

URBAN PLANNING INSTRUMENTS AS BIODIVERSITY PROMOTERS IN CITIES

Planeación urbana
instrumentos promotores de biodiversidad en las ciudades

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RESUMEN

El tema de la biodiversidad urbana fue incluido en las discusiones académicas de la Convención de las Naciones Unidas sobre la Diversidad Biológica (CDB) de 2006. En este artículo se describe la evolución conceptual sobre el tema en las reuniones internacionales, que reúnen al gobierno, sociedad civil y el mundo académico; y pone de relieve el concepto de servicios de la biodiversidad del medio ambiente para el funcionamiento de las ciudades y las iniciativas para crear Índices de Biodiversidad Urbana (IBU), tales como el estado de la técnica en la materia.

El artículo analiza cómo articular los instrumentos tradicionales de la planificación urbana para promover la biodiversidad urbana, y la contribución de los índices urbanos bajo las leyes de los planes maestros que dan forma a los espacios urbanos en diferentes escalas. Como resultado, se obtuvo un conjunto de posibles instrumentos de planificación urbana, como los patrones de uso del suelo y la zonificación y subdivisión capaces de estructurar una agenda para la conservación de la biodiversidad en zonas urbanas.

Palabras clave: biodiversidad urbana, gestión ambiental urbana, planificación urbana.

ABSTRACT

Urban Biodiversity subject was included in academic discussions of the United Nations Convention on Biological Diversity (CBD) from 2006. This article highlights its conceptual evolution in international meetings, which bring together governmental, civil society and academia; and highlights the concept of environmental biodiversity services for cities functioning and initiatives to create urban biodiversity indexes (UBI), such as the state of the art on the subject.

The article discusses how to articulate the traditional urban planning instruments for urban biodiversity promotion, and the contribution of UBI under the laws of urban master plans that shape spaces in different scales. As a result, it obtains a set of possible planning instruments, such as land use patterns and zoning as able to structure an agenda for biodiversity conservation in urban areas.

Key words: biodiversity, environmental management, planning.

INTRODUCTION

THE URBAN ISSUE ON BIODIVERSITY CONVENTION

The role of urbanization in the loss and degradation of global biodiversity discussed during the UN Conference on Environment and Development (UNCED) in 1992, resulting their inclusion in Agenda 21 and in Convention on Biological Diversity (CBD). The Convention was ratified by Brazil in 1994, through Legislative Decree n. 2 of National Congress.

Biodiversity management was understood as the responsibility of national government, with little attention paid to local government in the implementation of the first acts of the CBD. The role of municipal governments began to be recognized from the increase of studies that articulate the urban issues with environmental concerns, but also because cities concentrate the political and economic power of nations.

Besides the local government, other actors are essential to achieve effective actions, such as representatives of the municipal legislature that should provide necessary laws to ensure the implementation of measures of protection and conservation. Engaging citizens, companies, NGOs and other actors in society will give the role of the formation of the opinion that the city has.

The first initiative in the context of the CBD, which comes from the local, occurs in 2006. The Local Action for Biodiversity Program proposed by ICLEI (Local Governments for Sustainability), aimed to guide the cities and local authorities on the importance of sustainable cities with a focus on biodiversity.

Brazil, held the first meeting on Cities and Biodiversity (Curitiba, 2007), when it was proposed the Global Partnership on Cities and Biodiversity, and was approved *Curitiba Declaration on Cities and Biodiversity*, which reaffirmed the commitment of mayors in actively contribute to the implementation of CBD objectives to achieve the goals until by 2010.

During the 9th Conference of the Parties (COP 9) in 2008, was held the Conference of Mayors, entitled “Local Action for Biodiversity”, which brought together officials from several countries and was launched Bonn Declaration (Call for Action). Still, during COP 9 was adopted Decision IX/28 that recommends to the Parties the engagement of cities and local authorities, recognizing that strategies implementation and action plans for biodiversity success requires strong collaboration between different levels of government, especially local governments. At the time, Singapore that hosted the World Summit of Cities, has proposed a draft indicators to measure biodiversity in cities, which led to the institution of Urban Biodiversity Index (Singapore Index).

In 2008, during the World Conservation Congress of IUCN, was officially launched the Global Partnership on Cities and Biodiversity, which included UN, ICLEI and IUCN, which had the active participation of the host cities of the COPS 8, 9 and 10 Curitiba (Brazil), Bonn (Germany), Nagoya (Japan) respectively, and Montreal (Canada). This last county hosted the Secretariat of the Convention on Biological Diversity (CBD).

In January 2010, Curitiba hosts the Second Meeting on Cities and Biodiversity, which was discussed the text that should be submitted to the 10th Conference of the Parties (COP10). There was approved the 2nd Curitiba Declaration on Cities and Biodiversity. In parallel to COP10, in Nagoya, Japan, a meeting was held in the Summit on Cities and Biodiversity, which originated Nagoya Declaration on Cities and Biodiversity. Because of COP10, the Parties adopted the Sub-national Government, Cities and Other Local Authorities Action Plan.

During the Eleventh Meeting of the Conference of the Parties (COP11), held in Hyderabad, India in 2012, the urban theme kept growing in visibility with the discussion of the document *Cities and Outlook Biodiversity*, produced by 123 scientists under the coordination Swede Thomas Elmqvist of Stockholm Resilience Centre.

In a very concise way the key messages that of the document are:

- Urbanization is both a challenge and an opportunity to manage ecosystem services globally.
- Rich biodiversity can exist in cities.
- Biodiversity and ecosystem services are critical natural capital.
- Maintaining functioning urban ecosystems can significantly improve human health and well-being.
- Urban ecosystem services and biodiversity can help contribute to climate-change mitigation and adaptation.
- Increasing the biodiversity of urban food systems can enhance food and nutrition security.
- Ecosystem services must be integrated in urban policy and planning.
- Successful management of biodiversity and ecosystem services must be based on multi-scale, multi-sectorial, and multi-stakeholder involvement.

- Cities offer unique opportunities for learning and education about a resilient and sustainable future.
- Cities have a large potential to generate innovations and governance tools and therefore can-and must-take the lead in sustainable development.

The main recommendation of these events was to encourage the realization of joint projects between national governments and cities to implement strategies and action plans of national and local biodiversity, also suggesting the exchange of experiences on best practices in urban biodiversity.

Another recommendation was that the regional development agencies and international banks engaged in projects that include infrastructure development for cities, integrate biodiversity considerations. Training programs on biodiversity for local authorities are encouraged to induce the production of knowledge about the state of biodiversity in cities and the construction of management tools.

Biodiversity Summit on Cities and Sub-national Governments, held in October 2014 in Pyeongchang, had more than 270 representatives. The event consolidated a network of 40 cities committed to the promotion of urban biodiversity strategies and proposed the articulation of the Biological Diversity Convention (BDC) with the goal 15 of Sustainable Development Goals (SDG) terms that aims to incorporate the promotion of urban biodiversity in cities.

BDC does not provide quantitative methods for establishing the sustainability of use, but defines five general areas of activity to analyze in cities. These five areas the need to:

- i. Integrate the conservation and sustainable use in national decision.
- ii. Avoid or minimize adverse impacts on biological diversity.
- iii. Protect and encourage customary use of biodiversity in accordance with traditional cultural practices.
- iv. Support local populations the development and implementation of remedial actions in degraded areas.
- v. Encourage cooperation between its governmental authorities and private sector in developing methods for sustainable use of biological resources.

The events demonstrate the perception that technical and urban managers have about the importance of urban areas for biodiversity protection.

Urban functions depend on environmental resources and demonstrate that the proposed initiatives are restricted to diagnose areas with greater or lesser biodiversity through the mapping of variables that can interfere with the protection and promotion of biodiversity. More often meets aspects of different sizes: from behavioral policies. Small steps achieved to set or adjust the instruments that incorporate the protection and promotion of biodiversity in urban planning.

THEORETICAL ARGUMENTS: ENVIRONMENTAL SERVICES AND URBAN BIODIVERSITY

Studies on biodiversity¹ expanded the original meaning that supported the previous discussions of the BDC, and can be best expressed in three categories (MMA, 2005): (i) genetic diversity, which refers to the variation of genes within species; (ii) species diversity, which refers to the variety of species found within a region; (iii) diversity of ecosystems, environments and landscapes, involving factors such as soil types, the depth of groundwater and climate, for example.

The relevance of urban biodiversity fits the diversity of ecosystems, and the concept of environmental services, which best expresses the importance of protecting and promoting biodiversity in urban planning strategies, to incorporate the urban planning protection strategies environmental services ensuring sustainability cities.

Environmental services are a wide range of goods and services provided by ecosystems that sustain life, regulating the ecological balance, and that provide goods that provide cultural services. (Millennium Ecosystem Assessment, 2005).

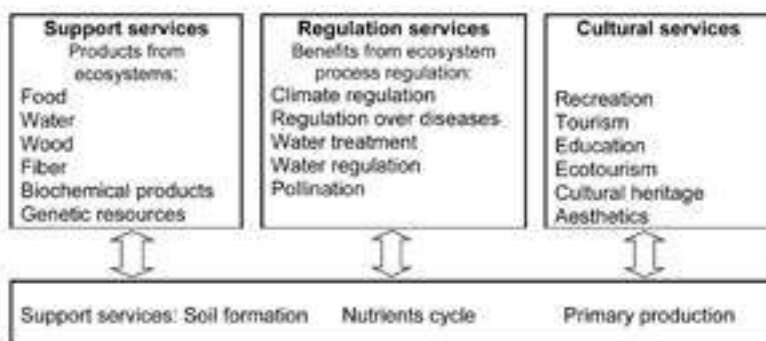


Figure 1. Environmental services

Source: Adapted from Millennium Ecosystem Assessment, 2005.

¹ Biodiversity is defined as the total number of genes, species and ecosystems of a region, and can be divided into three categories (WRI / IUCN / UNEP, 1992).

In Brazil, Bill #792/2007 defines the legal definition for environmental services, and it is still in analysis in Brazilian Congress. Environmental services are flows of matter, energy and information from natural capital stock, which combined with services and human capital produces benefits to humans, such as:

- Goods produced and provided by ecosystems, including food, water, fuel, fiber, genetic resources, and natural medicines.
- Services obtained from ecosystem process regulation, such as air quality, climate regulation, water regulation, water treatment, erosion control, regulation of human diseases, biological control and risk mitigation.
- Intangible benefits that enrich life quality, such as cultural, religious and spiritual values, traditional and formal knowledge, inspiration, aesthetic values, social relations, sense of place, cultural heritage value, recreation and ecotourism.
- Services needed to produce all other services, including primary production, soil formation, oxygen production, soil retention, pollination, provision of habitat and recycling nutrients.

Understanding environmental services maintenance, especially regarding the role of urban areas, the scale of the processes that maintain these services is relevant. Some environmental services derived from limited scale processes, may be, at least partially supplied by alternative technologies. However, services resulting from cycles of larger scale, as carbon and other elements essential to life cannot be replaced and its interruption could mean the end of human life.

The importance of protecting and promoting biodiversity for urban development differs from traditional nature conservation, and requires a change of defensive action to protect the nature of the impact of development -to a more active action to satisfy human demand for biological resources, ensuring the sustainability of long-term cities.

Biodiversity is strongly influenced by the built environment and economic dynamics, social and cultural community. The loss of biodiversity affects ecosystem functioning in the city and its surroundings, causing problems such as heat islands, urban floods, shortage of drinking water, disease spread and reduced ability of self-purification of natural ecosystems. There is also the relationship between the loss of urban biodiversity and climate change on cities.

Therefore, urban ecosystem and biodiversity conservation create a range of benefits to the city inhabitants, promoting necessary environmental services to population welfare, such as water supply, air quality, leisure and health. The important thing is to know how to integrate biodiversity

issues to the mitigation and adaptation to climate change, to sustainable management of water and waste, to land use planning and to other public services available to the urban population.

The urban environment is generally understood only from the negative impacts on natural resources. The traditional approach to urban management needs new strategies to old problems such as improper disposal of solid waste; the contaminated water dump in rivers or in inappropriate areas; and disorderly urban expansion leading to exploitation of natural resources in a predatory manner.

The integration of protection strategies and promotion of biodiversity and urban planning are set up as a proactive approach to urbanization.

UNDERWAY INITIATIVES TO PROTECT BIODIVERSITY IN URBAN AREAS

The biodiversity protection initiatives that has prevailed in the cities have emphasis on maintenance of green areas. They are native species conservation actions in the green spaces of the city such as parks, gardens and groves. There are initiatives to create gardens in cities where they grow plants that attract birds and other animals; encourage the creation of other gardens as a way to increase urban biodiversity.

Green areas also have impact on the performance of environmental services. They can provide better air quality in urban centers; minimize the impact of carbon emissions; promote a better quality of life; and supply locally grown food.

Colding, Lundberg and Folke (2006) emphasize that fauna and flora of green areas can create habitat networks that are functionally related, which facilitates the process often critical in urban areas, such as seed dispersal, pollination, and even same transport nutrients and organic matter.

They also report that home gardens maintain a rich flora, including rare or endangered ones, indicating the existence of studies, which state that, in the UK, private gardens contain two times more plant species than any other habitat assessed. Garden still maintain a high number of invertebrates, and this finding applies regardless whether plants are native or exotic.

Savard, Clergeau and Mennechez (2000) state that planted residential areas create air corridors through trees canopy, and are useful for migratory birds that use them to provide food and protection from predators.

Biodiversity in urban areas can also act as a connector between habitat fragments, i.e., can minimize natural vegetation process of reduction and isolation. Despite not being understood the effects of

habitat fragmentation on biodiversity maintenance, the connection between fragments is essential for plant population's conservation. It also contributes decisively to gene flow between populations, which occurs through propagules and pollen scattering. Thus, anthropic areas connecting the fragments, or even small fragments and isolated plants may contribute to gene flow (MMA, 2003).

Colding, Lundberg, Folke (2006) point out that even large portions of protected areas located in cities are unable to maintain dependent and sensitive species to disturbance over time, if surrounding areas are neglected.

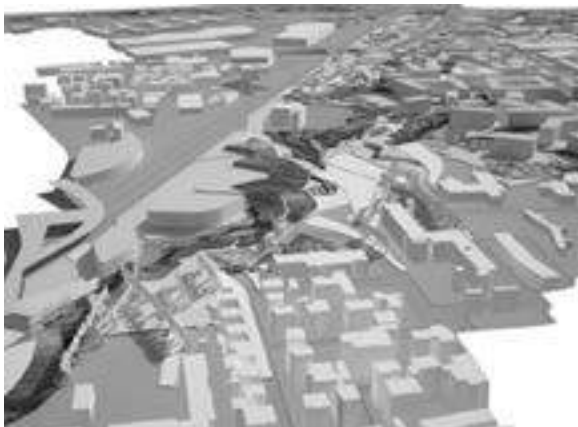


Figure 2. Project that identify existing green areas and connect them in urban corridors of biodiversity
Source: 3rd Prize in the competition for Cesena Master Plan, Italy-mirallestagliabue.com

The strategy for biodiversity conservation through conservation units, dissociated from an approach that ensures conservation of broader landscapes, may not ensure effectively the maintenance of viable ecologically communities. This is because conservation units are true “islands” which, isolated amid landscape, suffer a progressive deterioration of their environment, mostly from the edges, in the face of human activities and natural disturbances (MMA, 2003).

Nowadays the emphasis on the treatment of urban green areas as biodiversity protection strategy is a restricted view in safeguarding the environmental services required for the functioning of cities. Therefore, it is necessary to perform the analysis of the potential of the tools provided in urban policy to incorporate protective actions of environmental services.

URBAN MANAGEM INSTRUMENT ANALYSIS TO IMPROVE BIODIVERSITY PROTECTION

The more used urban land use regulation instruments in urban planning in both developed and developing countries, land use zoning and, land subdivision rules and building codes that can be classified as regulatory instruments physical-territorial.

Usually, these rules regulate on shape, volume, density, location, height limits, and mandatory free areas. According to Clark, in Ribas (1994, 2003), five specific scales of physical-territorial regulation affect those urban areas:

- Global configuration of city and urban macro-zoning, translated in the master plan.
- Specific urban areas or zoning.
- Land division.
- Construction regulation.
- Infrastructure systems. Water, sanitation, public lighting, roads and transport.

Urban planning no longer use only regulations of their morphology. The urban instruments evolved, expanding the idea of management beyond morphological space, and has incorporated new principles: equity, efficiency and effectiveness, flexibility and social participation in the definition of planning and management instruments of urban land.

Those new principles are the baseline that support sustainable public policies and include strategic management instruments. The most widespread are the following ones: (Ribas, 1994)

- Regulatory rules of ownership, tenure and transactions, environmental control, infrastructure and for public services.
- Urban development stimulus: incentives and direct and indirect support for land development, urban revitalization and improvement, and infrastructure provision to guide urban development.
- Taxes and fees on property, infrastructure and services, and subsidies for infrastructure provision, construction and services.
- Institutional Coordination of land use and of financial, socioeconomic and environmental development in space, national, regional and

local policy coordination, that affect land use and development, support to low-income and other vulnerable groups in city.

- Social control -recently were included social control instruments as public hearings, government and society policy councils, plebiscite, referendum etc.

In Brazil, these principles were the basis of the *Urban Development Law* approved in 2001, which, after 14 years, is partially implemented in all municipalities with over 20,000 inhabitants, 1.391 cities.

Biodiversity protection is not explicitly addressed in the Brazilian Urban Policy. This paper examined two categories of instruments (morphological and strategic) and their application in protecting biodiversity. At this point, we present the results for the instruments of physical planning.

URBAN MANAGEMENT INSTRUMENTS AND POTENTIAL ACTION TO PROMOTE BIODIVERSITY

The analysis considers three instruments from Brazilian legislation, according to their scales of intervention in the urban space. The instruments chosen considered the scope of activities and objectives in terms of urban policy. *The Urban Master Plan*, *The Urban Development Act* and the *Forestry Plan* were elected because they are adopted in most major cities.

The scales of intervention are regional, which includes the city; intra-urban, with their sectors and neighborhoods; and the lot.

- In regional scale, identification of ecosystems to be protected and corridors to be implemented, water basin in order to support measures at regional scale and its repercussions in terms of city.
- In city scale, proceed an inventory of the natural resources inside cities- its organization, distribution, abundance and importance to maintaining connection among fragments and to environmental services. With this information, should be checked for possible “hotspots” of urban biodiversity and established strategies for their preservation or use, considering the community and its relationship with environment. Another procedure might be recognition of the surroundings of protected natural areas, to determine measures that can minimize the impact on natural resources.
- In developments of urban expansion areas, consider preserved natural areas and its relevance to connect between habitat fragments, trying to integrate with green areas from private

developments or from recreational facilities, such as clubs, golf fields and cemeteries. This may contribute to connect fragments.

- In neighborhood scale, tree plantation in boulevards, squares and green areas, adopting native species.
- In private property scale, encouraging vegetation planting in home gardens with owners' awareness about the importance of their actions at the local level, in order to promote ecological corridors, facilitating species movement in the city.

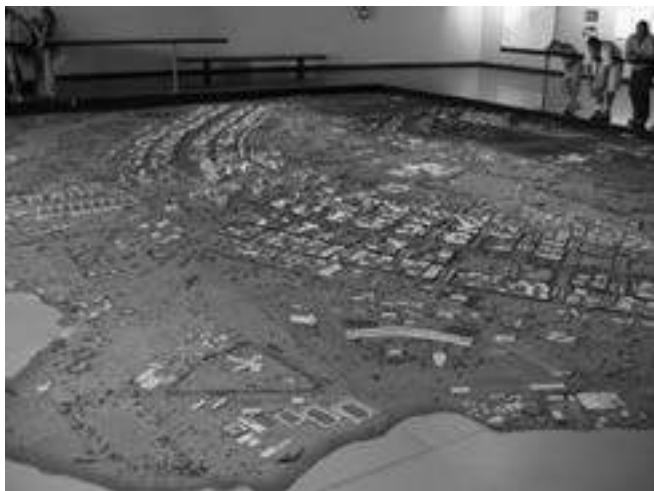


Figure 5. Model Lucio Costa's of Pilot Plano of Brasília, 1955.
Source: Author photograph, 2012.

Articulate the objectives and instruments available to urban planning to promote and conserve biodiversity, concerns that should permeate the definition of these instruments regarding the protection of biodiversity are:

In natural habitats, biodiversity can be present in:

- Conservation units in urban areas, especially those of protection, that contains preserved natural attributes.
- Permanent preservation areas along urban streams or rivers.
- Open or interstitial spaces arising from uncertainties related to land tenure, or from infrastructure treatment plants that create idle areas around, useless for develop.
- Expansion urban zones that are not yet developed, usually located far from densely populated central areas that were previously rural.

- Urban parks that has unspoiled natural areas.

In modified habitats, biodiversity may be present in:

- Green urban areas. *The Federal Law* nº 6.766/79, which regulates for division of urban land, states that the development must provide open spaces for public use, among which is part of the green areas and squares.
- Public or private squares.
- Urban parks.
- Huge facilities like clubs, golf fields, cemetery, or *non-aedificandi* areas inside private properties that has reduced built areas.
- Private garden.
- Along roads and avenues, where vegetation serves to decorate urban landscape or shade roads.



Figure 3. Urban Park of Flamengo, Rio de Janeiro. Source: Cultura e Cidadania Journal, 2012.



Figure 4. Forest rate resulting from land use design. Source: Cultura e Cidadania Journal, 2012.

The relationship between protection needs of environmental services, the scope of urban policy instruments and the performance scales is explained in Table 1.

Table 1. Propositions to incorporate biodiversity protection into usual urban instruments.

Urban management instruments	Biodiversity protection actions
Urban Master Plan	• Develop biodiversity promotion strategies in order to link natural areas to spoiled uninhabited areas. • In order to improve biodiversity protection strategies, use instruments such as: • Establish ecological corridors or environmental connectors, or • Develop a "Urban Green Areas System" including streams, green public spaces (such as linear parks, sidewalks, playgrounds) green private areas (golf fields, clubs and cemeteries) • Develop fauna and flora inventory in strategic areas for environmental protection. • Propose a <i>Urban Forestry Plan</i>.
Urban Development Act	• In areas to be developed, establish a percentage of natural green covered area. • Define density, occupancy rate, construction and permeability rate of the lots, in order to protect natural vegetation. Therefore, the construction rates would be defined case by case, considering the features of the area to be developed.
Urban Forestry Plan	• Prepare the <i>Urban Forestry Master Plan</i> considering at least the following biodiversity protection guidelines: a) Trees in cities as diverse vegetation periods of flowering, fruiting and size; b) Prioritize typical species of natural flora; c) Consider using fruit species, in some places to feed birds, and perennial species to reduce the turnover of gardening practices; • Provide mentoring program for planting on private lands.

CONCLUSIONS

The application of the Brazilian Urban Policy instruments that can ensure the environmental services through biodiversity protection will depend on the scale considered urban (city, of their sectors or neighborhoods, and the lot) or the reach of each instrument: If *Master Plan*, *Urban Development Act* or *Forestry Plan*.

The proposals presented in Table 1 are feasible within the existing legal framework, and current knowledge. It is only need to expand the vision and institutional coordination in urban management.

The conciliation between urban and environmental aspects is the way of urban sustainability construction and, therefore, in translating the concept of sustainable development.

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