Nícolas Guerra Rodrigues Tão, Alexandre da Silva Faustino, Ricardo Siloto da Silva, Renata Bovo Peres. Convergence of urban and environmental research fields in conceptual proposals towards urban sustainability: improvement and challenges. *Thésis*, Rio de Janeiro, v. 2, n. 3, p. 299-317, jan./oct. 2017

submission date: 13/10/2016
acceptance date: 25/04/2017

Convergence of urban and environmental research fields in conceptual proposals towards urban sustainability: improvement and challenges

Nícolas Guerra Rodrigues Tão, Alexandre da Silva Faustino, Ricardo Siloto da Silva, Renata Bovo Peres

Nícolas Guerra Rodrigues Tão
Mestrando em Engenharia Urbana; PPGEU/UFSCar; nicolas.tao@hotmail.com

Alexandre da Silva Faustino
Mestrando em Engenharia Urbana; PPGEU/UFSCar; alexandre.mog@gmail.com

Ricardo Siloto da Silva
Doutor em História; Professor Titular do Departamento de Engenharia Civil, UFSCar; rss@ufscar.br

Renata Bovo Peres
Doutora em Engenharia Urbana; Professora Adjunta do Departamento de Ciências Ambientais, UFSCar; renataperes@ufscar.br

Abstract
Currently, there are new theoretical approaches that mix concepts of both environmental and urban sciences. This search for interdisciplinarity aims the development of guidelines to respond more holistically the demands of the population. These guidelines should be based on the various dimensions assigned to sustainable development. In this sense, what perspective can be established on urban planning that enables it to contribute for the environmental quality of cities and hence for the quality of human life? How some disciplines and theories that reflect on the processes and natural flows can bring alternatives to the urban setting that reduce the clearance of environmental and urban dimensions? In these terms, this article proposes the critical analysis of the concepts of urban ecology and biophilic cities, and concepts of sustainable urbanism and ecological urbanism as proposals that question environmental issues in urban setting, and vice versa. Parallels between models are established. Possible challenges and opportunities for the integration of social and environmental dimensions of sustainability in the context of urban space are discussed. In addition, some implications for urban projects are placed. Thereunto, this study conducted an exploratory and descriptive research, in theoretical-conceptual nature, with typology of bibliographical technical procedure. The product of this process is the critical analysis of a comparative matrix, which contains the main influences, concepts, strategies, implications for urban projects, approximations to sustainability and challenges of the surveyed approaches. It was evident that they alone are not able to fill the wide range of problems facing the urban space; each of which has varying levels of involvement with the different pillars of sustainability. Alternatively, it is possible to think locally in a better ownership of its principles and strategies. The tactics tend to be more assertive if arising from the dialogue between concepts

Keywords: *Urbanism, Environmental Urban Planning, Ecology.*

Resumo
Fruto da aproximação entre as ciências ambientais e urbanas, surgem novas abordagens teóricas que mesclam conceitos de ambas estas áreas. As tentativas de interdisciplinaridade visam a elaboração de diretrizes que respondam de forma mais holística as demandas da população, embasado nas diversas dimen-

sões atribuídas ao desenvolvimento sustentável. Neste sentido, qual ótica pode ser estabelecida sobre o urbanismo que o permita contribuir para a qualidade ambiental das cidades e, consequentemente, para a qualidade de vida humana? E como alguns campos disciplinares e teorias que refletem sobre os processos e fluxos naturais podem trazer alternativas ao cenário urbano que diminuam o afastamento das dimensões ambiental e urbana? Em busca de respostas, o presente artigo propõe uma análise crítica dos conceitos de ecologia urbana e cidades biofílicas, e dos conceitos de urbanismo sustentável e urbanismo ecológico, enquanto propostas que problematizam questões ambientais no cenário urbano, e vice-versa. São estabelecidos paralelos entre os modelos e discutidos possíveis desafios e potencialidades para a inserção das dimensões socioambientais da sustentabilidade no contexto do espaço urbano. Além disso, são colocadas algumas implicações aos projetos urbanos. Para isso, este estudo se propôs a realizar uma investigação de caráter exploratório-descritivo, de natureza teórico-conceitual, com tipologia de procedimento técnico bibliográfica. O produto deste processo é a análise crítica de uma matriz comparativa onde constam as principais influências, conceitos, estratégias, implicações à projetos urbanos, aproximações à sustentabilidade e desafios das abordagens pesquisadas. Evidencia-se que isoladamente eles não são capazes de preencher o vasto campo de problemas que se colocam no espaço urbano, sendo que cada um apresenta níveis variáveis de envolvimento com os diferentes pilares da sustentabilidade. Há que se pensar localmente na melhor apropriação de seus princípios e estratégias, a qual tenderá a ser mais assertiva se oriunda da interlocução entre os conceitos.

Palavras-chave: Urbanismo, Planejamento Ambiental Urbano, Ecologia.

Resumen
Con la aproximación entre las ciencias ambientales y urbanas, surgen nuevos enfoques teóricos que mezclan los conceptos de estas dos áreas. Los intentos de interdisciplinariedad buscan a la elaboración de directrices para responder de manera más holística las demandas de la población, pautados en las diversas dimensiones asignadas al desarrollo sostenible. En este sentido, ¿qué óptica se puede establecer en el urbanismo que permita contribuir a la calidad ambiental de las ciudades y por lo tanto a la calidad de la vida humana? Y ¿cómo algunos campos disciplinares y teorías que reflejan a cerca de los procesos y los flujos naturales pueden aportar alternativas a el paisaje urbano que reduzcan el distanciamiento de las dimensiones ambientales y urbanas? En busca de respuestas, este artículo propone un análisis crítico de los conceptos de la ecología urbana y ciudades biofílicas, y de los conceptos de urbanismo sostenible y urbanismo ecológico como propuestas que problematizan cuestiones ambientales en el contexto urbano, y viceversa. Se establecen paralelos entre los modelos y se discuten posibles desafíos y oportunidades para la integración de las dimensiones socio ambientales de la sostenibilidad en el contexto del espacio urbano. Además, se colocan algunas implicaciones para los proyectos urbanos. Por lo tanto, este estudio buscó a hacer una investigación de carácter exploratorio-descriptivo, de naturaleza teórico-conceptual, con tipología de procedimiento técnico bibliográfica. El producto de este proceso es el análisis crítico de una matriz comparativa que contiene las principales influencias, conceptos, estrategias, implicaciones para los proyectos urbanos, aproximaciones a la sostenibilidad y desafíos de los abordajes estudiados. Es evidente que ellos solos no son capaces de cubrir la amplia gama de problemas que enfrenta el espacio urbano, pues cada uno tiene presentan niveles variables de implicación con los diferentes pilares de la sostenibilidad. Se necesita pensar en nivel local cual la mejor apropiación de sus principios y estrategias, que tendrá a ser más asertiva cuando surgida del diálogo entre los conceptos.

Palabras-clave: *Urbanismo, Planificación Ambiental Urbana, Ecología.*

Introduction

Product of the proximity between the environmental and urban sciences, whether influenced by global organizations documents or local issues, new approaches arise merging concepts from both study fields. The attempts of interdisciplinarity aim the elaboration of a model that answers holistically the population's requests, based on the dimensions attributed to sustainable development.

Inside this debate, some questions can be established: which perspective can be set to urbanism that allows it to contribute to environmental quality of cities and, therefore, to quality of human life? In addition, how some disciplinary fields and theories that reflect about natural processes and flows can bring alternatives to urban prospects that reduce the gap between urban and environmental dimensions?

This study proposed a critical analysis of urban ecology and biophilic cities concepts, and urban sustainability and ecological urbanism concepts, whereas proposals that discuss environmental issues in urban context and vice versa. It pursues to identify contributions of these concepts for a more harmonious development between humans and the natural world. Thereafter, parallels were set among models and possible challenges and potentialities were discussed to the insertion of socio-environmental dimensions of sustainability in urban space context.

Environmental perspective upon the urban issue

Urban ecology

The urban environment is, by definition, a territory where human population and its activities are concentrated, so it's a product associated with the development of human civilization. However, in the process of sprawling through the territory, the expansion of human habitat occupied areas that sheltered other living beings and supported nature flows of matter and energy. Additionally, the characteristic production of cities, especially from industrial civilization, it's to misconfigure the natural process of occupied areas and thus disfigure the habitat of others living beings that so far benefit from it. Although the changes urbanization brings to ecosystems, their processes and species, it does not wipe them, but remodels and resizes to supply human needs in cities. In fact, there

is a whole ecology of urban processes and flows for human usufruct as well as other beings that inhabit cities (Niemela et al., 2011, p. 1-4).

Mc Donnell (2011, p. 8) and Forman (2014) state that traditionally the science of ecology tends to exclude the urban space and its dynamics off the developed studies and researches, aiming to comprehend the natural processes in its primitive forms, besides, it frequently evaluates the influence of the urban over the natural as negative. Although those radical positions, once ecology seeks to evidence the positive and negative anthropic influences over the ecosystems, this science bases itself in the absence of significant initiatives that propose the study of the urban space while a system.

Beginning by the concept of ecology that is "the study of interactions between organisms and the environment" (Forman, 2015, p. 312), this science aligned its studies to organisms that aren't human and environments that aren't anthropically built. Yet, the concept allows a broader interpretation in which the urban ecology stays itself: "the study of interactions between organisms (plants, animals and microorganisms), built environment (buildings and roads) and the physical environment (air, water and soil), where people concentrate" (Forman, 2015, p.312). What evidences the urban ecology uniqueness is the insertion of built environment as element of interaction. By this broader set different study focuses are possible, approaching and resourcing discussions that could be conducted by those disciplinary fields which face human needs, as sociology, architecture, urbanism, engineering, public health, economy, and others (Wu, 2014; Forman, 2014).

With this meaning, urban ecology brings an important contribution to the investigation of alternatives for the human development, specially the one made in urban spaces, so that could be compatible with the environment carrying capacity. This other way of development, which is not the one of nonlimited resources exploration and economic increase, is fundamental in the present context of global populational growth, intensification of urban development and natural resources depletion. In such perspective, urban ecology is a science that contributes to the finding of an equilibrium point which addresses to the conservation of ecosystems essentials for all life forms

For this, it will use approaches in scales that evince resources flows conducted by urban centers. In this

context, the territory can be seen as a mosaic of activities that supply the concentrated population in cities. Accordingly, strategies of production, transportation and consumption can be conceived to minimize the demand of new supplies, maximize the better use of those which are necessary and reduce waste generation, which induces a more efficient metabolism. Furthermore, inherent aspects of urban morphology and organization of land use and activities should be considered inside the city. Thinking it in a higher metabolic efficiency perspective means to reduce displacement need, locally provide the demand for goods, materials and energy, and also mix uses in a same region. Regarding the different life forms coexisting among the human beings in cities it's fundamental to know the set of existing green spaces, plants and animals, as well as the past populations which changed over time by many anthropic activities. Therefore, urban ecology can discuss the ecology of the cities, in other words, their functioning metabolism, or the ecology in the cities, by all means the living organisms, their fluxes and interactions, which live together with humans in the urban environment (Wu, 2014).

Because of the urban ecology theoretical ground in a spatial analysis over multiple scales, and by the plurality of terms and concepts about urban spatial scales, Forman (2014) proposes definitions for some analysis scales of urban ecological phenomena: urban areas, megalopolis, urban region, metropolitan area, city and suburban. Additionally, other concepts proper of the urbanism disciplinary field are defined, which are not matter of professionals of the discipline of ecology, but are indispensable to understand urban ecology discussions.

There are divergences about the development period of urban ecology. Forman (2014) states that it came from modern ecology (1950), and emerged with the most recent approaches of this science (landscape ecology, conservation biology). Yet Wu (2014) raises information which shows that urban ecology is previous to those disciplines, and so it would be derived from human ecology.

The emergence of urban ecology in its present bases occurred between the 70's and 80's. Before that period, different ecological studies were driven in the urban context, and only later the discipline evolved approaches regarding social and human questions, conceiving the notion of a disciplinary field which joins urban planning and social patterns to the ecological science. The main researches and advances done in the field

took place in Central Europe, specifically in German. Nowadays, research groups and topics in urban ecology are centered in: (1) mapping of habitat/biotope and related analysis; (2) species and resources inventories; (3) rural-urban continuum; (4) biogeochemical fluxes and material modeling; (5) combined human-biophysical systems; (6) urban regional spatial patterns, processes, and changes (Forman, 2014).

Biophilic Cities

The biophilia, concept popularized by Edward O. Wilson in the book "Biophilia" (1984), is the central idea of biophilic cities. Opportunities of contact between humans, environment, and other living beings are fundamental for a healthy quality of life, and are a characteristic of human nature itself, but which modern society has increasingly neglected. The notion of a biophilic city is to understand that nature permeates every space and process operating in the cities, and constantly surrounds the human being (Kellert, 2008, p. 1-2).

It's recognized that through the contact with nature the human being is capable to develop its capacity of contemplating beauty, which leads to reflections over the position of each person in the world and allows the questioning of aspects that transcend the individual dimensions, and promote engagement and interpersonal connections. Thus, a biophilic city is the one which "puts the natural element first in the project, planning and management of the city, recognizing the daily need of human contact with nature, as well as the economic and environmental benefits promoted by it and its systems" (Beatley, 2012, p. 164-165).

So, potentially, a biophilic city will be an urban area that contains biodiversity and which makes use of it for the benefit of its citizens, with implications that are present from the buildings to urban landscape as a whole. It works with the harnessing of existent natural elements and the recovery of the ones that have been degraded, by the association between low environmental impact project principles (reduce negative aspects) and the biophilic projects (potentialize positive aspects) (Kellert, 2008, p. 3-4).

It is also said that through this concept it is possible to increase the social participation, collective engagement and community involvement, what could start by contemplation activities in open and natural spaces, nature care and conservation, for instance (Beatley, 2012). When the biophilic city foster the contact with

natural elements and social living opportunities, it can bring healthier and pleased lives for its inhabitants (Gringe andPatil, 2009).

To encourage biophilia in cities and monitoring its evolution, Beatley (2012) suggests some dimensions that could be checked by indicators, for example: existing conditions and infrastructure (urban green cover percentage); behaviors, patterns, practices and life styles (visiting population in a park); attitudes and knowledge (inhabitants capable to identify species); and institutions and government (legal requirements for green roofs establishment).

To achieve the success of a biophilic city, the existence of structural elements that enable natural contact, such as parks, is not enough. Educational actions and formation programs which approximate citizens to these spaces and meaning them are necessary to avoid their underuse and neglect. Therefore, environmental educational centers, for instance, are positively recognized in this regard (White and Stoecklin, 2008).

Beatley and Newman (2013) discuss the contribution that biophilic cities approach brings to the urban resilience improvement. Resilience means the self-capacity of a system to undergo a disturbance and, without major problems, return to a state of equilibrium. That applies to infrastructure (spatial build and unbuild) and socioeconomic aspects (social cohesion, market diversity). The authors stand that biophilia allows conditions for infrastructural resilience (a park serving as buffer zone for floods), and social (increase population physical and mental health to overcome adverse events). Specially related to the social resilience dimension the authors highlight many contributions to the closeness among individuals through biophilia: it highs community and collective sense, reduces social isolation, contributes to participatory process, expands the perception of each individual upon its community, among others.

Despite the apparent benefits, there are some obstacles for a real development of biophilic cities. Many questions still remain, related with approximation ways between humans and nature in the cities, that need to be studied and enlightened. Notably, the distribution of natural elements on space (concentrate or disperse), if their existence in fact promotes more social interaction, and what is the minimal quantity of green areas per inhabitant essential to assure a good life quality. Another key point regards the cultural, political and economic resistance to the adoption of bio-

philia, once it proposes a paradigm shift. This puts the concept in a position of conflict with the set of values, legal parameters and visions of profit operating the production of cities.

Urban perspective upon the environmental urban issue

Sustainable Urbanism

Sustainable urbanism it's an emergent approach which addresses urban issues with sensitivity to environmental problems. It brings new perspectives over urban design and works with a toolset approach to make feasible its principles, presented by Douglas Farr in his book "Sustainable Urbanism: urban design with nature", published in 2013. The concept emerges as an answer to the American context, which has similarities with many other countries in the world, mainly due to the western capitalist character of its economy. However, it still has some particularities in terms of scale.

The North American lifestyle, based on progressive individuality, has led its inhabitants to an alarming scenario of obesity and sedentariness, which has obvious relationships with city planning, oriented to automotive transport and hostile to pedestrians. The suburbs, extensive housing areas with low density and large lots proportions, consume more and more space and leave their residents away from other services, since, generally, they are monofunctional areas, which entail motorized displacement. Besides the impacts over population heath, this urbanization model still motivates high fuel consumption and consequently the pollutants emission. It causes greater consumption of water, soil and energy than in denser localities with mixed uses (Farr, 2013).

To seek for solutions, the sustainable urbanism guides itself by some theoretical bases. Among them, the urban smart growth, developed by American state agencies as a response to the urban sprawling situation and its externalities. Some examples of these externalities are the higher infrastructural costs, monofunctional zoning and the conversion of natural habitats in urban areas. To solve such issues, the urban smart growth presents principles based on community sense, through the incentive of mixed uses, higher densities, open spaces, walkability and public transit. These directives meet strong cultural barriers of acceptance by American public (Downs, 2005).

Answering those same questions, the approaches of new urbanism also influence the sustainable urbanism. Ini-

tiative of architects from New Urbanism Congress, its ideas were aiming at contraposing the modern movement and the American suburbs, reinventing compacity and other concepts already spread by urban smart growth and previous movements. The projects of Traditional Neighborhood Developments are the typical molds for applying concepts of the new urbanism. Its agents work preferably on neighborhood scale, with well-defined and active centers where it's possible to enjoy services, public equipment and commerce. Together, these neighborhoods would provide a system of walkable access activities for all inhabitants (Ribeiro, 2010). Among the challenges faced by the approach, the low social diversity encompassed in practical proposes and the lack of applicable solutions to developed areas are considered as the main ones (Lara, 2001).

The third strong influence over sustainable urbanism ideas are the certifications of high environmental performance for buildings, known as green constructions, which answer to the matrix of sustainability efficiency. The Leadership in Energy and Environmental Design (LEED) it is an American program of certification, disseminated in other countries, focused on edifications. It is based on matrices of environmental performance criteria, energy saving for example, that if contemplated, are scored and define a classification level, in terms of sustainability of the building. Although the given focus to building projects, with a certain disregard on surrounding criteria, such as urban mobility, new scales of approaching at neighborhood level have been developed by the program (BLACK, 2008). There are other problems on the application of seals and certification to be faced: the absence of adaptability to distinct contexts; the greenwashing[1]; the deficit of studies proving the effectiveness of its application; the deficit of analysis in the life cycle perspective; the increase of prices, that selects the public and does not reach the housing informal sector (BRASIL, 2015, p. 115-116).

[1] "(...) Take ecological advantages as ways for distortion of reality (...) in order to induce the consumer to take false conclusions regarding its choice of products and services. (...) false impressions about environmental practices when its real activities are contrary to environmental interests and goods"(Tavares and Ferreira, 2012).

Based on the main aspects of the guiding concepts, the sustainable urbanism intentions clarify itself: to promote compacity, mainly at neighborhood scale, restoring the transport model back to pedestrian displacement and corridors of public transit, in contrast to the suburbs. The suggested model must be associated with the efficiency of buildings and urban infrastructure (Farr, 2013).

Another element emphasized by the proposed urbanistic model it's the biophilia. It strives for reapproximate human beings to nature, a relation that it's harmed by human isolation. The understanding of our relations

with other living beings and the environment cycles is minimal in urban settings where there is few contact with spaces naturally lighted and forested, once the natural systems were replaced. If these systems were maintained and the urban design became more organic, besides providing habitat for other live forms closer to human settlements, there would be possible for human being to identify itself and value the ecosystems services from which relies its survival (Farr, 2013).

Ecological Urbanism

The ecological urbanism it's an even more recent concept than sustainable urbanism. The first discussions began in 2009 at the seminar promoted by Mohsen Mostafavi in Harvard University's Graduate School of Design and Architecture, USA, which gathered researches, from many countries, aligned with the model ideas. The book "Ecological Urbanism", published in 2014, compiled the reflections and research presented at this event.

The ecological urbanism discusses in its foreword the world demographic and urban boom situation in contrast to the limited carrying capacity of the planet, and directly questions architects and urban planners about their possibilities to intervene in this situation. It presents three major crises as the global overview of modern urban issues: climate change, the price of oil and the real estate collapse. This picture points to the existence of a global concern towards a change of the environmental paradigm, however unaccompanied by true commitment of some large resource-consuming nations. In this context, it affirms the existence of such concern among architects and urbanists, although criticizes the proposals labeled the "sustainable architecture" examples. From the first projects focused on energy efficiency to the current dissemination of LEED certification, the clash between discipline and sustainability in urbanism persists (Duany, 2014).

Another topic raised is the scale followed by some sustainable proposals, especially the LEED, focused on the architectural object without considering its insertion in the larger piece, the city (Schroepfer, 2014). Therefore, there is a gap of an alternative framework of references to consider the urban dimension in new perspectives of limited global resources, and on how to respond the complex existing and possible situations in this urban scenario. Then, ecological urbanism would be "a system that, through the association between ecology and urbanism, can provide the knowledge, methods and clues about what the urban might become in the next years" (Mostafavi, 2014).

The proposal of ecological urbanism is to create possibilities for practices beyond conventional solutions, that is to say, to address the current oxymoron 'ecological urbanism' by converging ecology and urbanism. It is based on the concept of ecosophy, presented by Félix Guattari in "The Three Ecologies", which contemplates the environment, social relations and human subjectivity. Guattari proposes the revaluation of material and immaterial goods production, which takes into account the ecosofic problematic. In this, the subject must be rethought from its existential subjectivity, that is not based on science but on an ethical-aesthetic paradigm (Conley, 2014). It is a critique to structuralism and postmodernism in the late 1980s that would have disregarded human intervention and conceived ethical and aesthetic ideals to transform the goals of material and immaterial goods production. Under these circumstances, Mostafavi's concept proposes the debate about the essence of disciplines that study urban space, from Guattari's perspective. This would be a new view of the discipline through ecology's lens, based on a transdisciplinary and collaborative approach (Mostafavi, 2014).

Ecological urbanism must be transdisciplinary to deal with conurbation dynamics in the global scale, a proposal of interaction between architecture and urbanism disciplines. It brings a holistic and regional perspective that does not see the city as a single object, but rather a feature that interacts with other spaces beyond its surroundings, including the rural environment (Duany, 2014). In addition, locally made interventions are relevant, since they correctly reflect the urban society needs of a dynamic and adaptable space. Structuring a legal, political and economic framework that enables interventions at multiple scales is a major challenge, providing governance (Mostafavi, 2014).

The ecological urbanism considers density an important concept when thinking the cities strategically, seeking to produce them more compact and dense, what presupposes the approximation between public authority and private sector. For this purpose, it is necessary to have lasting public policies based on ethical and aesthetic principles that address issues such as density, land use, infrastructure and biodiversity. To reach it, it is presumed the questioning of lifestyle and current social constructions, such as individual motorized displacement, low density, food production and waste generation on a wide scale, and the absence of uncovering experiences in the cities. Ecological urbanism is the opportunity to test how new practices could change such situations, and is tied to a discourse of

human relations and communities rescue (Mostafavi, 2014).

It is a consensus in its discourse that the urban conception of cities should be participatory, part of an emancipatory exercise whereby the population's desires to transform the territory are as valuable as the knowledge accumulated with the traditional practice "top down". This configuration of design process allows adaptations to local social and cultural characteristics, by all means, it handles with territories individualities instead of crossing them with the "blank slate". In this regard, ecological urbanism does not define "fixed rules, but is based on flexible principles, adapted to the circumstances and conditions of each place" (Mostafavi, 2014, 40).

This movement aims to withstand the tendency to annul differences between places, that produces global cities with identical characteristics, disconnected from local traditions and cultures (Doherty, 2014). It pursuits to open up space to imagine and conceive projects for cities, with the use of theoretical-investigative exercises before the establishment of public policies. The intention is to explore multiple creative possibilities that, once conceived, will underpin the policies (Mostafavi, 2014).

While city beautiful and new urbanism movements suggested the rescue of a nostalgic image of past time and social homogeneity, ecological urbanism has its focus on the city as the necessary arena for the conflicting relations. It should be recognized the inevitable existence of its "political" dimension, the inherent social antagonisms, and exploited possible benefits of some conflicts, in order to feature the democratic politics. A society where there is a full consensus among its members is practically inconceivable, therefore, the urban space must be thought as a place that enables dialogues and debates about its problems (Mostafavi, 2014).

Interfaces conceituais e a sustentabilidade urbana

Built on the detailed information about the different concepts presented in the previous section, a comparative analysis was carried out (Table 01). It made possible to accomplish a critical analysis of each approach contribution to reach of urban sustainability.

TABLE 1
ANALYSIS OF THE APPROACHES STUDIED.
SOURCE: PREPARED BY THE AUTHORS.

Analysis	Urban Ecology	Biophilic Cities	Sustainable Urbanism	Ecological Urbanism
Influences	Science of Modern Ecology (1950) or Human Ecology (1920).	Biophilia, popularized by E.O. Wilson.	Response to the suburban and sprawled American context and its consequences. Popularized by Douglas Farr, based theoretically on Urban Smart Growth, New Urbanism and LEED Certification.	Context of climate change, real estate collapse and oil crisis. Seminar promoted by Mohsen Mostafavi at Harvard University's Graduate School of Design and Architecture, USA (2009).
Concept	Study of the interactions between organisms, built and physical environment.	Seeking the approximation between human being and nature in the cities.	An approach that addresses urban issues with sensitivity to environmental problems.	A system that, through the association between ecology and urbanism, can provide knowledge, methods and clues about what the urban can become.
Strategies	Analyze the urban environment from an ecosystem perspective, considering its own flows of matter and energy. To analyze the interactions and flows of organisms present in urban settlements.	Establish the natural element as the main criteria of the city design, planning and management. Promotes engagement, interpersonal connections and educational actions.	Promotes compacity, restoring the transport model back to pedestrian displacement and corridors of public transit. Should consider the efficiency of buildings and urban infrastructure.	Values and conflicts of ideas as inductors of urban sustainable development. Eco-efficient urban systems. Promotes flexibility as the response to different urban situations.
Implications to urban design	Search for metabolic efficiency through the urban morphology reinvention and organization of uses and activities within the city.	Use of existing natural elements and the recovery of those degraded. Insertion of nature into each urban component (roads, buildings, etc.).	It recovers the neighborhood unit as a key element on promoting self-sufficient spaces.	Permeability with rural environments. Highlights the public space as a political arena.
Approximations to sustainability	Emphasis to the environmental dimension. Social, economic and political dimensions are less discussed.	Emphasis on the environmental dimension. Economic and political dimensions are less discussed.	Emphasis on the environmental and economic dimensions. Political and social dimensions are less discussed.	Emphasis on the political and social dimensions. Economic dimension is less discussed.
Challenges	Greater openness to interdisciplinarity, especially with the social sciences disciplines.	Cultural, political and economic resistance. The practical sphere needs more studies.	To shape the approach to different contexts. To ensure that social demands are not neglected.	Still in a development stage. Translating the ideas framework into the practical sphere.

Either urban ecology and biophilic cities have as their main contribution, to the reflection on urban phenomena and its problems, don't see the city as an exclusive space for people, since both consider that the approximation between human being and nature is fundamental to the quality of life. The city is an ecosystem governed by the same laws of the natural ones, but its processes are transformed. That does not eliminate the existence of natural pulses in this space, but as the cartesian logic conceals them from everyday life, it makes the reconnection between nature and human being permeated by conflicts such as urban floods, sandstorms, population explosions, and species migrations.

It is essential for human development to recognize that in the city coexists people, multiple life forms and natural dynamics, while the conviviality and wise usage of these opportunities is beneficial. Urban ecology and biophilic cities have relevant considerations on these issues and significant potential for rediscovering harmonious relationships. In this terms, they advance significantly on the environmental and ethical dimensions of sustainable development, and biophilia is a key element.

It can also be inferred that these concepts bring advances in social issues, with major contributions to the formation of a collective sense and social cohesion. However, they do not go deep into political debates, about the social inequalities, or the current economic model of production. These issues are eviscerated in cities, and are embedded in the conjunction of urban crises that arise in many countries, especially those in development. Perhaps this is a point leading to such departure from these questions, since both urban ecology and biophilic cities are concepts that have matured in developed countries reality. Therefore, they may not have in their bases dynamics of the developing countries, that support the suggestion of institutions, means (political, social and economic) and infrastructures that enable their ideas.

It is fundamental that the pursuit of alternatives to sustainable urban development be attempted, or at least dimensioned, to the realities of poor countries at the margins of great powers. In these places, there is still an enormous gap for the solution of basic questions regarding human relations, which makes the attempt of rapprochement between people and nature immensely more challenging.

The comment about maturation in different realities it's also applicable for the approaches of sustainable urbanism and ecological urbanism. However, the ecological urbanism proposes a greater flexibility of response to different urban situations, as opposed to sustainable urbanism, which is more tooling and tight. In general, the sustainable urbanism proposal contributes to cities environmental quality, but does not establish strong relations with other dimensions of the sustainable development besides environmental and economic.

The roots of the concept on the efficiency matrix and Douglas Farr's experiences, who is a member of the LEED system committee, induce the proposals to the economic needs of market. What is positive in some

aspects, since it makes it viable and visible to the building sector. However, the model distances itself from sustainability by not establishing social and political principles, and giving little consideration to the city as arena of socioeconomic conflicts

The sustainable urbanism is also a very toolset approach. Its design for a specific context, the American, makes it necessary to adapt the proposed instruments when applying them in other urban realities. Otherwise, the indistinct replicability of its tools would neglect important cultural and social aspects that guarantee the social function of the city in other countries or even in different American realities than the usual.

The proposed tools for social participation, such as charrettes - workshops involving urban project stakeholders - have the potential to encourage public participation in decision-making processes. However, if the model responds to market needs equal attention should be given to community involvement, in order to establish a democratic process of cities design.

In contrast, ecological urbanism is an emerging and agglutinating field, which proposes the sum of some ideas that are still in construction. It permeates numerous dimensions of sustainability, emphasizing social and political issues, since without recognizing the city as a space of conflicting relations, it will not be possible to achieve the environmental quality sought by sustainability. It includes discussions about compacity and efficiency, but exposes some doubts concerning models that are tight and supposedly replicable, such as LEED certifications. These doubts, in addition to the scale issues (neighborhood, building), also involve the problems caused by the lack of model adjustment, mainly due to the western influence over cultures. It places political issues, and hence civil society, as protagonists of participatory processes and regulators of the models effectiveness.

By proposing the detailing of concepts and avoiding limited tools, ecological urbanism does not present solutions to environmental issues, but creates opportunities for their development in the future. Some indications of this are the proposal of mixing symbiotically humans and natural elements in functional habitats, and the interfaces established by ecological urbanism with urban ecology and rural issues.

In order to be consistent with its principles, it is necessary that the approach explores possibilities of configuring the urban space that do not come exclusively

from architects and town planners, since the transdisciplinarity proposed by the concept is still limited to the urbanism disciplinary fields. It must be considered that, nowadays, there are even more professionals with interconnections and contributions to the improvement of environmental-urban quality, such as biologists, environmental managers, chemists, engineers, among others.

Analyzing all the concepts regarding their approach to urban sustainability and the challenges placed to each one, it is evident that separately they are not able to solve the many problems occurring in the urban space. Urban ecology and biophilic cities present theoretical bases that can expand the urban planning and design framework present in sustainable urbanism and ecological urbanism, for instance. Therefore, it is not plausible to choose one as "the most appropriate", but it is to perceive that each one can fill a gap in the development of more sustainable cities, and can evolve as they confront their identified challenges.

Conclusions

The approaches can "pave" possible paths towards sustainability, through the instrumentalisation of urban environmental management, especially at the municipality level. A challenge established for Brazil and other countries, is to feasible and to implement policies that, in effect, lead to sustainability. Mainly overcoming the existing conflict between the collective interest, inherent to any development adjectived as sustainable, and the absence of a real social control of the public management system, which should be the main articulator of this process.

Moreover, it's fundamental to recognize the existence of distinct realities regarding environmental, social, economic and political aspects, as well as plural urban contexts. To attend this diversity, the use of the described approaches must have a notion of adaptability to local realities, an attribute not presented in all of them. It is believed that through the critical analysis of the instruments and strategies from environmental and urban theories, associated with broad social participation, it is possible to develop autochthonous approaches. These perspectives should be underpinned on sustainability principles the most holistically as possible and, on these locally structured bases, lead to new realities collectively signed.

References

BEATLEY, T. An Excerpt: Imagining Biophilic Cities. *Citygreen*. Issue 4, p.162-169, 2012.

BEATLEY, T.; NEWMAN, P. Biophilic Cities Are Sustainable, Resilient Cities. *Sustainability*. Issue 5, p.3328-3345, 2013.

BLACK, E. Green neighborhood Standards from a planning perspective: the leed for neighborhood development (LEED-ND). *Focus*, v. 5, iss. 1, 2008.

BRASIL (MINISTÉRIO DO MEIO AMBIENTE). *Sustentabilidade urbana: impactos do desenvolvimento econômico e suas consequências sobre o processo de urbanização em países emergentes*. Textos para as discussões da Rio +20: volume 3, habitação social e sustentabilidade. Brasília: MMA, 2015.

CONLEY, V. A. Práticas urbanas ecológicas: As três ecologias de Félix Guattari In: Mostafavi, Mohsen; Doherty, Gareth (org). *Urbanismo ecológico*. São Paulo: Gustavo Gili, 2014.

DORERTY, G. O verde é mais que os olhos veem: ecologias do verde em Barein In: MOSTAFAVI, Mohsen; DOHERTY, Gareth (org). *Urbanismo ecológico*. São Paulo: Gustavo Gili, 2014;

DOWNS, A. Smarth Grown: why do que discuss it more than we do it. *Journal of the American Planning Association*, v. 71, n. 4, 2005;

DUANY, A. Uma teoria geral do urbanismo ecológico. In: Mostafavi, Mohsen; Doherty, Gareth (org). *Urbanismo ecológico*. São Paulo: Gustavo Gili, 2014.

FARR, D. *Urbanismo Sustentável: desenho urbano com a natureza*. Porto Alegre: Bookman, 326 p., 2013.

FORMAM, T. T. R. Ecologia urbana e distribuição da natureza nas regiões urbanas. In: Mostafavi, Mohsen; Doherty, Gareth (org). *Urbanismo ecológico*. São Paulo, Gustavo Gili, 2014.

GRINDE, B.; PATIL, G. G. Biophilia: does visual contact with nature impact on human well -being? *Int. J. Environ. Res Public Health*, issue 6, p. 2332–2343, 2009.

KELLERT, S. R.; HEERWAGEN, J.; MADOR, M. *Biophilic design: the theory, science and practice of bringing buildings to life*. John Wiley & Sons, 2011.

LARA, F. L. Admirável urbanismo novo. *Arquitextos*, São Paulo, ano 01, n. 009.09, Vitruvius, 2001. Acesso em: <http://www.vitruvius.com.br/revistas/read/arquitextos/01.009/923>

MC DONNELL. Chapter 1. In Niemela, J., Breuste, J. H., Elmqvist, T., Guntenspergen, G., James, P., & McIntyre, N. E. (Org.) *Urban ecology: Patterns, processes, and applications*. Oxford: Oxford University Press, p. 8, 2011.

MOSTAFAVI, M.. Por que um urbanismo ecológico? Por que agora? In: Mostafavi, Mohsen; Doherty, Gareth (org). *Urbanismo ecológico*. São Paulo: Gustavo Gili, p.12-53, 2014.

NIEMELA, J.; BREUSTE, J. H.; ELMQVIST, T.; GUNTENSPERGEN, G.; JAMES, P.; MCINTYRE, N. E. Introduction. In.: _____ (Org.), *Urban ecology: Patterns, processes, and applications*. Oxford: Oxford University Press, p. 1 – 4, 2011.

RIBEIRO, F. P. O new urbanismo e sua influência no Brasil: o caso da "Cidade Universitária Pedra Branca" em Palhoça, SC. *Pós*, v. 17, n. 28, p. 36 - 56, 2010.

SCHROEPFER, T. Além do LEED, uma avaliação do verde na escala urbana. In: MOSTAFAVI, Mohsen; DOHERTY, Gareth (org). *Urbanismo ecológico*. São Paulo, Gustavo Gili, 2014.

TAVARES, F.; FERREIRA, G. G. T. Marketing verde: um olhar sobre as tensões entre green-washing e ecopropaganda na construção do apelo ecológico na comunicação publicitária. *Revista Espaço Acadêmico*, n. 138, p. 23-31, 2012.

WHITE, R.; STOECKLIN, V. L. Nurturing children's biophilia: developmentally appropriate environmental education for young children. *White Hutchinson Leisure & Leaning group,* 2008.

WU, J. Urban ecology and sustainability: the state-of-the-science and future directions. *Landscape and Urban Planning*, v. 125, p. 209 – 221, 2014.

Acknowledgments

This paper has financial support from the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), process nº 2015 / 09752-0 and 2015 / 09751-4.

The opinions, hypotheses and conclusions or recommendations expressed in this material are responsibility of the authors and do not necessarily reflect the views of FAPESP and CAPES.