat.

When comparing this with the above, in muggy areas, larger courtyards are often designed. The goal is to ventilate the courtyard to draw in more natural wind so that the heat can be taken away. In dry and hot areas, courtyard areas are often small; this design enables more sites to remain in darkness that sunshine cannot illuminate, so that people feel cool.

Adaptation to Road Networks

Traditional settlement roads were often very narrow and had many side roads; that is, the roads were made of streets (generally defined as the main road) and lanes (usually defined as side-roads). The wideness of a street often required a width of between 2–3 m so that at least a carriage and people in two sidewalks could travel together. Lanes were narrower; sometimes, these were only around 1 m wide, although some wider lanes were as much as 2 m wide [3] . Nevertheless, the main road still played the key role for traffic, so the main door of an occupied house was commonly installed to open into a main road. Then, a second door was usually installed to open onto a side lane whereby the host could enter and go out to purchase vegetables daily and to take out the garbage and do cleaning in the lane.

Courtyards development enabled doors to be opened more flexibly, and this had to adapt to the road system in traditional settlements. Meanwhile, the transformation of the depth and width of courtyards also was done based on allowing the building to adapt to changes on space and density for the road network, where a smaller net also had to adapt to the requirements of the local space.

The Present Significance on Traditional Settlements

In the long process of evolution process, traditional Chinese settlements have shown very strong adaptation. These changes may have had to adapt to different situations to adjust and improve to more idealistic human residence environments, e.g. in terms of natural features, social customs and habits, cultural and economic status, building construction, etc. In this way, traditional settlement features are worth considering.

Currently, with the rapid development of civilization, the urbanization of Chinese cities has encountered many problems. One problem is a lack of resilience. Therefore, scholars have started to suggest the concept of a "resilient city." This theory, has had different definitions, e.g. the ecological field tended to define resilience in the sense that systems have the ability to tolerate disturbance and have a recovery time if disturbed. However, the field of social ecology defined resilience by paying more attention to the systematic abilities of a city related to organization, study, and adaptation; even though systems were in a steady state, they would still be changeable. Some recent research studies have already analyzed the definition of a resilient city; basically, scholars have concluded that above described concepts of resilience represent the important inner qualities of *resilience*. [4] In fact, traditional settlements had already shown some features of a "resilient city;" that is, without advanced technology, cities had already met the requirements needed to adapt to the environment and to change society, and had already adjusted and had the ability to adapt. They can provide a basis for a more in-depth analysis and references related to the development of the present day resilient city.

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Nature-Based Solutions in city planning: the case of Segrate Municipality (Milan)

Roberto De Lotto

Introduction

Since City Planning assumed a specific role in urban development and management, the relations among the three basic systems: environmental system, settlement system and infrastructural system, have been deepened, studied and practically proved by scholars and professionals.

The "environmental issue" has been always part of the classical city and regional planning and, even if the theme of respecting and safeguarding environment has become more and more relevant and urgent, it is not possible to consider this as a "new" theme. The basic idea of the Howard's Garden City utopia was exactly the research of a new balance between the development of the industrial city and the natural and anthropic environment. Considering the urban expansion (sometimes urban explosion) the same aspect has been underlined almost one century after with the critics to the sprawl (Duany et al., 2000). The whole process that carried to recognize "sustainability" as main strategical behavior for all human beings, started in the early seventies (with the U.N. Conference on the Human Environment in 1972, in Stockholm) and the principles exposed in 1972 have been applied to every human action, considering urban and regional planning as a key point to be analyzed.

In the last decades many scholars tried to design a structural logical scheme that could interpret the different issues and phases that the city and regional planning, careful of the environment, should follow (among all, Steiner, 2000). The ecological planning has been translated into the Landscape Ecology, that is the science of studying and improving relationships between ecological processes in the environment and particular ecosystems. This is done within a variety of landscape scales, development spatial patterns, and organizational levels of research and policy. Key research topics in landscape ecology include ecological flows in landscape mosaics, land use and land cover change, scaling, relating landscape pattern analysis with ecological processes, and landscape conservation and sustainability (Douglas and James, 2015).

From the introduction of the Strategic Environmental Assessment (SEA), that in Europe was defined with the Directive 42/2001 (but that has different examples of similar applications also in the previous years in some European countries such as Great Britain from 1993), the process of regional, urban and city planning has been sustained by the evaluation of the impacts on the environment of all actions that derive from plans. Using specific techniques, methodologies, indicators (Clark, Meadows, Weber, Feldman), the SEA has become one of the fundamental elements that composes the comprehensive documents that a city plan is made of.

City planning and NBS

Nature-based Solutions emerged as synthesis of the different disciplines that work "with" and "for" the environment, and as a multi scalar and interdisciplinary serie of strategies, tactics and operational actions that directly involve the planning and the management of the city.

Following Eggermont et al (2015) there are three types of NBS:

"Type 1 consists of no or minimal intervention in ecosystems, with the objectives of maintaining or improving the delivery of a range of ES both inside and outside of these preserved ecosystems. Examples include the protection of mangroves in coastal areas to limit risks associated to extreme weather conditions and to provide benefits and opportunities to local populations; and the establishment of marine protected areas to conserve biodiversity within these areas while exporting biomass into fishing grounds (Grorud-Colvert et al., 2014). This type of NBS is connected to, e. g., the concept of biosphere reserves incorporating core protected areas for nature conservation and buffer and transition areas where people live and work in a sustainable way.

Type 2 corresponds to the definition and implementation of management approaches that develop sustainable and multifunctional ecosystems and landscapes (extensively or intensively managed), which improves the delivery of selected ES compared to what would be obtained with a more conventional intervention. Examples include innovative planning of agricultural landscapes to increase their multi-functionality; and approaches for enhancing tree species and genetic diversity to increase forest resilience to extreme events. This type of NBS is strongly connected to concepts like natural systems agriculture (Jackson, 2002), agro-ecology (Altieri, 1989), and evolutionary-orientated forestry (Lefèvre et al.,2014).

Type 3 consists of managing ecosystems in very intrusive ways or even creating new ecosystems (e.g., artificial ecosystems with new assemblages of organisms for green roofs and walls to mitigate city warming and clean polluted air). Type 3 is linked to concepts like green and blue infrastructures (Benedict and McMahon, 2006) and objectives like restoration of heavily degraded or polluted areas. Within this type, novel approaches such as animal-aided design (Hauck and Weisser, 2015) are currently being explored to bridge the gap between biodiversity conservation and landscape architecture." (Eggermont et al., 2015).

All these three types can have a direct translation into city plans, considering also that all the types involve both the public sector and the private one.

More than a very new concept, the idea is to give a common and wider definition to a serie of actions that were developed under different labels: Green Infrastructures (Benedict et al, 2006), ecological networks, ecobuilding, city greening, and so on.

The city of Segrate

Segrate is a Municipality in Milan metropolitan area, next to Milan on east. It is 17,49 sqkm wide, it has 35.234 inhabitants with a density about 2.000 inhabitants per sqkm. It is a recent settlement, that was built from the sixties of the XX century in a rural territory; the eldest buildings are rural "cascine". Segrate never had a strong industrial core and it developed mainly as residential settlement with some tertiary excellences: Mondadori (designed by Niemeyer), Fininvest, IBM, Microsoft (now moved).

The city was designed in neighborhoods, some of which with a very high quality of urban fabric and architecture. In example, three of these neighborhoods (San Felice - designed by Vico Magistretti and Luigi Caccia Dominioni, Villaggio Ambrosiano and Milano 2) are different re-interpretation of the

garden city, built from the late sixties and the eighties.

In Segrate there is a very strong presence of infrastructures: the Linate Airport (that is considered the urban airport of Milan), three multimodal logistic centers, high speed train lines, the two main roads that connect the east of Lombardy to Milan (Segrate occupies the "last mile" of the highway BRE.BE.MI). The environmental impact of such a quantity of infrastructures is relevant, considering that all these structures are related to a wide scale (metropolitan and regional) ad not to a local one.

As it happened quite all over the world, the economic crisis, and the crisis of the building sector, carried to an actual situation in which some interventions approved in the last 10 years, struggle to be completed. In the 2012 city plan, considering also the actuation phase, there was the forecast of arriving to 50.000 inhabitants. Around 6.000 inhabitants are evaluable in approved plans that already now are under construction.

This fact is extremely relevant considering also that in 2009 it was signed an agreement among Municipality of Segrate, Milan Metropolitan City, Lombardy Region and the Australian company "Westfield" to build the biggest commercial and leisure center in Europe (the total built floor approved is 285.000 sqm). Moreover, Westfield represents the biggest foreign investment in Italy (around 1,4 billion €). The comprehensive existing and forecasted settlements, and the presence of a huge flux of people and goods to and from Milan, carry to a very critical situation.

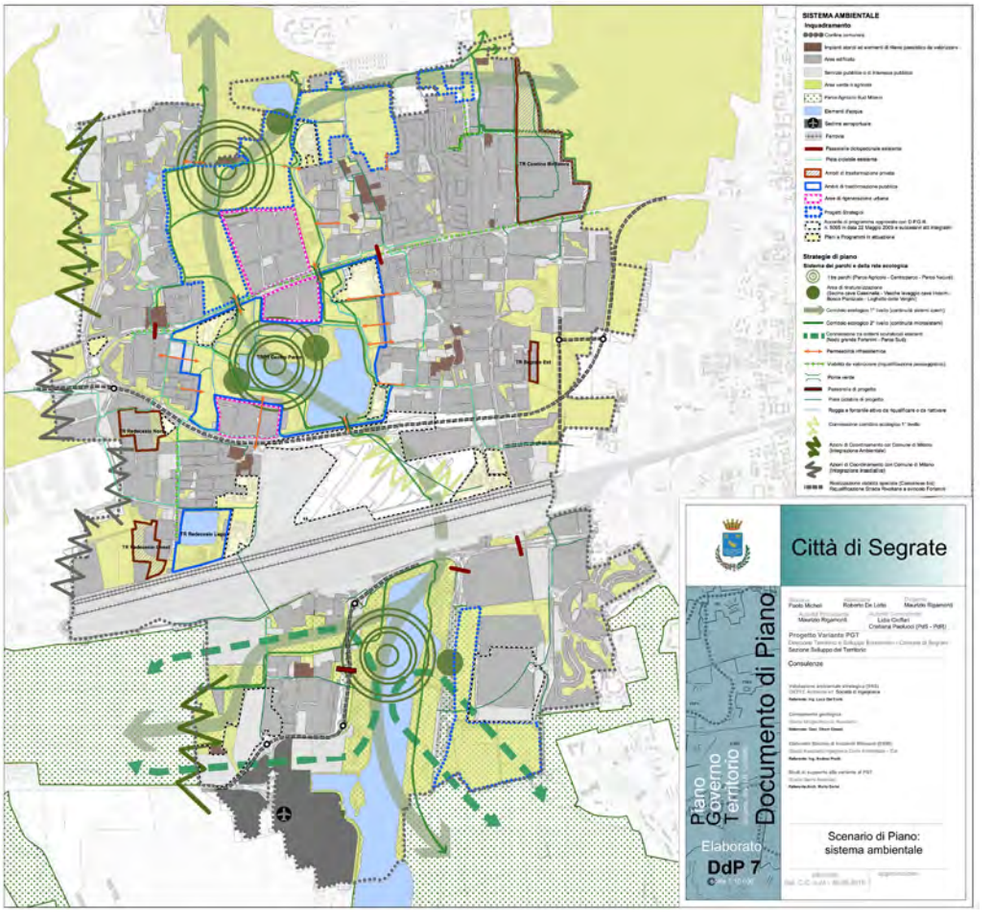

Figure 1– Environmental System of the new city plan of Segrate

The Segrate city plan process: a bottom-up best practice

In 2012 the new city plan was approved. The city plan was set up on the principle of continue increasing of buildings and, as it was cited before, was aimed to carry the population from 35.000 to 50.000 inhabitants.

In particular, there was an area wide about 1 sqKm called "Golfo Agricolo", that has always been agricultural land between the two neighborhoods Villaggio Ambrosiano and Milano 2, in which the city plan forecasted 300.000 sqm of new buildings, mainly residential. A group of citizen, united in a committee, legally contested the decisions of the city plan in order to save the "Golfo Agricolo" from the buildings. In 2014, because of this legal procedure, the plan was cancelled by the Regional Administrative Tribunal and then, after the opposition of the Municipality, it was partially recovered except the "Golfo Agricolo" that remained without planning previsions. In 2015 there were the Municipality elections. Because of the great value of the ecologist motion against the wish to build everywhere, a new political group (that was composed also by the same people who animated the committee) won the elections. Of course, one of the main keywords of the campaign was "to protect environment".

This bottom-up process, that carried common citizens to be effective on city planning decisions, is extremely interesting and demonstrates how loud it can be the need of a better urban environment. The new government of the city decided to provide a new city plan based on totally different paradigms in respect of the previous, that are very close to Nature-based Solutions.

NBS in the city plan

The new city plan, called Variante al Piano di Governo del Territorio (http://www.comune.segrate.mi.it/attivita_servizi/Sviluppo_del_Territorio/Variante_PGT_2015/index.html), was approved in July 2017 after less than 2 years of work. During the preparation of the city plan the "Golfo Agricolo" area was definitively defined by the National State Council as an area in which the previous previsions were wrong; so it was legally possible to maintain the area as green land. The main aims of the new city plan, apart from the specific case of the "Golfo Agricolo", were basically six:

- to safeguard the maximum quantity of green land from new buildings;
- to build a local Ecological Network;
- to improve the quantity of green (public and private) in the city;
- to reduce as much as possible the soil consumption also in already approved plans;
- to improve the environmental performance of already built land and of existing urban fabric;
- to involve all stakeholders in improving the environmental quality of the Municipality territory.

The feasibility of such aims is guaranteed by a serie of specific regulations that guide the whole process from the strategic level to the tactical one.

The points from 1) to 4) are typical city planning actions, that are fundamental to design the city at the wide scale.

The point 5) is deepened throughout a parameter called Biotope Area Factor, applied in Berlin since the end of the XX century, that measures the capacity of evapotranspiration of the soil and of the buildings facades and roofs.

The point 6) is the necessary step to make a public policy into reality.

As it is clear, the all 6 aims can be easily referred to every type of NBS.

It is interesting to underline the involvement of the citizen in improving an NBS approach (even if the term NBS was not still used, the set of actions carried out by the committee first, and by the local government then, can be considered as part of NBS); the social aspect is fundamental in the inter scalar character of NBS. For the big scale design the top-down methodology is more diffuse, but for the small scale and for the tactical phase it is necessary to involve all the social levels to have visible results.

For the existing city, the application of specific methodologies such as BAF needs to be guided by the public administration but must be put in action by the private subjects. To have the wish to really apply an environmental improvement of the performance of the existing city, it was necessary to define specific incentivisations in order to make the private act to enhance the collective environment having a personal advantage. So, some BAF targets have been defined basing on the covered ratio (following the Berlin experience): every transformation of the existing city must reach the BAF targets; if a private stakeholder is able to reach better performances, the half of the percentage of increasing of performance is converted in volumetric bonus. In this way, the virtuous behaviors are not only possible but also subsidized with volume rights.

Conclusions

The new Segrate city plan was approved a few month ago, so at the moment it is not easy to understand the real feasibility of the introduced strategies. Surely the relations between NBS definitions and City Plan decisions are very tight considering the multiscalar translation of the strategies into practical actions, and the involvement of citizens from the first stages of the process to the next applications of the plan.

Of course, some NBS oriented decisions, such as canceling settlement forecast, may cause lawsuits that could also carry to a modification of the final decision; fortunately, the actual normative apparatus in Lombardy Region aims to reduce soil consumption and soil sealing. So a big help comes from the general agreement toward environmental friendly behaviors. At the moment the aim of the Administration is to govern these difficult passages throughout a dialogue with the private stakeholders and throughout the research of economic advantages also in the preservation of green or agricultural land.

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Nature-Based Solution for the redevelopment and enhancing of urban commons

Giulia Esopi

Introduction

The commons, useful and scarce resources, are precious and essential elements for satisfying not only human needs but also those of living beings and ecosystem ones. Their value is recognized by many individuals and, for this reason, it is important to protect and keep them for future generations according to the principle of sustainability. Referring to city, urban commons (materials, intangibles and digitals) are valuable elements that can improve the quality of life and urban environment. Therefore, it is important to adopt strategies in order to protect and to enhance these resources and, simultaneously, to respond to main environmental issues due to climate changes. Nature-Based Solutions (NBS), as general approach and technical guidelines for designing, implementing and managing of natural features to solve urban problems, are actions for urban commons revitalization through the private involvement (as promoters and beneficiaries of the intervention). The paper analyses the interdisciplinary relationships that exist between urban commons and NBS and tries to understand how the latter can foster mechanisms of urban resources redevelopment and enhancing.

The commons as resources for multiple actors

From several decades, scholars from different scientific disciplines (jurists, economists, ecologists, sociologists, etc.) are concerned about the concept of common good. Depending on the reference field, the concept assumes different meanings which make its nature unclear and approximate. From economic point of view, the goods can be divided into: public good (non-excludable and non-rivalrous), private good (excludable and rivalrous), collective good (excludable and non-rivalrous) and common good (non-excludable and rivalrous). Excludability means the possibility of excluding those who do not pay from using the good; while rivalry implies that the consumption by an individual reduces the availability for others (above all: Frank at al, 2015).

In the essay 'The tragedy of the commons' published in 1968, Hardin refers to commons as open access resources that every person can use to meet its own needs. According to the author, over-exploitation of resources due to improper use of individuals will inevitably lead to a tragic situation and the only solution consists in the resource privatization or in its public ownership (Hardin, 1968).

According to Ostrom, the commons are shared, non-excludable (difficult to fence off) resources used (or produced) generally by more or less large communities. They do not necessarily constitute a citizen's right and, in this sense, they are differ from merit goods (indispensable to human survival or with high moral and social value and therefore to be safeguarded and assured to all human beings). She rejects Hardin's argument (based on State and Market dichotomy), arguing that these forms of commons management generate wastes and/or inefficiencies and the best way is the community management. The communities, composed by resource appropriators and users, are able to manage natural resources in a sustainable way over time through the ability to consolidate mutual trust relationships and to self-regulate common interests and practices. (Ostrom, 1990).

For Rodotà, common goods are finalized to social goals achievement and to fundamental rights satisfaction. "They belong to everyone and no one: everyone can access them, no one can boast exclusive rights. They are shared and therefore must be managed on equality and solidarity principles, making effective forms of participation and control of those concerned and incorporating the future dimension, in which it reflects intergenerational solidarity, a duty towards future generations" (Rodotà, 2012).

The references concern the concept of commons in a different way: Hardin refers to open access resources that anyone can freely use and for this reason can exploit them for personal gain (nobody's goods); Ostrom speaks of goods managed by a group of people, the communities (goods of some); Rodotà refers to good with widespread property rights to which everyone can access without having exclusive claims (good of all) (Moroni, 2015).

Despite the discrepancies highlighted, however, it is possible to trace some key elements that are presents in all the mentioned references:

- *Common as Resource.* The concept of common good is related to that of resource, an element or set of elements that can be used in order to meet needs. In this sense, resources are useful because they are indispensable for satisfying not only human needs but also those of living beings and ecosystem ones. Another feature of the resource is the scarcity, the insufficiency of a good in comparison to the need, aspect that is related to that of rivalry. The resources, useful and scarce, are precious elements to protect and keep them for future generations according to the principle of sustainability.
- *Presence of a people collectivity around the resource.* The concept refers not to a single but to a community of individuals who are gravitating around the resource for interests of a different nature (economic, social, environmental). The presence of individuals is an essential parameter that adds value to the resource itself. So, it is possible to catalog as common goods all material or intangible resources needed for a set of individuals such as water, soil, air, parks, open spaces, etc.

The commons within urban context

The commons are also a key topic of the contemporary urban studies debate. Referring to city, urban commons are small and large scale resources which are collaboratively managed by groups of heterogeneous users. In particular, it is possible to divide urban commons into three categories: materials (streets, squares, gardens, parks and green areas, school areas, buildings, etc.), intangible (inclusion and social cohesion, education, training, culture, civic well-being, urban interaction, environmental sustainability, sharing, etc.) and digital (websites, social applications, etc.) (City of Bologna). Material commons are resources that provide services of different typologies to citizenship and city users. In example, urban parks and green areas implement the ecological value of urbanized contexts; while squares and open spaces provide to users recreational areas. Intangible commons are effective resources

in terms of urban well-being and quality of life. Urban interaction makes public space valuable, bringing several benefits not only to involved actors but also to the whole community. Interaction facilitates a host of benefits such as knowledge exchange, social capital accumulation and various other positive externalities that occur to individuals in close proximity to one another (Foster, Iaione, 2016). Finally, digital commons are useful resources for sharing information and data.

Therefore, urban commons are valuable elements that can improve the quality of life and urban environment. For this reason, it is important to adopt strategies in order to protect and to enhance these resources and, simultaneously, to respond to main environmental issues: the Nature-Based Solutions.

Urban Nature-Based Solutions

Nature-Based Solutions (NBS) are defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (International Union for Conservation of Nature). The main aim of NBS is to preserve ecosystem services necessary for human life, to reduce negative impact due to climate changes and to accelerate sustainable urban development. These smart and green solutions contribute to improve urban ecosystem resilience, that is the ability of a city to react to environmental shocks (climate change, flooding, etc.) protecting biodiversity and natural ecosystems. In particular, ecosystem resilience is based on the concepts of biodiversity, ecological variability, interaction between spatial and temporal scales and cycles of adaptation.

In highly urbanized areas, characterized by high-density and high soil sealing, it is essential to adopt nature-based approaches in order to increase the ecological quality of the urban environment and to solve the main problems related to climate changes. In these contexts the percentage of green and permeable areas is not able to perform ecosystem functions, thus, artificial green elements and techniques (in example: green roofs and walls, green infrastructures and corridors, natural and semi-natural green spaces, etc.) can play a fundamental role.

In fact, from the environmental point of view, they contribute to the reduction of pollution and urban temperatures, improving local microclimate and reducing the heat island effect. Moreover, this solutions act on urban territory such as stepping stones, support points for transfer of organisms from large natural basins in the absence of continuous natural corridors. These units, if properly aligned, can replace to a certain extent a continuous corridor, unique element of the municipal ecological network (Peraboni, 2010).

From the social point of view, the NBS can produce new collective functions for citizens and city users and improve the quality of existent ones; while from economic one, they can increase urban attractiveness and property value and reduce maintenance costs (European Commission, 2015).

Nature-Based Solutions for the protection and promotion of urban commons

The main relationships that exist between urban commons and Nature-Based Solutions can be described as follow. First of all, it is fundamental to note the Nature-Based Solution role for the regeneration, redevelopment and enhancing of material urban commons. In this way, they become intervention strategies for buildings and urban open spaces that produce several benefits not only environmental but also socio-economic (see previous paragraph). In particular, Nature-Based Solutions on material urban commons can be categorized by typology and scale:

- *City plans and strategies (urban scale).* Several cities have adopted specific plans or strategies in order to foster environmental problems such as climate changes, floods, erosions and urban temperatures increase. Philadelphia, through "Green City, Clean Waters" plan aims to reduce floods, to improve quality of environmental resources and to become a healthier city. The strategy is the creation of a green storm-water infrastructure with a system able to intercept rainwater: some of which is filtered from the ground, one part evaporates in the air and one last portion is slowly released into the drainage system. The green infrastructure allows to manage water outflow by maximizing the environmental and socio-economic benefits (Philadelphia Water Department). The city of Melbourne has adopted a strategy for the creation of an urban forest in order to obstruct pressures on urban environment and people. In particular, the main aims will be reach increasing green roofs (from 22% to 40% in 2040), forest diversity and biodiversity, improving the state of vegetation and sensitizing the population (City of Melbourne).
- *Urban corridors actions (urban scale).* Urban corridors can be distinguished into two typologies: natural (rivers, streams) and artificial (mobility paths and artificial channels). Natural corridors have an intrinsic environmental value which is not always adequately protected within urbanized contexts; while artificial ones need ecological solutions in order to mitigate their impact on the territory. In the last few decades, the city of Seoul has moved from an urban-oriented development perspective to one that enhances the quality of life and the functioning of ecosystem. The recovery of Cheonggyecheon stream, which crosses the city in east-west direction, has provided a series of measures aimed at the consolidation of slope, water management, greenhouse effect, energy and urban heat. The project provides to lower the riverbed to allow flooding and to build a new embankment and side terraces that allow access to people and fauna. In addition to the many environmental benefits (flood protection, greater biodiversity, reduced heat island effect, health), several are socio-economic ones: the recreational spaces implementation in the central area of the city, the pedestrian and tourism improvement, the increase in land price (30-50% for properties within 50 meters from the project) and in companies number (Asian Development Bank, 2016, pp. 56-58). The "Green Street Stormwater" plan adopted by Milwaukee is a set of strategies that could be utilized in different street settings. This strategies (such as bio-retention, tree trenches, and porous pavements) applied to street and alley projects are useful to reduce rain off and to improve storm-water quality (City of Milwaukee, 2013).

- *Underutilized and abandoned areas actions (urban and local scale).* Underutilized and abandoned areas are often localized in strategic urban contexts (near central and high density areas), this feature coupled with lack of green spaces and ecologic elements makes them extremely suitable for Nature-Based Solutions. The NY High Line transformation from disused railway to public walkway is a virtuous example of urban regeneration. This project creates a green infrastructure which runs through a high density city area and generates new attractive public spaces. The green design incorporates the vegetation grew along the tracks during the years when the structure was neglected. The construction is essentially a green roof with water recirculation system that can reduce CO_2 emissions and heat island effect in the urban compartment. Furthermore, it is an intervention based on local community involvement (American Society of Landscape Architects; Friends of the High Line). Another emblematic example is Berlin former airport Tempelhof, which has been recently transformed into a vast public day park. It is one of the largest open spaces around the city center and its areas have become a significant habitat for various bird and plants species. The park development and conservation plan is based on public participation that plays a primary role in the choice of collective uses (Grün Berlin).
- *Urban spaces actions (urban and local scale).* The nature-based approach is also an optimal solution for urban open spaces. A classic example is that of pocket parks, micro green spaces at neighborhood scale that behave as small green spots by regulating urban microclimate, reducing pollution and mitigating pressure on large parks. In addition, these spaces can accommodate different typologies of functions and uses (even temporary) providing different services to residents and city users. Among the most emblematic examples there are Paley and Greenacre Park, New York (O'Brien, 2014).
- *Building actions (local scale).* In order to obstruct the climate changes effect within urban centers, Public Administrations promote the realization of artificial green elements. The green facade of Vienna Magistrate building (MA48) creates ecological niches and habitats for many kinds of insects and birds and having positive effects on the surrounding microclimate. This pilot project, financed by the city, is part of Vienna planning strategy. The great success obtained on multiple political levels led to the adoption of additional measures (Ecologic Institute, p. 16). The presence of a green roofs is able to respond to sustainability needs as well as increasing biodiversity and quality of the surrounding urban environment (City of London, 2011, pp. 12-13).

Regarding intangible urban commons, Nature-Based Solutions contribute to the improvement of environment quality and, therefore, to citizens' social, physical and psychological well-being and to quality of life. The environmental quality of an urban context depends on several factors that identify the load generated on environmental components (pressures), the quality of the components themselves and the policies and behaviors that are activated. Some of these parameters are countable (in example: percentage of pollutants present in the air and in the water, linear meters of cycle paths, square meters of available green areas) and others not (such as urban fabric, integration between open and built space, buildings aesthetic quality). Environmental quality is one of the key indicators of society's well-being together with health, education and training, work and life-time conciliation, economic welfare, politics and institutions, security, landscape and cultural heritage, research and innovation and quality of services (Istituto nazionale di statistica, 2015). "The urban environment influences human well-being, therefore, a healthy, supportive environment is indispensable to quality of life in cities. People need to breathe clean air, have access to clean drinking water and adequate housing conditions and enjoy quiet and peaceful places. Accessible, good quality, well-maintained green spaces and playgrounds, modern transport systems and safe, walkable neighbourhoods that encourage physical activity and social interactions are key constituents of urban quality of life" (European Environment Agency, 2009, p. 13).

Figure 1– Examples of Nature-Based Solutions applied to material urban commons

Conclusions

Nature-Based Solution are actions able to improve the state and the quality of material and intangible urban commons. Their application provides several benefits both at large scale than at local one. At urban scale, they become redevelopment opportunity of urban compartments; while at local scale they increase the microclimate and generate more attractive spaces. Moreover, the sum of punctual interventions ensures positive effects on the entire city system. In order to achieve optimum results, the implementation of these green and smart actions must be supported not only by Public Administration but also by private actors (individual and formal or informal groups and parties). The involvement of human actors is a key factor in recent urban planning processes. In fact, people are not only the beneficiaries of the intervention, but especially the promoters that participate during several implementation steps (decision making, construction, manage, maintenance and assessment). In NY High Line project, local community

has played a key role for the regeneration of abandoned space: a citizens' group started the campaign to convert the railway into new collective spaces and the citizens' association "Friends of the High Line" is now responsible for manage and maintenance activities. The Tempelhof park of Berlin is a people involvement intervention, in which current and future uses are determined through a participatory planning process.

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Smart Environment and Nature-Based Solutions

Veronica Gazzola

Introduction

In the last decades, different concepts emerged in the European scientific and research context about the theme of the urban sustainability, the environmental protection and the enhancement of its resources.

First Smart City, in its Smart Environment component, finds the opportunity to achieve sustainability and energy efficiency goals using different infrastructures and tools for managing and sharing information about the environment and its criticality. In recent times the concept of Nature-Based Solutions is underlined as a system of urban actions aimed to protect, sustainably manage and restore natural (or modified) ecosystems; moreover NBS address societal challenges in an effective and adaptive way, providing human well-being and biodiversity benefits. Starting from the analysis of these two concepts (definitions, evolution, features, etc.), the aim of the author is to define possible relationships, coherences and potential conflicts between Smart Environment and NBS.

Smart Environment for urban sustainability

Statistical data provided by major international institutions show that urban growth is increasingly becoming a global phenomenon. Long time now cities all over the world are in fact in a state of flux and exhibit complex dynamics where population is more and more concentrated (UNDESA, 2015). The substantial increase in the average size and in the number of cities generates several adverse effects on the physical and organization structure of the urban environment: social pressures, global economic crises, environmental problems also linked to consumption of natural resources (i.e. resource scarcity, degraded air and water quality, reduced availability of green space, etc.) are some examples. In time, the increasing need to redesign urban areas by focusing on the needs of citizens, by organizing resources in a better way and providing more efficient public services has obtained a key role in the definition of possible development guidelines for cities. In this regard, since the 1990s the concept of Smart City has been pointed out as strategic solution to problems linked to the irreversible process of conurbation. Over the past few decades, during which research institutes, universities, institutions and companies have given a strong contribution on the theme focusing on different aspects and areas of action, the attribute 'smart' deeply evolved. First it defined the 'digital' city characterized by global intelligent use of digital technologies, then it grew the 'socially inclusive' city where not only digital infrastructures but also mobility, quality of environment, governance of urban systems, economic context become important factors to consider for the urban growth and finally scholars focused on the city able to ensure 'better quality of life'. Within all this extensive scientific literature, 'sustainability' emerges as main strategic theme (Table 1).

Steria, 2011	Integration of technology into a strategic approach to sustainability, citizen well-being, and economic development.
Think, 2011	Fundamental aspects of a Smart City: friendliness towards the environment, use of information and communication technologies as tools of management, and the ultimate goal of sustainable development.
Toppeta, 2010	A place with a high quality of work, study, life and social relations; capable of supporting the expectations of a better future individually and collectively, compatible with the planets resources and people's human rights.
Caragliu et al., 2009	A city can be defined Smart when investment in human and social capital and traditional (transport) and modern (ICT) communication infrastructures fuel sustainable economic growth and a high quality of life, with a wise management of natural resources through participatory governance.
Hollands, 2008	Territories with a high capacity for learning and innovation, which is built in the creativity of their population, their institutions of knowledge creation and their digital infrastructures for communication.
Giffinger et al., 2007	A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent, and aware citizens.
Appleyard et al., 2007	A city striving to make itself more efficient, sustainable, equitable, and liveable.

Table 1 – Main definitions of Smart City

Smart City is idealized in fact as sustainable city aimed to create, using technology systems, an urban environment able to ensure a balance between economic development, environmental protection and social equity. In particular, its Smart Environment component identifies an urban context (natural or rural) promoting a sustainable development by several activities as the reduction of waste production and the enhancement of recycling; the drastic reductions in greenhouse gas emissions limiting traffic, streamlining industrial emissions and promoting building regulations and techniques able to decrease impact of heating or cooling systems; the promotion and protection of urban green areas, the urban planning limiting soil consumption and promoting the redevelopment of brownfield sites.

In terms of technology, the increasing distribution of efficient and low-cost monitoring systems and sensors spatially well distributed over a territory, permits to measure, obtain and transfer real-time data and information about a detected environment in order to share knowledge among different urban actors. In addition to the expert group using these detection technologies, the active involvement of citizens becomes fundament to build a smart urban environment. Data and reports from high-tech systems can support in fact active policies and actions to be taken in a given community.

In conclusion, the concept of Smart Environment and in general of Smart City can be considered on the basis of two main dimensions: a 'technological dimension' that takes account of the existence in an urban context of high standards of innovation products and a 'social dimension' that involves the social capital of a urban system in order to reach appropriate levels of quality of life by an efficient use of its resources. The intersection of these two dimensions brings to the definition of the so-called 'anthropogenic sensors', term used to define those citizens that, using and managing independently technology systems, are able to monitor and geo-reference urban phenomenon (Sagl et al., 2012; Fisto-

IUCN, 2016	Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
European Commission, 2015	Living solutions inspired by, continuously supported by and using Nature designed to address various societal challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits.

Table 2 – Main definitions of Nature-Based Solutions, NBS

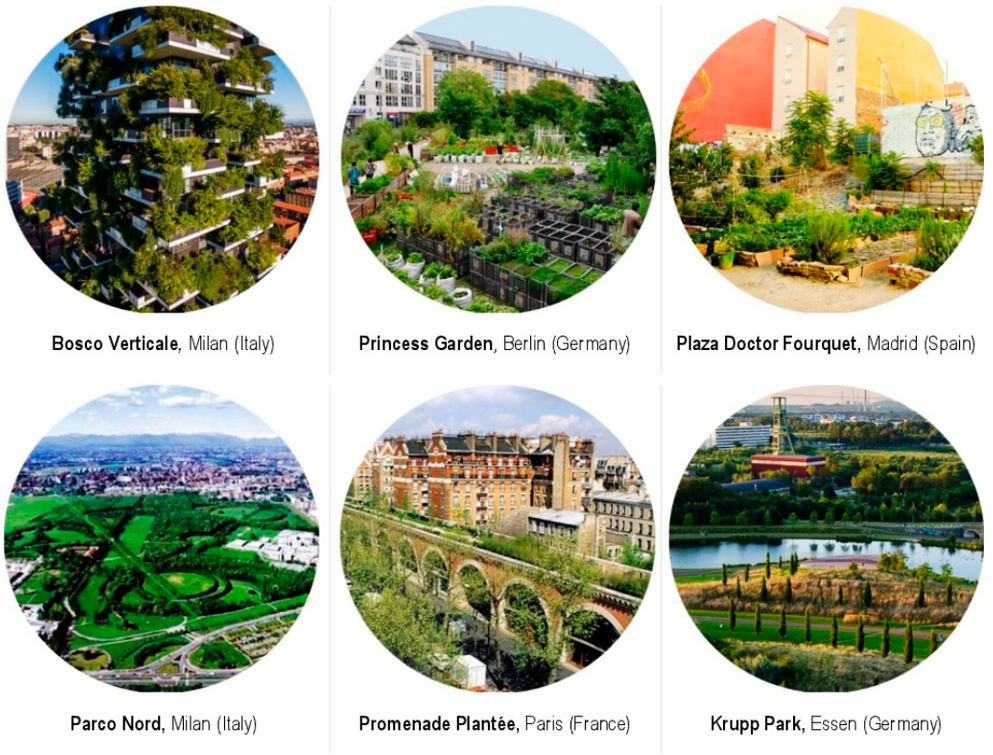

Image 1 – Some examples of NBS in contemporary cities

la, 2013). In urban contexts, there are a lot of possible applications in this sense. It is possible to measure and control some issues of urban human activities linked to traffic, parking, noise, waste management, air quality or structure monitoring of buildings. Then at a greater scale, monitoring systems can be used to detect natural criticalities, risks (i.e. fires, landslides, floods, etc.) or unfavourable weather conditions. The availability of the information on the environmental status and the possibility of easy access to them represent essential conditions to reach a good level of sustainable urban smartness.

Nature-Based Solutions to re-nature contemporary cities

The increasing interest and awareness of the value of using and applying nature-based norms and principles (refers to ecosystem approaches, biomimicry or direct utilisation of elements of biodiversity) to obtain several positive effects on urban environment lead more and more to the definition of solutions and actions to societal challenges providing simultaneous environmental, social and economic benefits. In this sense, since its first appearance in scientific literature in the early 2000s, the concept of Nature-Based Solutions (NBS) has been emerged as a priority area to enhance sustainable urbanisation, to restore the functionality of degraded ecosystems and their services, to develop climate change adaptation and mitigation, to improve risk management and resilience (Word Bank, 2008; European Commission, 2015) and to provide benefits for biodiversity and human well-being (UN, 2013; Cohen-Shacham et al., 2016).

Increasingly developed and applied by International Union for Conservation of Nature (IUCN) and other organisations as the European Commission (Table 2), NBS concept identify three main types of Nature-Based Solutions involving: 1) better using existing ecosystems, 2) modifying existing ecosystems to better deliver selected ecosystem services or 3) design and management of new ecosystems (IUNC, 2016).

At the urban scale, NBS concept (Type 3) identifies a range of scalar interventions: the design of city-wide ecological networks, the local urban parks that provide recreational functions and benefits in terms of cooling alleviation, the micro-scale design to retain water (i.e. rain gardens, roadside bioswale) or to reduce heat stress (i.e. green walls, green roofs) (Scott and Lennon, 2016). As trees provide cooling and insulation and reduce the urban heat island effect, green infrastructures can contribute to cutting energy and resource demands/costs and green roofs/green walls can decrease the need for heating and air conditioning. Sustainable urban growth can also be reached by the conversion of abandoned land into urban community gardens and by the regeneration of former factory sites transformed into green spaces for the people. Using Nature-Based Solutions to enhance urban spaces can stimulate healthy physical activity with positive effects on health, well-being, social cohesion and community support.

Nowadays, a lot of NBS application projects can be found in urban contexts. For example, the city of Milan implements different Nature-Based Solutions as part of its architectural and urban renewal strategies. Bosco Verticale (Boeri, 2014) is an advanced engineering and technological project which uses NBS as an example of sustainable urbanisation: two residential towers (respectively 110 and 76 meters high) host 900 trees and over 20 000 plants distributed according to the sun exposure of the facade. It is estimated that the ecosystem services from the plants in the two towers (CO_2 storage, air quality, biodiversity improvement) are equal to the services of 2 ha of forest (European Conference, 2014). Another good example is represented by Urban Gardening experiences promoting gardening as a hobby, encouraging social contacts, making green areas more accessible. Green urban areas (i.e. public parks, gardens, urban forests, etc.) are created for multiple purposes with people's involvement in their management. Parco Nord in Milan (Borella, 1983) which offers local inhabitants farming, forestry, cultural and recreational activities, preserves landscape and ensures the protection of biodiversity;

the in Paris (Jacques Vergely and Philippe Mathieux, 1993), an elevated freight rail line was transformed into a park; the Krupp Park in Essen (Germany) (2009) steel factory transformation into a 230 hectares green belt are just some of many examples (Image 1).

Considerations for the implementation of NBS in an urban Smart Environment

On the basis of definitions and features of described concepts of Smart Environment and NBS, it is clear that a possible link between them permits to reach a better sustainable urban development in contemporary cities characterized by uncontrolled urban sprawl and therefore serious problems about human health, quality of life, well-being and security of citizens. Their common goals are in fact related to provide solutions to significantly increase cities' overall energy and resource efficiency. In particular, both emerged as priority themes for the EU's Horizon 2020 (the European Framework Programme for Research and Innovation 2014-2020), their key challenges should bring positive effects (economic, social and environmental) for cities and communities, resulting in a better quality of life, including health and social cohesion. Keeping together the main features of Smart Environment and NBS becomes a strategic approach to reach these goals in a more efficient way. Nature-based Solutions can be implemented in an integrated manner with other solutions to societal challenges, in particular with human/social capital and modern communication infrastructures. Using Information and Communications Technology, ICT as a supporting tool for NBS and ecosystems, greater benefits can be reached in terms of sustainable urban development. This aspect is increasingly emerging in the scientific context.

In this regard, during the conference "Nature-based Solutions: From Innovation to Common-use" organized by the Ministry of the Environment of Estonia and the University of Tallinn in last October has been underlined the importance of Geographic Information Systems (GIS) environmental data analysis, mobile phone apps for the monitoring, planning and better management of natural systems in order to inspire, develop and maintain NBS. In addition to this, ICT can play an important role in raising general awareness of NBS through citizen science projects and community led urban development. The conference results show that at the moment there are some eco-innovative technologies involving different customers and actors (cities, data providers, citizens, etc.) that can make easy the access to this city knowledge, adding value and revenues for the urban ecosystem (i.e. The City Enabler, GreenFrame, UNaLab project, etc.) (NBS, 2017). Starting from these results on the theme, future researches should focus on the development of long-term sustainable data platforms, ICT and innovative communication strategies securing open access and interoperability along data infrastructures in order to continuous build up of knowledge about the environmental status of an urban context and consequently manage intelligent and sustainable cities by NBS.

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Mexican Nature based Solutions for the improvement of rural communities, within tourism development

Tiziano Cattaneo, Emanuele Giorgi, Viviana Barquero, Andrea Alicia, Mendez Espitia

The role of Tourism as a Driving Force in the Contemporaneity

In the last decade, a young middle class, started seeking for culture and creative goods, creating a new demand in many markets of the world, with important effects on infrastructures, environment, culture and economy. The phenomenon of tourism represents a very strong driving force in the definition of the society and, as consequence, of the environment and the economy: in 2016 the international arrivals have been 1.2 billion, while it is supposed to be 1.8 in 2030; in 2017 tourism represents the 10% of world's Gross Domestic Product (UNWTO, 2017). From and environmental point of view, carbon dioxide emissions arrive to cover the 566 Mt of Co2 in the 2015 (UNWTO, 2017). Diversification of the touristic destinations is another key factor in the touristic phenomenon of the last six decades, making several new destinations emerging in addition to the more traditional Europe and North America. From the importance of this phenomenon it is easy to understand how great the impact on society is and how easily it can become a key driver for socio-economic development, especially in developing countries. Many times, however, this facilitation of the re-establishment of economic resources can cause an easy disregard for the social environment, in terms of territorial and natural equity, in terms of biodiversity loss, pollution and destruction of natural resources.

These so great dangers, at the same time so closely related to forces of potential development for the territory, have imposed policy guidelines for a conscientious and sustainable development of the tourist phenomenon, leading many times by Nature Based Solutions (NBS). Analyzing case study cases of Mexican projects of tourism promotion affecting the promotion of life in abandoned villages and environmental enhancement, this research seeks to investigate how Mexican tourist promotion policies are reflected in reality.

Research seeks to clarify how Mexico has more or less nationally targeted NBS practices for tourism promotion and how these have been met in real cases.

Tourism Phenomenon in Mexico -Benefits on the Communitarian and Territorial Context

Data about the impact tourism has had in recent years in the world as described above, are more relevant if they are analyzed in countries with large growth and high potential for developing tourism strategies, such as Mexico. In this country, the federal government, together with state and local governments, is developing guidelines for the sustainable development on tourism (SECTUR, 2011). The sustainable tourism phenomenon in this region has an important impact on its economy, its territory, its environment and its culture. For instance, just in 2016, Mexico was ranked eighth on international arrivals, moving from 23.3 million international tourists in 2010 to 35 million in 2016 (WORLDBANK, 2016)

Meanwhile, as it is happening in a lot of countries, the attractive lifestyle of cities followed by the automation of agriculture creating unemployment in rural areas has forced the abandonment of rural villages. This has strongly impacted the indigenous communities as well as the protection of biodiversity and environment, being tourism a potential solution for this kind of problems.

Although Mexico has no specific normativity for Sustainable Tourism, there is a program for Sustainable Tourism since 2011 (SECTUR, 2011), which is more an instrument of promotion for sustainable practicesin the sector than an enforcement program. The Mexican Secretariat of Tourism collaborates with Earthcheck (2017), who is the consulting agency that offers certificates for sustainability, as a way to encourage sustainability actions within touristic attractions. The Mexican Federal Attorney for Environmental Protection furthermore regulates basic practices based on environmental quality and destination cleaning. However, we found that the Pueblos Magicos program, although is not considered within the sustai-

nable tourism program, it promotes true sustainability within rural communities.

The "Pueblos Mágicos" program as a sustainable approach towards improvement to rural communities.

The Program "Pueblos Mágicos" was created as a way to encourage tourism within the non-traditional international touristic spots of the Mexican Country. The program was generated as a strategy to generate economic development in the interior regions of Mexico, triggering other sectors that have been abandoned mainly due to migration to urban settings. According to the Secretariat of Tourism in Mexico, the Program "Pueblos Mágicos" aims to encourage sustainable development through strategies that generate value of the attractions found within the community. In order to be granted as "Pueblo Mágico", a town or community should demonstrate its own character through unique attributes, symbols, or historic or natural venues that contribute to the understanding of the town's everyday cultural and social values (SECTUR, 2014). This program was institutionalized in 2001 when thirty locations were incorporated throughout the country, representing an initial investment of 187.1 million pesos (SECTUR, 2002). "Pueblos Magicos" promotes rural tourism and complements the seven most important national touristic programs: Beach Centers, The Heart of Mexico, Mar de Cortés-Barrancas del Cobre, The Route of Gods, Colonial Treasures, Mayan World, and Borders (SECTUR, 2002). This means that, in order to be part of the "Pueblos Magicos" program, a community must be located within 200 kilometers or two-hour distance from these existing routes or touristic features.

The incorporation and permanence in the program depends on the level in which sustainability is involved in the different activities, attributes or venues within the location. The marketing approach is oriented towards a sustainable tourism approach, encouraging a specific target market to visit the location; a market that is more conscious about the natural and built environments, and is interested in learning from the native cultures.

In order to be considered a "Pueblo Mágico", a town should demonstrate the direct and permanent participation of the living community and the local government. Community members of a "Pueblo Magico" are encouraged to participate at induction workshops for planning and management for cultural tourism. In these workshops people is invited to generate traditional economic activities such as artisanal production; ecotourism activities like nature observation, fishing, horse riding; and, cultural tours, where town's everyday life can be shown.

A transversal relationship among public institutions, government, economic actors, and local society is required in order to promote successful activities that end in a long term development practice benefiting social and economic aspects of the community mitigating poverty and social exclusion (SECTUR, 2014).

In 2017, the "Pueblos Mágicos" program incorporated an addendum granting access to a credit fund specifically for rural tourism investment. This credit fund is oriented to help either entrepreneurs interested on rural tourism, developing activities considered ecotourism; or to local food service providers interested in supply hotels and restaurants on rural towns. The aim of this addendum is to encourage investment in specific areas, such as local food production and consumption, or economic activities related to ecology and adventure programs, in communities that have less than 50,000 inhabitants (SECTUR, 2017).

The approach followed by the "Pueblos Magicos" program has benefited 111 rural communities to date (DATATUR, 2017) with economic resources for developing existing or new infrastructure, urban image, touristic resources and equipment, creation, improvement, and rehabilitation of sites with touristic potential, creation and innovation of touristic products, and investment on service quality. Community members were benefited with courses and workshops on how to create their own business, supporting the economy of hospitality further developed in their town.

Three Case Studies of NBS Touristic Promotion in Mexico

We selected three case studies that present successful stories on how the "Pueblos Mágicos" program has changed their economic reality by promoting strategies that involve nature based solutions. Since the wide dimension of Mexico, the great cultural difference in the country and the strong local identity of the different regions, considering projects from totally different areas of Mexico has been necessary. The three case studies are presented as follows.

Community Tours Sian Ka'an, Quintana Roo

Close to the most cosmopolitan and populated touristic areas on the southeast coast of Mexico such as Cancun, Islas Mujeres, and Playa del Carmen, Sian Ka'an is located. Declared world heritage by UNESCO in 1987 (UNESCO, 2017) and Pueblo Mágico in 2015 (DATATUR,2017), Ka'an is a community which decided to work towards the development of new forms of tourism that will decrease impacts on the environment as well as maintaining the local benefits of tourism. The hazard arises with the lawless volume of tourism in the closest areas, main reason why a local Mayan group of entrepreneurs with a responsible attitude of protection of resources, determined to create a tourism company named Community Tours Sian Ka'an which has become a successful case of sustainable tourism. The purpose of this company is to minimize the environmental, economic, social and cultural cost and maximize the benefits tourism can bring to the closest communities. Their growth methodology initiated training a group of people through a process of guidance from national and international organisms based on innovation a compromise. This company brings in around 7,000 tourists to the area, in which each step of the operation process seeks to be resilient with the ecosystem by reducing their carbon footprint and also making up for CO_2 emissions. According to Gilbert et. al. (1994) this example of sustainable tourism is known as Responsible Tourism, which is characterized by individual actions which recognize the need to feel and to be responsible for the development of a touristic area taking into account the intrinsic values that are held by those involved.

El Llanito, Dolores Hidalgo, Guanajuato

Dolores Hidalgo is a city in the central Mexico with 50,000 inhabitants, a symbol of the national identity, as on September 16 of 1810, Father Hidalgo launched the famous shout that paved the way for the Mexican independence. Due to this historical importance, it was selected in 2002 as one of the first Pueblos Mágicos (DATATUR, 2017).

However, the contemporary city, the symbolic destination of national tourism, has grown quite widespread, coming to incorporate villages that, however, retain their own character and identity. These villages, although being aggregated in the urban area, suffer from phenomena of abandonment by younger population groups. One of these villages, the one of El Llanito, which develops around one of the churches once occupied by Father Hidalgo has been the subject of actions for tourism promotion. In particular, the church and his adjacent kiosk have been recovered. In this building that hosts a rural museum, the inhabitants of the village welcome tourists who arrive to see one of the symbols of the life of the Father of Homeland, but in particular to experience the discovering of the local Otomí traditions in terms of craftsmanship and cooking, inspired by an ancient lifestyle, in close relation to nature: from the production of the first ingredients coming directly from the surrounding fields, to harvesting wild plants, to grinding corn and to the production and marketing of food. The recreation of reconnection experiences with a natural dimension of production and the search for sustainable promotional forms of local culture are the basis of a tourist offer that restarts the life of the village by promoting activities and tourist events. The experience that is offered to tourists is therefore based on the total relationship with a zero-impact lifestyle where you can experience the artisanal and culinary production (GOB, 2017).

Casas Grandes Chihuahua, Chihuahua

The Casas Grandes Region in Chihuahua is internationally known for its 13th century adobe ruins, considered the most important archaeological site of Northern Mexico, being World Heritage since 1998 (UNESCO, 2017). Communities in Casas Grandes since ancient times had produced pottery, however, when Spaniards came to Mexico and conquered this land, they tried to implement agriculture to these sites, despite the dry climate conditions. After the Mexican Revolution in the beginning of 20th Century, there were neither natural nor capital resources to maintain agriculture within this territory, forcing to younger generations migrate to the United States, until one member of the community, Juan Quezada, started creating pottery from the sand and other mineral materials found on the land, as a remembrance of ancient memories. The community followed Quezada's path, so that today this community has an annual average revenue of 10 million dollars and an international reputation from their artisans (de Jong, 2011).

The region was appointed as Pueblo Mágico in 2015 due to both the World Heritage Site and the cultural heritage of the pottery sector. The economic resources coming from this designation are allocated to development projects that encourage sustainable practices that promote tourism, mainly focused on the pottery business. The Casas Grandes town, therefore, has developed hospitality venues with specific construction characteristics, using earth as main construction method. The Museum of Northern Cultures, located in the Paquimé archaeological site, has also been developed with sustainable building strategies resembling ancient buildings once found in the area.

The experience offered to tourists allows understanding on how ancient cultures were respectful with nature but also how nature was useful to them without harming the environment.

Conclusion

These cases serve as examples of what we consider a sustainable approach towards using Natural Based Solutions. Unlike the common thought that natural based solutions are mainly the fact of renaturing cities and using pristine land for recreational and relaxation purposes, we further believe that natural based solutions can become a strategy for development by using natural resources to promote economic development for rural communities, which mainly are abandoned due to a lack of opportunities in their villages. By promoting the intensification of activities and the life of suburban areas, which are in risk of being abandoned or being agglomerated into urban sprawl, we can create sustainable opportunities that will reconnect to the natural dimensions outside the city. This approach will benefit not only the villagers themselves but also is discouraging migration to urban areas, preventing ecosystem degradation provoked by uncontrolled urbanization and the loss of natural capital.

These examples are approaching sustainable tourism by using natural based solutions developing their cultural, social and environmental resources, while generating an economic value to their communities, encouraging territorial resilience towards climate change.

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Transculturation in Architecture Nature Based Solutions of Contemporay Architectural Practice in Shanghai

LIU Kan

Introduction

Shanghai, in Chinese literally means "on the sea", is Chinàs largest city. Itŝ modern times and cultural background symbolize the transfer between Western and Chinese civilization. Starting from the treaty of Nanking in 1842, Shanghai as one of the five cites in China opened to Western trade and residence. Shanghai is a city of paradoxes, which combine the Western cultural and the Chinese spirit that witness the dramatic growth from more than a centurỳs transformation. After the Peoplès Republic of China (PRC) was establishes since 1949, Shanghai experienced a radical change. Thanks in parts to the open policy initiated in 1978, the economic reform as the prior growth is well conclude the urban development of Shanghai.

The Transculturation in architecture has always been a blend of different streams amalgamating in a given cultural context at a given period in time. The foreign architectural practice as their interpretation of the "local" elements, which in turn was adapted by local architects and further developed as an "own" architectural identity is seems to be a general principal of cultural transfer in architecture. Shanghai architecture reflects the inherent conflict and complexity of the cultural integration. The characteristics is both contradictions and harmony, annoying and interesting, not only abnormal but impersonality, not only dynamic but chaotic, both luxury and budgeting, both obsolete and innovative. In general, the cross-culture fusion from Modern Shanghai results to the multi-cultural integration and create the unique identity of Shanghai architecture.

Shanghai Architectural Identity

Shanghai's history of modern architecture is very concerned the history of architects (Lai, D.L. 2006). 1843 Shanghai opened as a treaty port, after 1890 large numbers of Western architects came to Shanghai (Wu, J. 1997). The profession of modern Chinese architects can be said that originate from foreign architects entering Shanghai (Wang, K. 2015). In 1927, Shanghai Institute of Architects was established by the oversea educated Chinese architects Lyu Yanzhi, Fan Wenzhao, Zhuang Jun, Wu Zhenying, Zhang Guangqi, etc. In the next year, it renamed Chinese Institute of Architects. In the year of 1931, there were 39 formal members and 16 associate member. Of the 39 formal member, 37 of them had studied abroad, of which 29 returned from the United States, two from Britain, one from Japan, two from France, two from Germany, and one from Belgium (Liu, K. 2011).

According to the statistics of China Architecture Society of China in 2015, China has first level registered architects 32542, second level registered architects 19171, all of that is 1/37620 of the national population. Compared to United States, there are 22360 architects accounting for 1/1429 of the population; Spain has 51,000 architects, similar to the number of Chinese architects, accounting for the population of 1/915; Germany has 101600 architects, almost twice as much as China, accounting for 1/789 of the population; Italy has 147,000 architects, accounting for 1/4 of the population (Zhou, G. S. and Zou D. C. 2013). According to the American Institute of Architects (AIA), 70% of US architects have oversea working experience, 30% of all firms of architectural practices are international architectural firm. In Europe, the Horizon 2020 has conducted researches on the design practice of European architects abroad. The project has cooperated by architectural historians from nearly 20 universities in 14 countries. Research products such as publication Architecture beyond Europe (ABE Journal) is very much important to understand the European architects out of Europe practice.

Shanghai foreign architects participate, the phenomena in the breadth and depth can nothing be compared in the world today. Shanghai Pudong Lu Jiazui Development Company from 1990 to 2015 project development statistics show that in Pudong Lu Jiazui area built 200 architectural projects, of which 98 by foreign architects design. Compare with the project square meterŝ scale, foreign architects complete more than twice the size of the local Chinese architects do during the same period of time.

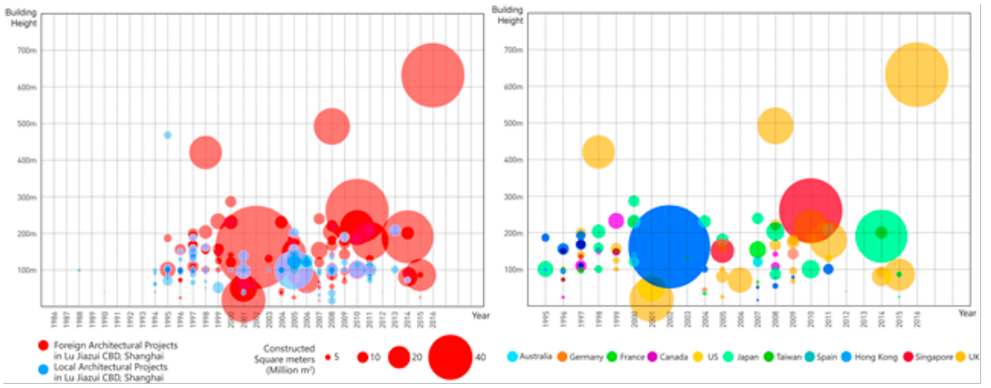

Figure 1– Clustering Pedigree Map of foreign and local architectural practice in Lu Jiazui CBD area of Shanghai.

Contemporary Architectural Practice in Shanghai

Transculturation in architecture can effectively intervene in Shanghai architectural and cultural events. The study from time, event and context, could be more in-depth to understand the Shanghai architectural culture. As a narration, the foreign architectural practice in Shanghai after 1949, as an important argument on Shanghai architectural identity, depicts unique characteristic on transculturation in Shanghai architecture.

In the first 30 years of China found after 1949, the development follows the domestic ups and downs of the planned economic system, which is basically isolated from the international environment of architecture (Zou, D. N, 2009). Since the 1980s, foreign architects have gradually participated in the large-scale urban construction in Shanghai, bringing new architectural ideas, design ideas and working methods, played a positive role. Projects from early periods single building to the city planning, regional planning, urban design, landscape design, interior design, etc.; types from the hotel, extended to public buildings, residential buildings, building heritage and heritage areas.

In 1989, municipal government of Shanghai organized the "Top 10 Architectures, Shanghai". Three projects: the Shanghai Exhibition Center (1955) designed by Soviet Union architect Sergei Andreyev, Hua Ting Hotel (1986) designed by Hong Kong architects Wang & Tung International, Ltd., and Shanghai Jingan Hilton Hotel (1989) designed by Hong Kong AP Architects Ltd. In 1992, the Pudong Lujiazui Central District International Competition of Urban Design, invited architects from Italy, Britain, Japan, France to participate into the competition. In 1999, Shanghai organized a public voting for excellent buildings in Shanghai after 1949. Except one project was constructed in 1950s, all the rest were coming from 1990s. Amount the top 10 projects, 5 were done by foreign architecture practices.

The urban development of Shanghai can be divided into four eras: the period of industrialization and commercialization (1949-1978), the period of centralization (1978-1990), the opening and development of Pudong District (1990-2010), and the globalization on contemporary architectural practice after 2010 Shanghai world EXPO. Regarding to the foreign architecture practice in Shanghai, the staging can be subdivided into Shanghai city's recovery (1949- 1956), the urban development of Shanghai under the aim of industrialization (1956-1966), stagnation and development of Shanghai (1966-1978), the "Reform and Opening" and the high-rise buildings in Shanghai 1980s (1978-1990), the first decade of the Pudong development (1990-2000), the first decade of Shanghai from 21 century (2000-2010), 2010 Shanghai World EXPO, and the new agenda of Shanghai in architecture after 2010.

In this study, totally researched on 184 projects completed by foreign architects in Shanghai after 1949. Besides one project from 1950s, there are 6 projects by foreign architects completed in 1980s; from 1990 the opening and development of Pudong District to the year 2000, the complete projects reached to 47, accounting for 25.5%; after 2000 to 2010, the foreign architectural practice in Shanghai has 117 complete projects, accounting for 63.6%. From the development trend could be seen, since 2000, the first ten years of Shanghai complete foreign architecture projects more than the total quantity from 1949 to 1999, 50 years the foreign architectural projects in Shanghai.

Architects in Shanghai have diverse cultural backgrounds, foreign architects and international architecture firms, mainly from the United States, Hong Kong, Canada, Japan, Germany, Singapore, France, the United Kingdom, Taiwan, Italy, Australia, Switzerland, Spain and other countries and area. Based on survey statistics since 1949, Shanghai's foreign architects built 184 projects, including US architects accounted for 34%; European architects increasing rapidly after 2000; Hong Kong, Taiwan, Singapore and Japan, for the convenience of language or distance reasons total projects accounted for 30%.

Conclusion

Shanghai architecture reflects the inherent conflict and complexity of the cultural integration. The characteristics is both contradictions and harmony, annoying and interesting, not only abnormal but impersonality, not only dynamic but chaotic, both luxury and budgeting, both obsolete and innovative. In general, the cross-culture fusion from Modern Shanghai results to the multi-cultural integration and create the unique identity of Shanghai architecture. This study focuses on the phenomenon by foreign architectural practice in Shanghai after 1949, which used to be considered as the external manifestations on cultural transfer and architecture, and promoted the transforming of Modern Shanghai. As one of the result in architecture from the global impact, the importing of foreign architecture practice in Shanghai not just push forward the social and technical changes, which represented by foreign architects and their works, but also the role and impact in cultural transfer change the identity of Shanghai architecture. The global impact by foreign architectural practice does not simplify the culture of city by losing sense of characteristic. On the contrary, the trend of transculturation motived different culture relation come into Shanghai to become more pluralistic and pragmatic in architectural practice, which turn into the architectural identity of Shanghai to transform the city, which become kind of unique that blowing the rest out of water.

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Chinese Vs. European strategies for eco-development of territories: differences and suggestions

Cecilia Morelli di Popolo

Introduction

UN habitat evaluate that in 2030 one citizen on three will live in a city with at least half billion of citizen. The ever-increasing urban population, and therefore the size of cites and satellite centers, requires more ground, more energy, and generate more pollution and pressure on the environment and on people's health.

The natural environment will be under strong pressure: the most critical aspect is to find an equilibrium between economic/urban growth and environmental protection (connected with healthy and quality life). Following the WUP, "Cities are where the pressures of migration, globalization, economic development, social inequality, environmental pollution and climate change are most directly felt. Yet at the same time they are the engines of the world economy and centers of innovation where many solutions to global problems are being piloted" (World Urbanization Prospects, the 2011 Revision: Press Release. New York, 2012, Released: 5 April 2012).

What are the consequence for the development and government of territories?

Urban development context

According with the World Urbanization Prospects made by United Nations, the world's cities are growing in size and number: in 2016, there were 512 cities with at least 1 million citizens. In Asia and Africa it is possible to find the world's fastest growing cities: 6 in Africa and 40 in Asia (20 in China alone). The consequence is that most cities are vulnerable to, at least, one type of natural disaster: with the increasing of the population, the high risk of exposure to a natural disaster increase a lot. Around 15% of cities (including also megacities like Tokyo and Manila) can be under two or more types of natural disaster, in particular along the coast.

The paper wants to focus on the strategies

regarding the development of the territory in China, and the differences and similarities with European development strategies. Indeed, in Europe 70% of population live in cities and this percentage will increase to 80% by the middle of the century (this percentage means 36 million of new citizens by 2050). In Chinese country, with the development of Mega-city and Super-city, the situation is even more particular and interesting.

The relation between this two areas in the field of eco-urban development, become more tangible from 2012, when the European Commission and the Government of People's Republic of China signed a Joint Declaration, in order to create a partnership with the main aim of urban sustainable development strategy.

In particular, the partnership will highlight the following subjects:

1) Strategies and polices relevant to the development of urbanization;

2) Spatial distribution of urbanization;

3) Sustainable development of urban industrial economy;

4) Urban public services system;

5) Urban infrastructure investment and financing mechanisms;

6) Urban housing supply system and patterns;

7) Urban energy supply and demand management;

8) Urban mobility, public transport and smart transport;

9) Urban green building;

10) Urban ecological protection, environmental protection and treatment;

11) Protection of urban historical and cultural features and formation of urban landscape;

12) Urban governance;

13) urban-rural integrated development;

14) Exchanges and discussions as well as personnel training on urbanization development

(Joint Declaration on the EU-China Partnership on Urbanisation, Brussels, 3 May 2012).

The subjects inside the Joint Declaration follows different thematic included in development programme of each country: 7th Framework programme of EU research founding (FP7), 2007-2013, and the 12th Five-Year Plans for economic and social development of the People's Republic of China (2011-2015).

Starting from this agreement, different European and Chinese cities put their names to cooperation agreements. This cooperation is a sort of platform in which the two government can share, promote and support different ideas and programs for the sustainable urban development, between the business, academic and governative system.

It is obvious that one of the most important reason of this agreement is economic: the economic role of China is relevant for each EU countries; from the other side, the culture, the history, the development of sustainable EU programs are important and significant inside academic and governative systems.

The connection and equilibrium between sustainable development and economy, in these two countries, followed different strategies, with the same objectives: the protection of the territory and the economic development of the areas.

EU Context

Starting from Istanbul (with a population of more than 14 million of inhabitants), the cities of London, Berlin, San Petersburg, Madrid, Paris, Rome, Kiev and others, overtake 1 million of citizens. In 2030 the prevision of the population distribution will be 3 cities with 10 million of citizens or more (equal to 2016), 2 cities with 5 to 10 million of citizens (decreasing from 2016 with 3 cities), 55 cities with 1 to 5 million (increasing from 2016 with 48 cities) 92 cities with 500.000 to 1 million (increasing from 2016 with 87 cities). Differently to the other areas in the world, EU city development will be equal and in some case decrease the number of inhabitants.

Starting from the research thematic that comes from the FP7 programme, EU commission develop a new framework programme for research and innovation, Horizon 2020. In the field of urban sustainable development, to get a more complex, competitive and complete strategy policy, the European Commission focus on "Nature-Based Solution", to obtain a more sustainable and resilient societies. The Nature-Based Solution (NBS) "provide sustainable, cost-effective, multipurpose and flexible alternatives for various objectives. Working with nature, rather than against it, can further pave the way towards a more resource efficient, competitive and greener economy. It can also help to create new jobs and economic growth, through the manufacture and delivery of new products and services, which enhance the natural capital rather than deplete it" (NBS website).

Re-naturing cities and territorial resilence are the main pillars inside this policy, which are strictly connected with the actual situation of the development of the cities and increasing of the number of citizens.

Inside NBS strategies, it is possible to identify some specific subjects of the Joint Declaration on the EU-China Partnership on Urbanisation, that are connected with NBS like Urban energy supply and demand management; Urban mobility, public transport and smart transport; Urban green building.

Different EU cities, like Paris, Madrid, Berlin, Stockholm, Milan, London (before Brexit) decide to invest in the thematic connected with the NBS, trying to improve the actual situation: air quality, urban mobility, climate adaptation, resource efficiency, biodiversity, afforestation of rural areas.

The slowest development of European cities (due to a lower number of citizens, but also to the crisis) can help the different government to invest in NBS solutions, and to regulate the different kind of strategies and challenges of different investment: in this ways it is possible to find the most efficient and sustainable solution for the city.

Chinese context

With the third Plenum of the Eleventh Communist Party Central Committee, held in December 1978, Deng Xiaopiing changed the economic policy of the Government from "close" to "open economy". The "Reform and Opening Up" slogan by Deng, regarded a new way to expand the Chinese power to foreign country. The main aim was to focus on the strong development of industry (in particular manufacturing), agriculture, national defense and science-technology, considered as development key for the future.

The consequence of this policy and of the increasing of the economic power, developed in a strong migration from rural area to urban area, in order to find an improvement of economical and life quality.

"Statistically, in 1979 the proportion of the nation's population in urban settlements, either in the form of cities or designated towns, was 17.9 percent. This rose to 40.5 percent in

2003 and at an accelerated rate from the late 1990s onwards. Over this period some 350 million additional people found themselves in urban areas.[...] The magnitude of urbanization between 1978 and the present is largely unprecedented, with the emergence of something like 468 new cities, 18.000 new designated towns and the accommodation of over half a billion people" (Rowe, 2008, p.76).
If in 1950 the percentage of population in Urban Areas in China was 11,8 with a slow increasing till 1978, from this year the percentage increase a lot: 17,9 (1978), 27,3 (1991), 33,9 (1998), 46,5 (2008), 57,9 (2017), till 75,8 as a prevision for 2050. In 2008 the annual urban population were composed by 624.891 thousands of population. In 2017 are 819.767, and the future prevision will be 1.049.948 in 2050 (UN data, F19 Annual Urban Population at Mid-Year by Major Area, Region and Country, 1950 – 2050).
The 13th Five Year Plan (2016-2020) that starts from the main point of the 12th Five Year Plan include a great section about the urban strategy for the development of whole Chinese territory: New Urbanization (Part VIII), Development coordinated between regions (Part IX), Ecosystems and the environment (Part X).
In this Plan, it is possible to see a changing from the past: the urbanization model, used in the last 30 years in China, from the environmental point of view is dangerous, due to the enormous use of land resources for city expansion. In addition, the important element that characterized the urban system (public services, quality of urban life, efficiency) does not work in a right way: the pollution overtake all the limits, there is low quality of life, and low quality of services and so on. The government decided to revise the urban planning strategy, in order to adjust the inefficiency at medium and small scale, and to reduce the scattering of resources (Sha et al., 2014). The strategies are two: one regards a medium and small scale, with intervention at neighborhood scale inside the city, the other regards bigger scale. From this rapid development, the government decide to create the "super-city". This structure is realized with the idea to manage in a better way a huge number of people, built area, industrial area, and, more than others, the economic profit. This urban agglomeration is composed by (usually) three large cities, with a specific geographic area, that develop in particular through the implementation of infrastructure network. The Chinese supercity (called also world-class city clusters) are: Jing-Jin-Ji (Beijing-Tianjin-Hebei region); Yangtze River Delta (Shanghai, Jiangsu, Zhejiang, Anhui region); Pearl River Delta (Guangdong, Hong Kong, Macau region, and include the megacities like Guangzhou and Shenzhen).
As indicate in the Plan, the most important aspect in Jing-Jin-Ji are related to the fighting against pollution, and the implementation of environmental strategies in the area: "We will establish a regional monitoring network, early-warning system, and coordinated response mechanisms for ecosystems and the environment, and reduce total pollutant emissions in the Beijing-Tianjin- Hebei region. We will better coordinate efforts to prevent and control air pollution, implement gasification projects in key areas of heavy air pollution, and ensure that the concentration of fine particulate matter is reduced by at least 25%. We will strengthen the protection of drinking water sources and joint pollution control efforts around rivers, lakes, and coastlines. We will set a red line for the protection of ecosystems, implement management by region, and establish ecological corridors around the Yongding River and elsewhere. We will redouble afforestry efforts in the Beijing-Tianjin-Baoding region and wetlands restoration efforts around lakes such as Baiyangdian and Hengshui, and ensure joint efforts are made to develop the Bashang Plateau Ecological Protection Zone and the Yanshan-Taihangshan Ecological Conservation Zone" (13th Five Years Plan, p.109).
It is obvious to understand the two conflicting aspects of the strategy: from one point of view the implementation of urban area, with the focus on efficiency and infrastructure, from the others the importance to the environment, that can be strongly contaminate by pollution related to the mega Chinese cities.
Starting from the interest of people, two of the Major Objective of the Plan are to improve the standards of living and quality life, and of environment and ecosystem. "Aggregate energy and water consumption, the total amount of land used for construction, and aggregate carbon emissions will be effectively controlled, and aggregate emissions of major pollutants will be significantly reduced. We will basically complete functional zoning and the building of protective barriers for eco-security" (13th Five Years Plan, p.17).
In this Plan, the new focus is to diminish the use of land for construction, to reduce the use of water, to reduce the energy consumption and to increase the non-fossil energy from 12% to 15% of primary energy consumption. Other important investment are related with the air quality (strictly connect to the infrastructure system) passing from 76,7% of the year/days of good air to more than 80, and a reduction in PM 2.5 intensity in cities.
Chen Jining, Minister of Environment Protection, recently said that the last data reported 'good air' days in 2016. In particular, 338 cities monitored reach 78,8% days of good air (more 2,1% from 2015). The policy of Chinese Minister is to implement action to fight the pollution and to fine environmental violations (value: 440 million yuan, equal to 64 million U.S. dollars). In parallel, Chinese government approved the establishment of 18 national nature reserves last years.
The instrument used by the Chinese government to ensure the Environmental protection is the Functional Zoning. China is divided in different zones: strategic urbanization based on the two east-west and three north-south economic belts (related with super-city); strategic agricultural development based on the 23 agricultural production belts within the seven agricultural production zones; strategic ecological security based on the two ecological shields and three ecological belts; sustainable development of maritime space (13rd Five Years Plan, p.102). These different zones will be analyze with different indicator that underline problems, ecosystem situation, other characteristics, in order to define the better way to develop strategies to protect the environment.

Policy and research strategy

Regarding the specific policy, it is possible to focus on particular key points, underlying the differences (and analogy) between the two actual development strategies (NBS and 13th Five Year Plans). These key points comes from the 7th Framework programme (FP7). From these key points, EU committee lay the

foundations for the Nature-Based Solutions strategy.

Biodiversity and Ecosystems

EU: the main point is to understand the changes and dynamics of ecosystems, to understand and develop similar strategy to human activity and to social and economic development. In NBS strategy, the research can focus in particular on the relationship between human activity and environment, society and economy in order to better manage the protection of ecosystem, and to obtain a social and economic benefit from the environment.

CHINA: improving the protection on existent forest (in particular stopping logging in all virgin forests). Invest on forestry farms. Protect grassland (control the transformation, desertification and salinization of grassland area). Reduce the expansion of desertification, and control the levels of major rivers, lakes, wetlands and all the water eco-system. Specific policy of ecological restoration are underline for the Key Regions (Super-city areas). Specifically the key point are: protection and restoration of national ecological security barriers; afforestation efforts; comprehensive land consolidation; virgin forest protection; prevention and control of sandstorms and integrated management of soil erosion; protection and restoration of wetlands; rescue of endangered wild species of fauna and flora (13th Five Years Plan, pp.135-136).

Natural resources management

EU: the main aim is to improve "the knowledge base and develop advanced models and tools that can help to mitigate resource degradation" (NBS website). This key point is focus in particular on the sustainable management of resources, and on the sharing of best practices. Integrated water management is one of the thematic that NBS wants to analyze.

CHINA: the development in key regions (Super-city) is strictly connect with the importance of the support capacity of natural resources. "We will research the establishment of an ecological value evaluation system, explore the creation of balance sheets for natural resources, and establish accounts for natural resource accounting in physical terms" (13th Five Years Plan, p.138)

Sustainable urban development

EU: the strategy in EU is focused in particular on energy, transport, environment, waste, water, ICT, land use, citizen engagement, social cohesion, human health, air, water and soil pollution, etc. All these thematic are analyzed in order to become more efficient and more sustainable under environmental and economical aspect. Inspiring by nature, it is possible to find an equilibrium between necessity of urban development and sustainable development.

CHINA: the creation of Functional Zoning can help to reach this goal: "To use nature in a restrained and orderly way, we will adjust and improve the spatial structure, working toward: strategic urbanization based on the two east-west and three north-south economic belts; strategic agricultural development based on the 23 agricultural production belts within the seven agricultural production zones; strategic ecological security based on the two ecological shields and three ecological belts; sustainable development of maritime space" (13th Five Years Plan, p.120). The main idea is to increase the ecological space, and to increase the density in urban areas, in order to decreasing the use of new soil.

Climate change adaptation and mitigation

EU: the importance of the climate change and global carbon cycle was one of the main point of FP7 research topic. The social and economic implication of the climate change and the importance of mitigation is now strictly connect with the NBS policy, because of the resilience aspect of city development.

CHINA: conscious that China is one of the most polluters, the government starts to develop strategies inside the Plan connected with the 2030 agenda for Sustainable Development, made by United Nations. In particular, the adaptation to climate change is related to rural-urban development planning, infrastructure development, and productive force distribution.

Disaster risk reduction

EU: connected with the increasing of the number of citizens in specific areas and with the climate change, the exposure of the cities (and citizens) to natural disaster increase a lot in last decades. The research in the last EU programme focus on this aspect, underlying the differences between the different hazard, and the possible consequence on the cities. The use of NBS solutions can be a strategy to reduce the disaster risk for the environment and for the cities.

CHINA: The government establish systems for ecological risk prevention and control, in order to better respond to ecological and environmental emergencies. Other important risk is related with pollution: the Chinese government starts to control in a better way the emission of CO_2 and other elements, to prevent and control the emission.

Conclusion

As for Europe, for the developing of the future China, the main goal is to find an equilibrium between protection of environment and the economic (and urban) growth. Differently, the speed of the growing of the city needs different strategy in the Chinese country then in European countries.

The two policies are general and not specific, and sometimes specific planning strategy on territory are not described. The main differences is that for EU the NBS strategy is general and able to adapt to specific territory (i.e. a specific city). For China, the strategy is related to a huge scale and bigger territory than NBS.

Moreover, in China the main documents regarding the development strategy (the 13th Five Years Plan) is strictly connected with politics aspect, and consequently a lot of key point are related to People's Republic of China party policy.

Chinese government try to enforce the environmental policy in the last decade. The challenge can be taken if the future Chinese research focus more on some form of alternative energy and relative technologies.

"China is currently experiencing increased pressure for an environmental policy agenda that improves conditions locally, while having a global impact. Within 20-30 years there will be a more robust and environmental policy that is more stringent. The country would still need to deal with an overall degradation of the environment through a scarcity of drinkable water, developable land, and clean air" (Tunney Lee, 2016, p.30).

If we think that in 2030 60% of global population will live in a city, in particular due to Chinese mega-cities development, it is obvious to understand in what way the Chinese environment will be under pressure with people that move around (Un Habitat; Tunney Lee; 12nd Five plan).

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Definition and objectives of Nature Based Solutions

Susanna Sturla

Introduction

The first factors that cause the decline of the quality of life in European cities and in most of the world are the rising levels of pollution, the increasing of heat islands, the loss of biodiversity and extreme events related to climate change. These events have detrimental effects for human health and well-being. Cities are the largest carbon producers; mitigation and compensation recently introduced by strategic environmental assessment are not in any case sufficient to improve environmental quality at local level.

Urban growth is happening in contradictory ways to the concept of sustainable development, perhaps economic development and social development are priority respect to environmental protection and it create pressures that affect human health.

The concept of classical development, linked exclusively to economic growth, was bypassed in the 1970s by a new model of development able to reconcile economic growth and equitable distribution of resources but this new vision that included not only economic but also environmental and social aspects is not giving the expected results.

The increasingly apparent effects of global warming caused by the over-consumption of non-renewable and highly polluting resources have created the need to respond in a tangible and unified way and to find a common way to buffer the damage caused.

The city, seen as a component of the ecosystem by which it exchanges and generates relationships, has a much higher consumption of resources to the natural capability of self-renewal.

In this particular and delicate context, cities play an important role as, through the implementation of new integrated urban planning that include social, economic and environmental considerations, can stimulate urban development and resilience.

European Commission on Research and Innovation in its Horizon 2020 programme promotes Nature-Based Solutions (NBS) as new way to improve sustainability and resilience in cities.

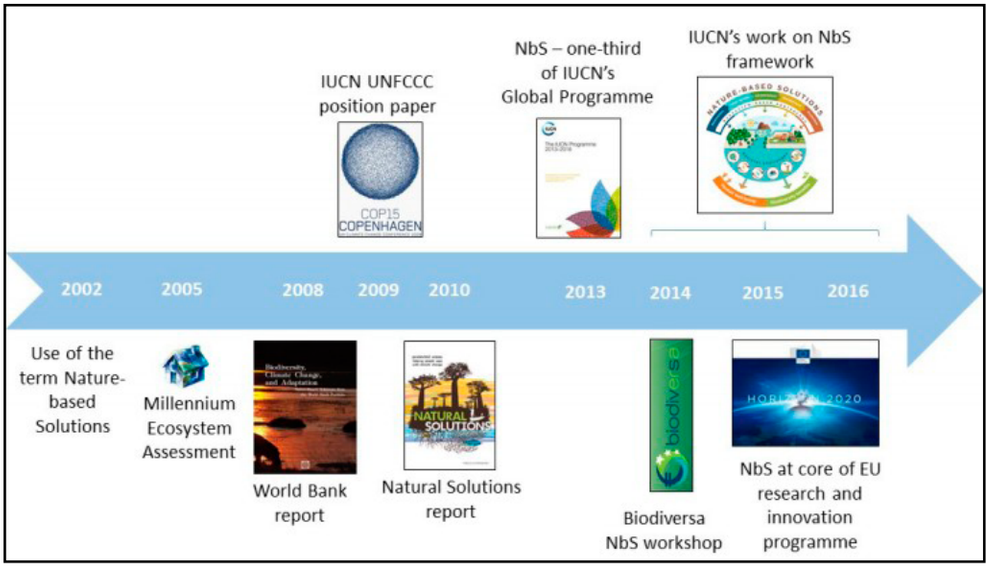

Fig. 1 - Timeline of the development of the NbS concept.
Source: Nature-based Solutions to address global societal challenges.

The EU, in this sense, has invested in so-called Nature-Based Solutions with the aim to offer a transition path with realistic, incremental steps toward a sustainable environment and economy. The EU focus is to build new knowledge through the strength of community networks considering the innovation and the implementation of Nature-based Solutions (NBS) to get healthier, culturally diverse and greener regenerated (including deprived districts and neglected or abandoned areas) European cities, with better living conditions for all.

This is a new term in city planning and design that identifies a wide range of environmental interventions related to protect, sustainably manage, and restore natural or modified ecosystems; now this concept needs to be studied in depth because NBS have clear overlapping with all the well-structured system of green infrastructure that since a decade have been well defined in urban planning discipline.

NBS background

The term NBS is not new, at first it entered in the scientific literature in the early 2000s, in the context linked to solutions of agricultural problems. At the same time NBS has been appear on land-use management and planning and water resource management.

From the mid-2000s, the concept has been appeared in literature on industrial design and biomimicry. The term biomimicry refers to sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. Biomimicry has also been used for green infrastructure and other soft engineering approaches that it has been used as nature-based solutions to urban water management problems.

From 2009 NBS is used in literature relating to methods for increasing resilience to the impacts of climate change – often synonymous with 'ecosystem-based adaptation'. The role of NBS has been actively promoted by the Nature Conservancy in the US and the IUCN (IUCN, 2012), and has also been a focus of World Bank investment in climate mitigation and adaptation projects (Word Bank, 2008). NBS is also used in the context of urban planning to increasing urban quality of life.

NBS concept and definitions

In literature there are many different definitions of Nature based solutions:

1. NBS are any transition to a use of ecosystem services with decreased input of non-renewable natural capital and increased investment in renewable natural processes.[1]
2. NBS are defined as living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource-efficient and adaptable manner and to provide simultaneously economic, social, and environmental benefits.[2]
3. NBS are defined as actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.[3]
4. NBS is a way of applying the strength, resources, and abundance of nature to global environmental and social challenges.[4]

It is important to underline that EU is building this concept on two premises:

1. some societal challenges stem from human activities that have failed to recognize ecological limitations;
2. sustainable alternatives to those activities can be found by looking to nature for design and process knowledge.

NBS refers to the use of nature in tackling challenges encompassing a wider definition of how to conserve and use biodiversity in a sustainable manner. By going beyond the threshold of traditional biodiversity conservation principles, this concept intends to additionally integrate societal factors, socio-economic development and efficient governance principles.

NBS interventions can be synthetize in (i) complementing other natural or artificial measures; and (ii) involving the use of conservation measures and resilience.

As many scholars' state, the scope of 'Nature-Based Solution can be explored' by unpacking its different elements, where:

- the term Nature refers to better use existing ecosystems by minimizing the intervention on the systems themselves.
- the term Nature based refers to modify existing ecosystems to better deliver selected ecosystem services.
- The term Solutions refers to create new ecosystems (e.g. through ecological engineering, green roofs, etc.)

According to Eggermont, H., et al (2015) Type 1 consists of no or minimal intervention in ecosystems, with the objectives of maintaining or improving the delivery of a range of Ecosystem Services both inside and outside of these preserved ecosystems. Examples include the protection of mangroves in coastal areas to limit risks associated to extreme weather conditions and to provide benefits and opportunities to local populations; and the establishment of marine protected areas to conserve biodiversity within these areas while exporting biomass into fishing grounds.

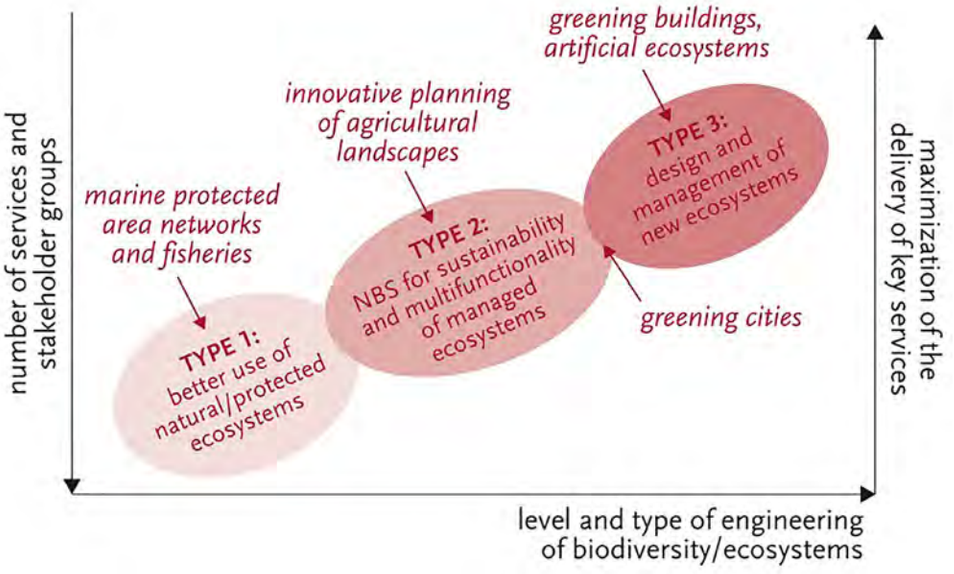

Figure 2 Schematic representation of the range of nature-based solution approaches.
Source: Nature-based Solutions: New Influence for Environmental Management and Research in Europe

Type 2 corresponds to the definition and implementation of management approaches that develop sustainable and multifunctional ecosystems and landscapes (extensively or intensively managed), which improves the delivery of selected Ecosystem Services compared to what would be obtained with a more conventional intervention. Examples include innovative planning of agricultural landscapes to increase their multifunctionality; and approaches for enhancing tree species and genetic diversity to increase forest resilience to extreme events.

Type 3 consists of managing ecosystems in very intrusive ways or even creating new ecosystems (e.g., artificial ecosystems with new assemblages of organisms for green roofs and walls to mitigate city warming and clean polluted air). Type 3 is linked to concepts like green and blue infrastructure (GI) and objectives like restoration of heavily degraded or polluted areas. Within this type, novel approaches such as animal-aided are currently being explored to bridge the gap between biodiversity conservation and landscape architecture.

The gradient in ecosystem service use from nature-based to more technical forms is determined by the ratio of renewable capital versus non-renewable natural capital invested to generate benefits.

Such NBS bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. Another important concept to underline stated by IUCN is that NBS are determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge, so the three type of NBS relate, adapt and interact to local context and environment.

NBS in urban areas

Urban planning in the city is the means by develop actions linked to NBS in order to develop and built resilience.

In particular Urban Planning:

- Is integrated encompassing social, economic, and environmental considerations;
- Provides a process and tools for mainstreaming climate change into town development;
- Operates at both a town-wide scale as well as a site-specific level;
- Has potential to incorporate legal and economic incentives for green development;
- Can be a vehicle for inclusive and participatory planning and management of urban development.

Is very important to underline that many aspects links to NBS are interconnected to urban planning challenges in particular

the economic development in urban areas is highly dependent on the wealth and quality of natural resources; the environmental dimension in urban planning is most often linked to regeneration of derelict areas, to the improvement of recreation facilities and to the general well-being of citizens, and the social dimension in sustainable urbanization focuses on people's well-being and is linked to a city's livability.

Relation among NBS and other closely related concepts

The idea of 'nature-based solutions', as already seen, is being used to reframe policy debates on biodiversity conservation, climate change adaptation and mitigation strategies, and the sustainable use of natural resources, but it is not clear how NBS might be distinguished from the other concepts associated with the opportunities for improving human well-being by managing ecosystem services and natural capital in appropriate ways.

The NBS framework is built on and supports several other closely related concepts, including the ecosystem approach, ecosystem-based adaptation and mitigation, green infrastructure (GI) and ecosystem services (European Commission, 2015).

In particular, EU commission in its report stated that green and blue infrastructure can be part of NBS or NBS can be used to build adequate green infrastructure (GI).

Another concept very close to NBS is ecological engineering, in particular, Barot et al.(2012), indicate that the goal of ecological engineering is to develop more sustainable practices informed by ecological knowledge with the aim of protecting and (2) restoring ecological systems, (3) modifying ecological systems to increase the quantity, quality and sustainability of the services they provide, or (4) building new ecological systems that provide services that would otherwise be provided through more conventional engineering based on non-renewable resources.

These are the same concept that are applied on NBS.

So, it is possible to consider NBS as an umbrella concept that covers a range of different approaches that emerge from a variety of spheres with a common focus on environment and on societal challenges.

These NBS approaches can be classified into: (i) ecosystem restoration approaches (e.g. ecological restoration, ecological engineering and forest landscape restoration); (ii) is-

Objectives	definitions	NBS	G.I.	ecosystem approach	ecosystem-based adaptation and mitigation	ecological engineering
Water quality and supply	Includes actions on water purification and regulation such as improvement of riparian vegetation, wetland restoration	x	x	x	x	x
Climate change adaptation and mitigation	Enhancing ecosystem resilience and functioning, help society to adapt to climate change (e.g. natural flood management, coastal protection, green roofs)	x	x	x	x	
Biodiversity conservation	Combating biodiversity loss by protecting and improving areas of high conservation value, restoring new areas of habitat where possible and improving connectivity between existing natural areas through increasing the permeability of the wider landscape and the protection of spatial connectivity features	x	x	x	x	x
Soil protection	e.g. afforestation, sustainable agriculture, land management	x	x	x	x	x
Human health/quality of life/well-being	e.g. establishing recreational areas, installing green roofs to improve local climate and air quality, creating jobs and promoting rural and regional development	x	x	x	x	x
Sustainable management	Taking actions specifically aiming to improve the ecological quality and permeability of landscapes, therein addressing multiple ecosystem services and functions and adopting a long-term perspective	x	x	x	x	x
Socioeconomic benefits	The value of services and benefits to people, measured in monetary terms.	x	x			

sue specific ecosystem-related approaches (e.g. ecosystem-based adaptation, ecosystem-based mitigation, and ecosystem-based disaster risk reduction); (iii) infrastructure-related approaches (e.g. natural infrastructure and green infrastructure approaches); (iv) ecosystem based management approaches (e.g. integrated coastal zone management and integrated water resources management); and (v) ecosystem protection approaches (e.g. area-based conservation approaches including protected area management).

Analogy and difference with other environmental solutions already applied

NBS still remains a general metaphor without sufficiently clear guidelines to enable effective and concrete application.

In this section it is analyze and sinthetyze general EU objective for sustainability development in respect to the environmental solutions already studied and applied, that is green infrastructure, ecosystem approach, ecosystem-based adaptation and mitigation and ecological engineering.

The principal four goals of EU pursued in the last 10 years are:

- enhancing sustainable urbanisation,
- restoring degraded ecosystems,
- developing climate change adaptation and mitigation and
- improving risk management and resilience.

These goals are well specified and defined in:

- Biodiversity and ecosystems:

Include the relationships between the environment, the society and the economy were analyzed in order to identify – and mitigate – potentially harmful effects on the environment and on human health and society.

- Natural resources management:

Include resource management, water, soil, forests and desertification was aimed at strengthening collaboration among researchers, academics and the industry to find the most cost-effective management measures for sustainable resources management. The overall aim was to improve the knowledge base and develop advanced models and tools that can help to mitigate resource degradation.

- Sustainable urban development:

include energy, transport, environment, waste, water, ICT, land use, citizen engagement, social cohesion, human health, air, water and soil pollution, climate change impacts and adaptation, etc.

- Climate change adaptation and mitigation:

Include the assessments on the role of biodiversity and ecosystems in the global carbon cycle, on future climate projections, on the natural, social and economic impacts of climate change and on relevant mitigation and adaptation strategies, including novel responses to climate change.

- Disaster risk reduction:

include research on individual hazards, on exposure and vulnerability assessment and on risk-analysis.

Every concept closer to NBS pursued specific or plural goals.

In the table below, it is synthetized EU objectives in relation to other concepts associated to NBS.

Conclusion and next step

As possible to see, EU objectives have already been pursued from the other concepts associated to NBS. Only socioeconomic benefit is not pursued by ecosystem adaptation and mitigation, ecological engineering and ecosystem approach, at least not specifically.

So, at first approach it seems that NBS in respect to the other concepts would to be the global way that embrace not only environmental aspect based on natural or artificial elements, but it considers the whole system of sustainability.

In respect to green infrastructure NBS is only not consider natural or artificial green element but it uses or copy characteristics and peculiarities that it could be find in nature adapting in local and specific context.

The next step is to verify how and how much

NBS is able to satisfy these objective through different case study.

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Nature-Based Solution to improve urban flexibility and resilience

Elisabetta M. Venco

Introduction

Nowadays more than half of the world's population lives in urban areas and it is expected to increase by more than two thirds by 2050 (UN, 2015). The speed of urban growth, the continuously changing of citizens' needs and the modifications of external and internal conditions create heavy pressures on ecological environment, urban environment, urban structure, social system and human health.

Important part of the macro-microclimate degradation processes of urban environment is caused and fostered by soil cover and soil waterproofing. In particular, the so-transformed surfaces determine and develop the phenomenon of urban heat island, due in particular to the increased solar energy absorption by roads and buildings. With a strong redaction and in some case the total removal of the natural infiltration through the permeable layers of soils, the rapid outflow of rainfall into waterways create many problems in the management and control of storm water: the amount of water used decreases and the risk of natural disasters increase considerably. Moreover, urban soil has little capacity to retain water: the result is a reduced evapotranspiration, with less cooling of the temperature near the ground. Consequently, urban centers are more vulnerable and consequently more at risk in relation to recurring climatic events during seasons (heat waves in summer and sudden and rainy rains during fall and spring) and in case of not common or predictable and sudden events.

The described phenomena affect consistently the quality of life and the health of citizens: during period of high temperature and high humidity conditions, people who live in cities have a higher risk of mortality than those who live in suburban or rural environment. In addition, the scarcity of vegetation is not able to discharge its ecosystemic functions and attenuate the gas emissions, the production of artificial heat from air conditioning and heating systems and the increase of particulates and CO_2.

Today, the problems that society and therefore urban system face can be studied and resolved with the support of an ecological approach to planning: the city is not a defined and closed element but an object that transforms itself into time. So, the city plan has to be able to guide the rapid changes of city (and society) without too detailed, rigid or fixed rules, but through the definition of plausible scenarios, requiring quick adaptation to *civitas* and *polis* changes and needs.

Contemporary phenomena (episodic and local requalification, dismissing of entire urban blocks, city development by parts and not as a unique system, urban sprawl, post-catastrophe reconstruction) highlight the gap between needs and solutions. if it is stated that the material component of cities has to adapt to the needs of those who live there, it is necessary to consider cities and territories as flexible environments and the urban structure has to adapt itself to different external (socio-economic context) and internal (project scenarios) conditions while maintaining the anthropological peculiarities of city as a place with an identity.

In a such complex context with so many elements involved, it is essential to find new methods and application techniques that will be able to integrate the use of natural solutions increasing ecosystem/urban resilience, urban livability in a flexible manner. Eco-policies (environmental, economic, ecological policies) e in particular environmental policies (i.e. Nature-Based Solutions, NBS) for green interventions are important instruments to improve these features in regional and city planning.

Nature Based Solutions in urban context

From 2009, the term Nature Based (refers to ecosystem approaches, ecosystem-based approaches and/or direct utilization of elements of biodiversity) Solutions became more widely used in literature relating to methods for increasing resilience to the impacts of climate change (European Union, 2015).

In particular, in an urban context with high density, high soil sealing, and high coverage ratio, it is possible to increase ecological value through green widespread interventions involving eco-systemic and functional aspects at different scales: from regional scales (regional parks) and whole cities (urban parks) to neighborhoods (neighborhoods/pocket parks) and specific buildings (green roof/wall and other green solutions in urban texture or buildings' shape). The ecological strategies can be implemented through public projects or can be applied on private property becoming a fundamental component for community health and quality of life.

In literature, there are many different definitions of Nature Based Solutions. Among all:

- NBS are elements/actions that permit transition to a use of ecosystem services with decreased non-renewable natural capital input and increased investment in renewable natural processes (Maes et al., 2015);
- NBS are living solutions inspired by, continuously supported by and using nature, designed to address societal challenges in a resource-efficient and adaptable manner and to provide economic, social, and environmental benefits (European Union, 2015);
- NBS are actions to protect, sustainably manage and restore (semi-)natural ecosystems that address societal challenges effectively and adaptively, providing at the same time human well-being and biodiversity benefits. Therefore, the ecosystems evolve to a new state of equilibrium between productivity, adaptability, and resilience (Cohen-Sancham et al., 2016).

Moreover, it is possible to define three different types of NBS: the first one concerns a better use of existing ecosystems minimizing the intervention on the systems themselves; the second one modifies existing ecosystems to better deliver selected ecosystem services and the latter creates new ecosystems (Balian et al., 2014).

In the end, it is possible to identify some NBS principles (Cohen-Sancham et al., 2016):

1. Environmental rules: embrace of nature conservation norms (and principles);
2. Way of development: implementation alone or in an integrated manner with other solutions to societal challenges (i.e. technological and engineering solutions);
3. Context interesting: site-specific determination in strictly relation to natural and cultural contexts that include traditional, local and scientific knowledge;
4. Social equity: production of societal ben-

efits in a fair and equitable way, in a manner that promotes transparency and broad participation;
5. Living ecosystem: maintenance of biological and cultural diversity and the ability of ecosystems to evolve over time;
6. Landscape scale application;
7. Sustainable services: enhancement of trade-offs between the production of immediate benefits, and future options for the production of the full range of ecosystems services;
8. Policies' process: fully integration in the overall design of policies, measures or actions, to address a specific challenge.

At the moment, there is plenty of NBS virtuous examples among actions, elements, ecological indexes spread all over the world: planting trees to reduce air pollution and improve health; Sustainable Urban Drainage Systems (SuDS) designed to reduce the potential impact of new and existing developments; the Biotope Area Factor (BAF; Casella et al., 2015); biobased geological CO_2 storage; green/blue infrastructure[1] and so on (Balian et al., 2014).

Resilience and urban resilience

From materials science and engineering fields, the word resilience (from the Latin verb *resilio*, to bounce) is the physical property of a material to return to its original shape or position after a deformation (stress) not exceeding its elastic limits: from here in, the term has been used in various disciplines especially related to ecological research (Venco, 2017).

In literature, it is possible to define three main approach to study resilience:

- Engineering approach: after a stressful event, it is the ability of a system to return to the original equilibrium state; moreover, it is interesting the concept of stability condition around the equilibrium point (Odum, 1969);
- Ecological approach: it represents the amount of disturbance that a system can absorb before collapsing into a lower equilibrium state affected by different sets of processes; moreover, it is interesting the idea of systems with balanced behavior and the possibility of multiple equilibria states (Holling, 1973);
- Adaptive, Systemic and Socio-Ecological Approach: it is the capacity of a system to anticipate unexpected event in order to minimize potential negative impacts; the focus is on adaptive system capabilities and learning mechanisms (Holling, 2001; Folke, 2006).
- In literature, related to the different meanings and contexts in which resilience develops, there are several definitions. Among all, it is useful to mention:
- Social resilience is the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change [...] ability of communities to withstand external shocks to their social infrastructure (Adger, 2000);
- Amount of change a system can undergo without changing state (IPCC, 2001);
- The ability of a system to absorb perturbations or stresses without changes in its fundamental structure or function that would drive the system into a different state (Kasperson, 2005);
- The ability of a system to recover from the effect of an extreme load that may have caused harm (UKCIP, 2003);
- Refers to three conditions that enable social or ecological systems bounce back after a shock. The conditions are: ability to self-organize, ability to buffer disturbance and capacity for learning and adapting (Tompkins et al., 2005);

Moreover, many researchers have defined the main principles of resilience (De Lotto et al., 2016). In particular:

- Foster (1997) proposed 31 principles for achieving resilience and organized them in several categories: General systems (functional redundancy), Physical (not site specific, modular, standardization, mobile, stable, fail-safe design), Operational (efficient, reversible, incremental operation, autonomous operation), Timing (short lead time and rapid response to stimuli, open-end life span), Social (compatibility with diverse value systems, equitable distribution of benefits and costs, accessibility), Economic (incremental funding, high benefit-cost ratio, equitable division of benefits and costs) and Environmental (minimal adverse impacts);
- Godschalk (2003) defined resilient systems (in relation to natural/anthropological/technological stresses and disasters) as: Redundant, Diverse, Efficient; Autonomous, Strong, Interdependent, Adaptable (flexible), Collaborative;
- In "Transition Cities" by Hopkins (2008), there are the following resilience concepts: diversity; redundancy; modularity; local based policies and strategies; concept of small related to the balance between environmental, social and economic resources, development and consumption grade of resources, social inclusion, self-organization, construction of bottom-up processes and active sharing (Colucci, 2012);
- Lewis and Conaty (2012) defined seven main principles for resilient communities: Diversity of cultures, Modularity of elements, Social capital, Innovation, Overlap, Tight Feedback Loops, Ecosystem Service (Thayer et al., 2013).

Nowadays, resilience has a fundamental role in urban planning development. In particular, it is defined as the ability of a complex system (i.e. urban settlement) to cope with external and internal stresses through adaptation and mutation strategies and to return to an equilibrium state (not necessarily equal to the original one). So, resilience could be read as a new way to understand and manage urban planning.

In the urban context, it is possible to define the following types of resilience (Cutter et al., 2010):

- Infrastructural Resilience: related to the reduction of urban settlement physical vulnerability (buildings, infrastructure networks - mobility and technological services) and related to the community ability to respond and recover after a stressful event;
- Institutional Resilience: related to the community governmental and non-governmental system;
- Economic Resilience: related to the community's economic diversity as job places, number of enterprises and their working capacity after a disastrous event;
- Social resilience: related to the community's demographic characteristics.

Focusing on urban systems, to be resilient they must possess the following features and abilities:

- pursue a balanced and sustainable development model based on integration of social, environmental, and economic issues;
- preserve and enhance local resources;

- reduce environmental impacts due to human phenomena (industrial systems, fuel pollution, etc.);
- encourage social participation both in the planning phase and in the management phase.

The capacity of an urban area to be resilient depends on the organization and the relationships existing among the internal elements: considering that a flexible system allows the rapid recovery and the necessary swing of activities, flexibility approach helps to reach resilience goals (Jha et al., 2013).

Flexible city

The speed of mutations of population needs and the instability of contexts' conditions are vivid in the city (as the most important place of community living and evolving) and require the city to adapt to citizens needs in real time.

Adaptation and evolution are typical elements of organic and ecological systems that, since long, highlight the relevance of their role in urban studies (i.e. the idea resilience, the ecological planning, and the environmental assessments). It the early of XX century, Geddes identified the city as a specific organ through which men are able to evolve. Moreover, in 1942, during CIAM, it was emphasized the organic nature of the city: the evolution considers form and function no longer statically but in a continuous movement (Welter, 2002). So, evolving city means that even what appears more stable, such as urban settlements, is continually transformed.

Thus, in relation to the idea of evolving city (city as an organism: Geddes, Choay, Welter), it is not possible to define specific and strictly rules, but structural lines and possible scenarios. New cities and interventions of renewal and requalification must be able to anticipate the need for changes and, therefore, the need for flexibility is increasingly required in all fields (urban planning, engineering, social science and so on).

The urban structure and the different subjects involved (citizens, stakeholders, professionals, decision makers), require the ability to adapt to different and quick modifications of external (global socio-economic environment) and internal (social and organizational scenario) conditions.

It is necessary that the material component of the city must adapt to the needs of the citizens and, as a consequence, to think about cities and territories as flexible environments. Therefore, flexibility is the adaptation to the social and economic conditions, the ability of the city to be efficient in a short time according to the demands of the context and it is well expressed in the relational, government, environmental, physical and infrastructural systems.

Therefore, as previous researches have showed and defined (De Lotto, 2011), it is possible to recognize different main themes linked to three principle dimensions: theoretical, related to the tangible city (physical part) and related to social phenomena. So, the six main topics of flexible city are:

- Temporal Dimension: significant changes in the anthropological sense happen in short, medium and long periods;
- Variable Geography: dimensions and physical shapes of cities (urbs) are not fixed a priori but derive from a continuous process of adaptation to all the changes occurred in civitas and polis;
- Reversibility: based on the idea of sustainability, any contraction of urban shape should allow the re-naturalization of the urban area (life cycle assessment of the whole city and not just a building);
- Functional un-differentiation: at local level, the city must be able to adapt its functions and increase or reduce the urban load based on citizens and cities' needs without compromising, at a wider scale, the infrastructure system and the urban structure;
- Layer Structure: third dimension is essential to think about functional levels with different degrees of long-lasting qualities and adaptability;
- Ethero-organization: it could represent the optimal balance between "top-down" and auto-organization "bottom-up" planning model.

Linkage among NBS, Resilience and Flexibility

While it is quite obvious the strong relationship between NBS and Resilience (also in the meaning of urban resilience), and between resilience and flexibility, author wants to define, underline and deepen the nexus and link between NBS and flexibility (or NBS and flexible city). It is well demonstrated that restore degraded ecosystems using nature-based solutions can improve the resilience of ecosystems, develop ecosystem services and meet other societal challenges maximizing environmental, social and economic co-benefits. Moreover, NBS not only increase the resilience of society to external economic and environmental stresses, but also contribute positively to improve human health and well-being. Sustainable urban planning with nature-based solutions provides opportunities for adaptation to climate change, increases urban resilience to risks (i.e. droughts, floods, and heatwaves), reduces pollution and enhances opportunities for small-scale climate mitigation, i.e. through increased carbon storage (European Union, 2015 a).

In any urban context, flexibility can contribute to increased resilience: a flexible city, thanks to the organization of its inner structure and internal relations, allows the rapid recovery of its activities after the occurrence of a stressful event. It is possible to say that the greater the flexibility of the system, the greater the ability of the same to respond to external stresses (any kind of stresses) and then find a new (dynamic) equilibrium (Venco, 2017).

In order to define the similarities and the coherence among type and principle of NBS and the six main topic of Flexibility, author makes an evaluation of their interaction by making a comparison. By assigning a numerical value from 0 to 1 to the interaction among elements (where: 0 means no interaction, 0.5 weak interaction and 1 strong interaction), author defines the strength of the links among the most significant theoretical concepts of NBS and Flexibility, and the effectiveness and the importance of them in the present cultural, social, political and professional context.

The logical connections' diagram (Figure 1) shows the bi-univocal relationships among the defined NBS principles and the main topics of Flexibility. In particular, it specifies the strength and weakness of the links that, independently from their features, connect all the elements of the two defined sets.

Conclusions

In previous paragraphs, author highlights how the NBS principles are very well linked (in Figure 1 there are all the bi-univocal links

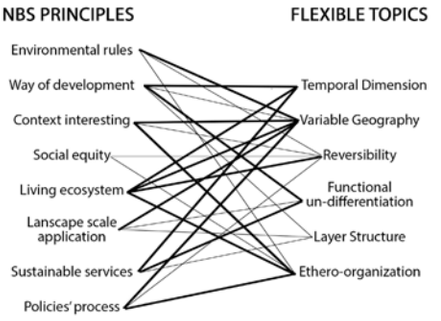

Figure 1– Link between NBS principles and Flexibility topics.

among the elements involved) with the topics of Flexibility. In particular, the concepts related to "Way of development", "Living ecosystems", "Ethero-organization" and "Variable Geography" are the most and well connected elements. Moreover, the flexible topic "Reversibility" is particular important in the development of punctual or territorial spread Nature-Based Solutions because they bring back the anthropological elements in any urban settlements to a more natural state (in a variable percentage in relation to context and specific development aims) from a sustainable and resilient point of view.

It is interesting that all the elements in the two sets are general principles and not punctual ideas or singular objects: this characteristic allows better connections and their suitability to each other is more recognizable and applicable in different contexts and with different meanings.

Furthermore, there are not isolated elements but a relevant number of strong connections. In example, it is quite obvious the importance of a "Policies' process" in relation/based on an "Ethero-organization" planning model that allows a more acceptance of the necessary changes and a greater participation of citizens. Moreover, the "Way of development" and the "Temporal Dimension": all the interventions based on NBS have to be developed in different time horizon (at least short-medium-long) and the urban settlement (or the territory) has to be able to manage the changes without the decline of its inner social-economic-structural peculiarities and the loss of identity. The "Variable Geography" is strictly related with almost all of NBS principles: in particular, all the interventions have to consider and compare the social-cultural-economic and environmental context in which they will develop.

Therefore, it is possible to state that Nature-Based Solutions and Flexibility are driving forces for the enhancement of Resilience as ecosystemic and urban resource for the development of future territorial and city plans.

1. Green infrastructure can be defined as a network of multi-functional green spaces (new/already existing, rural/urban) that supports natural and ecological processes: parklands, forests, wetlands, greenbelts, floodways, the system of small/punctual green elements (green roofs/walls), soft permeable surfaces, green streets and avenues, green open spaces and so on.

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