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PARKS IN THE URBAN LANDSCAPE AND THEIR POTENTIAL FOR THE DEPLOYMENT OF PROTECTED AREAS – A CASE STUDY IN SOUTHEASTERN BRAZIL

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ABSTRACT

The present study aimed to evaluate the public spaces entitled "park" in the city of Sorocaba, São Paulo State, Brazil. The evaluation was divided into three steps 1) identification of areas, bibliographical research on the concept; 2) preparation of a proposal for selection of areas with greater environmental relevance, based on the criteria of size, percentage of native forest cover, and function of these spaces; 3) systematic evaluation of these spaces and construction of an environmental quality index for selected areas. We identified 33 parks, and 42.5% of the total was excluded by size, 42.5% by percent of minimum vegetation, and five parks showed favorable requirements for establishing protected areas. Of the land area of all parks, 41% has native forest cover, 42% has area smaller than 5 ha, altogether, they account for only 5% of the forest cover. The five selected parks as potential for the establishment of conservation units account for 47% of the vegetation cover. We conclude that there are no standards or criteria for the creation of public spaces entitled "park" in the city, which hinders effective management of these spaces. We identified the need for changes in the SNUC (National System of Conservation Units) to encompass these urban spaces

Key-words: Municipal parks; Urban parks; Open spaces; Conservation units.

"PARQUES" EM PAISAGEM URBANA E SEU POTENCIAL PARA IMPLANTAÇÃO DE ÁREAS PROTEGIDAS - ESTUDO DE CASO NO SUDESTE DO BRASIL

RESUMO – O presente trabalho teve como objetivo avaliar os espaços públicos intitulados "Parque" no município de Sorocaba, a método de avaliação se constitui em três etapas: identificação das áreas, pesquisa bibliográfica sobre o conceito; elaboração de uma proposta de seleção das áreas com maior relevância ambiental, com base nos critérios: tamanho, percentual de cobertura florestal nativa e função destes espaços; avaliação sistemática destes espaços, assim como construção de um índice de qualidade ambiental para áreas selecionadas. Foram identificados 33 parques, pelo método proposto 42,5% foram excluídos pelo critério tamanho, 42,5% pelo critério percentual de vegetação mínima, 5 preencheram requisitos favoráveis para instituição de unidades de conservação. Da área territorial de todos os parques, 41% apresentam cobertura florestal nativa, 42% destes apresentam área menor que 5 ha, juntos são responsáveis por apenas 5% da cobertura florestal, os cinco parques selecionados com potencial para instituição de unidades de conservação são responsáveis por 47% da cobertura florestal. Concluímos que não há normas ou critérios para instituição dos espaços públicos intitulados como "Parque" no município, este fato traz prejuízos na gestão eficaz destes espaços. Foi identificada ainda a necessidade de alterações no SNUC (National System of Conservation Units para abranger estes espaços em meio urbano.

Palavras-chave: Parques Naturais Municipais; Parques urbanos; Espaços livres; Unidades de conservação.

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INTRODUCTION

The genesis of free spaces protection occurred by religious motivation in primitive societies. In the West, according to historical account, the first protected areas emerged to ensure a hunting territory or resources of flora to the royalty and aristocracy (VALLEJO, 2009).

The protected areas entitled "parks", according to Scalise (2002), originated from the urban architecture reform proposed by Georges-Eugène Haussmann in Paris between 1850-1860, and influenced the entire Europe. In America, the American Parks Movement, led by Frederick Law Olmstesd in New York, occurred in Chicago and Boston, and promoted the construction of large contemplation gardens and landscape parks. The objective was to meet demands for spaces for recreation, leisure, contemplation, and soothing of the damage caused by the intense industrialization promoted by the industrial revolution.

The design of larger protected areas focused on the conservation of natural areas (wilderness), scenic beauties protection, biodiversity and maintenance of ecosystem services emerged at the end of the 19th century in the United States. It started with the establishment of the Yellowstone National Park, its perspective was conservationist and dichotomous between "human" and "nature", and it was soon spread to several countries (VALLEJO, 2009).

Since then, the design of protected areas has evolved and the use of the terminology "park" was suitable both for urbanists and conservationists and, incorporated into other areas, this fact resulted in multiplicity of expressions and conceptual vagueness, according to Benaduce (2007).

In urban spaces, legal mechanisms provide maintenance of green spaces in allotments and urbanistic interventions as compensatory mechanism for environmental impact. These spaces are compulsorily transferred to the public domain and the percentage of area allocated varies according to the municipal legislation. These spaces become patrimony of the whole community, assets of common use for the people, endowed with legal protection of inalienable character, with a clear social and environmental mission. In this sense, Article 17, of the Brazilian Federal Law No. 6.766/79, prohibits the allocation of these areas to any purpose other than the socio-environmental character for which they were created.

Benaduce (2007) identified that in São Paulo State, 40% of the areas of the parks had this origin. In other cases, the spaces come from expropriations for protection purposes and public interest, when its attributes are justified (RANGEL and RIBEIRO, 2010). The management of these areas by Brazilian municipalities is confusing, mostly there is no identification means and spaces for urban purposes and those with potential for conservation are mixed conceptually.

The city of Sorocaba is no exception. Among its numerous public spaces, many of which are commonly called "parks" may have equivalence to conservation units (CU) according to the National System of Conservation Units (SNUC) (BRASIL, 2000), for its characteristics of biodiversity and conservation of resources of the physical environment. However, others have a small size, small or absent percentage of native forest cover

and the main urban function. There is an obvious generalization of the concept of "park", also observed in other municipalities by Lima et al. (1994); Richter (1981); Tandy (1982) (*apud* LIMA et al. 1994); Loboda and Angelis (2005); Bruccheri and Nucci (2006), Oliveira (2007), Coporusso and Matias (2008) and Pereira (2011). The term "park" is used indiscriminately in the sense of Urban Park and Municipal Natural Park.

In this context, the objective of this work was to analyze the physical, biotic, and use free public spaces entitled "park" in the city of Sorocaba, São Paulo State, Brazil. We aimed to describe if the creation of these spaces is in accordance to standards, rules or criteria. We propose a method based on physical and biotic characteristics that make distinction between the spaces with predominantly urban characteristics from those with a potential for CU. We also constructed and applied an index of "environmental quality" to these selected areas to assess whether they have potential for the deployment of protected areas.

MATERIALS AND METHODS

Study site

The study was conducted in the municipality of Sorocaba, in the southwest of the state of São Paulo, between the coordinates 22-24°45'S lat; and 47-48°15'W long. According to official data of IBGE (2012), it has a population of approximately 586,625 inhabitants and territorial extension of 448.989 km^2. The current Master Plan (Municipal Law No. 8,181/2007) features this extension in 17.6% as rural, 71.17% urban and 11.23% industrial.

The remaining vegetation is composed of the Atlantic Forest and Cerrado (Brazilian savannah) biomes, with predominance of semideciduous seasonal forest (KRONKA, 2005). According to Mello (2012), the natural vegetation highly fragmented in the municipality and 2,537 forest fragments correspond to 16.68% of the territory. Of the fragments identified by the author, 62% is smaller than 1 ha.

Method

The research method was divided in three stages. Stage 1 consisted of a documentary and cartographic analysis of the established parks in Sorocaba. Stages 2 comprised a preliminary assessment of all these spaces with criteria for distinguishing between the spaces with urban purposes and those with the potential to establish CU. Stage 3 was a detailed analysis of selected areas with potential for the deployment of conservation units using an index of "environment quality" built with the objective to evaluate their natural attributes.

Stage 1

This phase consisted of the bibliographic survey, secondary source, in order to examine the doctrinal treatment of Urban Green Areas, Parks and Conservation Units. We analyzed the Brazilian and foreign municipal systems that somehow presented typology and classification suggested by the dominant doctrine. We also consulted laws, decrees, and similar legal instruments, primary source.

For the study area, we identified the legal instruments (laws and decrees) for the creation of parks, which permitted to evaluate the location, cartographic survey, size, and function of these spaces.

For the cartographic survey, 66 scanned aerial photographs were used in scale 1:20,000, with spatial resolution of 0.4 m, in the year 2006, which comprised the entire municipality, provided by the Municipal Government. These images were vectored, georeferenced, and exported to the ArcGis® 9.0 software to identify, locate, and delineate its territorial extension, land area, water resources, vegetation cover, and extension of permanent preservation area.

Stage 2

We carried out visits in October and November of 2012 to all parks and their surroundings to identify the physical and biotic characteristics, soil occupation, and use of these spaces by the population. The characteristics of size, occupation by native vegetation in fragment, form of occupation of surrounding areas, presence of urban, rural, natural, industrial, or residential infrastructure was reviewed with reference to Angelis et al (2004); Benini & Martin (2010), Bellester-Olmos & Carrasco (2001).

In this stage, the objective was to distinguish the spaces with characteristics and potential to fulfill urban functions (urban parks, squares, green areas, forests, gardens, squares, and others), from those whose natural characteristics justify the creation or maintenance of protected areas, using as reference the characteristics of conservation units (CU) provided in SNUC (BRASIL, 2000).

Burke et al. (2009), Barragán (2001) and Morsello (2001) defend the use of size criterion and mention concepts of the theory of island biogeography (MACARTHUR and WILSON, 1967) to establish minimum sizes, varying according to the species to be protected. Therefore, a division was proposed in size classes described in Table 1, where spaces smaller than 5 ha were deleted. The use of this exclusion criterion is justified by problems related to the edge effect (BORGES et al, 2004). The use of the minimum percentage of native forest cover, as an exclusion criterion, is based on the necessity of a minimum area of vegetation to fulfill environmental functions. Avelar & Silva Neto (2008); Falcón (2008); Guzzo (2006); Bellester-Olmos & Carrasco (2001) and Cavalheiro et al (1992) champion this concept, thus, we excluded the areas that did not provide minimum variable percentages in relation to the area size (Table 1) and we did not consider isolated trees, only native fragments. The minimum percentage of vegetation is reduced gradually due to the size of the area in order to ensure a minimum area of vegetation that can range from 3.5 to 40 ha or more, according to the area size. The parameters established as minimum size and vegetation occupation are

justified by the findings of Liira et al (2012) that found that the best conditions of a forest fragment in the woods in rural areas are defined in terms of a minimum area of 2.5 ha.

Table 1. Minimum percentage of forest cover and size of the areas analyzed.

Size Classes	Minimum percentage of forest fragment (land area)
<5 ha	Exclude
5.1 to 10 ha	70%
10.1 to 50 ha	60%
50.1 to 100 ha	50%
Larger than 100.1 ha	40%

The function was another concept considered as it prioritized conservation of natural attributes and identified occurrence of access structure that enables the reception of visitors, due to the presence of equipment for public use.

The surroundings were evaluated through the analysis of land use near the "park". We considered preferential areas whose surrounding is endowed with natural attributes that allow connectivity to other forest fragments, such as vacant lots, existence of native and exotic reforestation, broad and wooded avenues, among others.

We considered areas without features for the creation of CU with dimensions smaller than 5 ha, with percentage of native vegetation areas in continuous fragment below the percentages described in Table 1, spaces with the main function for leisure, recreation, sports practices, and social conviviality with direct use and areas with the surroundings with intense urbanization and occupation (dense urbanization and consolidated, highways, factories).

Stage 3

Only the areas selected and identified as potential for the creation of CU and protected areas in stage 2 were the object of analysis at this stage.

These areas were evaluated in a systematic manner through an index of "environment quality" built for these spaces. The selection of the indexes that comprise this index was based on Angelis et al (2004); Bellester-Olmos & Carrasco (2001); Benini & Martin (2010); Cavalheiro & Del Picchia (1992); Durigan et al, 2006; Kliass (1993); Pereira (2011); Sanchotene (2004); Souza (2010) (Table 2).

The concept of index considered in this study had as reference Siche et al. (2007), who define index as a numeric value that represents the interpretation of the reality of a system, using a method in its calculation.

Among the indexes, the size area took into consideration the results obtained by Mello (2012) that identified the size variation of fragments of native vegetation in Sorocaba City.

For each of the indexes, we assigned a score between 0 and 10, varying according to the number of the characteristics analyzed and their importance, considering that each characteristic described has as a reference a desirable situation for wholly preservation of natural spaces. Durigan et al. (2006) used a similar method in a study for the creation of protected areas in the Cerrado biome for the state of São Paulo, Brazil.

The index built for the parks of Sorocaba was based on the sum of each score multiplied by the correction factor of 1.11 to allow the sum of the maximum score to reach 100. The spaces with higher scores reflect the occurrence of attributes that confer to the area better natural characteristics vis-à-vis other areas analyzed.

Indexes 1, 3, 5 and 6 (Table 2) were analyzed by means of aerial images obtained from the City Hall of Sorocaba, vectored and used with the aid of ArcGis® 9.0 software. After this preliminary analysis, these indexes were checked in the field to test the veracity of the information.

Indexes 2, 4, 5 and 7 were analyzed in the field to identify the successional stage of the vegetation with forest characteristics (Index 2) and the CONAMA resolution No. 10/93 and 01/94 was used as a reference. The method of analysis was to select randomly in each park sampling units (transects) with dimensions of 05 x 20m with three repetitions per area, totaling a sampling area of 300 m^2. The sampling units were distant from each other in the field by at least 10 meters.

In these sampling units, we measured all individuals with CBH (circumference at breast height) ≥ 10 cm and the height of all arboreal individuals (higher woody individuals in the sampling point). We also recorded other aspects required to identify the successional stage of the vegetation of each park.

The epiphytes were analyzed according to their presence or absence, through visual estimate, classified as "rare" when covering up to 5% of the arboreal area of the parcel in question, "little" when the percentage of coverage varied between 5-25% and "dense" when the percentage of coverage was greater than 25% of the coverage.

The lianas were analyzed according to Res. CONAMA No. 01/94 and their potential as index species (GENTRY, 1991). For the indication of their presence and absence in the sampling units, we used as a criterion the visual observation throughout the sampling area. The classification of woody and herbaceous lianas is based on the system proposed by Whittaker (1978).

The presence of herbaceous heliophytes (grass) was diagnosed by visual observation. Their occurrence in the sampling unit was classified as "rare" or "absent", when the percentage of occupation varied between 0-5%, "little" when this percentage varied between 5-25%, and "dense" when its occupation was greater than 25%. The index species identified in Res. CONAMA No. 01/94 were used for better characterization of areas.

The index of land use (index 3 of Table 2) in the surroundings aims to diagnose soil occupation in the park vicinity, which is desirable for the connection with other forest fragments. Its analysis occurred differently according to the most common uses in the municipality. We considered the use that occurs in prevalence (50% or more of the areas) of the surroundings. The analysis of this item has as reference maintenance concepts in the mitigation areas in CU, assigned as fundamental for the maintenance of natural attributes, emphasized by Ishihata (1999) and Morsello (2001).

Index 5 (Table 2) was first examined in aerial images and the data were checked in the field through visual analysis.

Index 7 (Table 2) consisted of analyzing the presence of infrastructure for leisure and recreation, such as equipment for sports, social conviviality, and leisure.

Table 2: Indexes used for assessing selected areas as potential for categorization in SNUC in the municipality of Sorocaba, São Paulo State, Brazil.

INDEX	CLASS		Score
1. Native vegetation in the fragment	1.a.Composition- Exotic and Native		05
	- Native		10
	1.b.Percentage of total vegetation	40 – 50%	1
		51 – 60%	2.8
		61 – 70%	4.6
		71 – 80%	6.4
		81 – 90%	8.2
		91 – 100%	10
	1.c.Ntive vegetation outside the Permanent Protection Area (PPA)	< 20%	1
		20.1 -30%	2.29
		30.1 -40%	3.58
		40.1 -50%	4.87
		50.1 – 60%	6.16
		60.1 – 70%	7.45
		70.1 -80%	8.74
		>80.1%	10
2. Successional stage of vegetation	Initial regeneraion stage		3.33
	Medium regeneration stage		6.66
	Advanced regeneration stage		10
3. Territorial area	5.1 to 10 ha		02
	10.1 to 50 ha		04
	50.1 to 100 ha		08
	Larger that 100.1 ha		10
4. Land use in the surroundings Score = average of scores of occurrence.	Urbanized, paved roads		01
	Grasslands		2.8
	Factories		4.6
	Annual agriculture		6.4
	Silviculture		8.2
	Native vegetation		10
5. Protection of water springs	No water course		01
	With water course, no springs		04
	Springs		07
	Marshes + springs		10
6. Connectivity	No fragments in a radius of 100m		01
	With fragments in a radio > 100m		3.3
	Fragments < 100 m non-connected and area ≤ 50 ha.		5.5
	Fragments < 100m connected and area ≤ 50 ha.		7.8
	Fragments < 100m connected and area >100 ha.		10
7. Function	Leisure, recreation, sports and social conviviality.		3.33
	Historical, architectonic		6.66
	Protection of natural resources		10
∑ . 1,11 = index of the area			**100**

RESULTS AND DISCUSSION

The analysis of the legislation that defines the public open spaces remained uncertain, since there is no uniformity in the legislation. In many cases, the legislation only addresses the concept generally, not specifically, allowing municipalities to establish "parks" according to their own purposes. Thus, the consultation to the legislation did not answer the purpose of conceptualizing the term "park". Some authors have certain aspects in common, however, the different approaches corroborate the findings of Lima et al. (1994), Richter (1981), Loboda and Angelis (2005), Coporusso and Matias (2008), and Pereira (2011) that there is no universal method of classification of public green spaces, varying according to local needs and diverse cultural aspects. In all proposals reviewed, the classification considers the function of the space in the city, its size, and in some cases, the percentage of vegetation cover is also considered, however, with highly variable parameters.

The adoption of the terminology "park" for public green space started in the 20th century with the objective of promoting the social and physical contact with nature (COSTA, 2011). Since then, several authors have addressed differently the aspects that define the term. The review of the municipal legislation and decrees established by Sorocaba City for "parks" shows the existence of 33 parks (Table 3), 25 of which were established after the creation of SNUC, and only the Municipal Natural Park "Biodiversity Corridor" was established as a CU.

The parks altogether cover a territorial extension of 1,593.87 ha and the smallest has 0.28 ha, while the largest has 1,074 ha. As a reference, we found some publications in a few cities that used similar measurements of free spaces. Galvão et al. (2003) identified in Curitiba, Paraná State, Brazil (year 2000), 14 parks that covering an extension of 1,841 ha, in addition to 13 gardens with a territorial extension of 63.3 ha, where the smallest of park in Curitiba measured 4.6 ha. Gomes (2009) identified Ribeirão Preto, São Paulo State, Brazil, 17 parks that covered altogether an area of 194.3 ha, where the smallest park had 1.1 ha and the largest, 27.5 ha.

In this study, differences were observed in the areas of some parks, between the planned design in the legal instrument (Law or Decree – Table 3) and that observed in the field and by cartography. This divergence occurred by incorporation of other public areas surrounding the park, however, it did not affect the use of the proposed method.

Table 3. Established parks in Sorocaba City and their instruments of creation. *Eliminated areas by size; **eliminated by percentage vegetation cover, selected areas as potential to establish CU in bold.

ID	Park	Area (ha)	Vegetation cover (%)	Vegetation (%)	
				Within PPA	Outside PPA
1	**Pq. Natural Dr. Braulio Guedes da Silva (Law No. 4.934/95; Law No. 4043/92)**	**9.38**	**71.55**	**61.45**	**38.55**
2	Pq. Linear - Armando Pannunzio (Law No. 8.521/08 – Decree No. 19.518/11)**	1074	0.5	100	0
3	Pq. Maestro Nilson Lombardi (Law No. 8.449/08)**	7.31	0.00	0	100
4	Pq. Flávio Trettel - Vila Formosa (Law No. 8.446/08)**	11.95	9.17	48.85	51.15
5	Pq. Natural Antônio Latorre (Law No. 7.985/06)*	4.45	19.10	6.57	93.43
6	Pq. Natural Juracy Antônio Boaro (Law No. 7.940/06)*	1.87	71.00	73.2	26.8
7	Pq. Maria Barbosa Silva - (Law No. 7.855/06 – Decree No. 17.887/09)**	16.,39	2.98	75.12	24.88
8	Pq. Kasato Maru (Law No. 7.845/06)*	0.94	17.29	100	0
9	Pq. Santi Pegoretti Maria Eugênia (Law No. 7.807/06)**	20.56	29.69	75.12	24.88
10	Pq. Natural João Pellegrini (Law No. 7.665/06)*	2.59	10.31	43.04	56.96
11	Pq. Yves Ota (Law No. 7.405/06)**	12.03	45.87	63.84	36.16
12	Pq. Natural da Cachoeira - Dr. Eduardo Alvarenga (Law No. 7.379/05)**	15.82	17.95	79.48	20.52
13	Pq. Raul de Moura Bittencourt (Law No. 7.301/04)**	20.58	31.06	49.5	50.5
14	**Pq. Natural Chico Mendes (Law No. 3.034/89)**	**15.17**	**77.73**	**30.26**	**69.74**
15	Pq. Quinzinho de Barros - Zoológico (Law No. 1.087/63)**	13.15	32.7	18.05	81.95
16	**Pq. Municipal Mario Covas (Law No. 6.416/01)**	**52.67**	**83.14**	**36.43**	**63.57**
17	Pq. Dos Espanhóis (Law No. 8.536/08)*	4.74	9.17	66.71	33.29
18	Pq. João Câncio Pereira - Pq. Água Vermelha (Law No. 3.403/90)*	2.02	50.54	93.21	6.79
19	**Pq. Pedro Paes de Almeida - Horto Municipal (Law No. 2.815/88)**	**21.75**	**72.04**	**31.88**	**68.12**
20	**Pq. Natural Municipal Corredores da biodiversidade (Law No. 10.071/12)**	**62.47**	**49.62**	**34.8**	**64.2**
21	Pq. Carlos Alberto de Souza (Decree No. 14.418/05; Law No. 5.963/99)**	10.43	20.71	61.16	38.84
22	Pq. Brigadeiro Tobias (Decree No. 19.372/11; Law No. 9.889/11)*	4.56	28.28	94.79	5.21
23	Pq. Jd. Botânico (Decree No. 18.567/10; Law No. 9.918/12)**	6.51	18.43	0	19.80
24	Pq. Do Éden (Decree No. 18.468/10)*	0.81	7.40	85.73	14.27
25	Pq. Walter Grillo (Law No. 8.506/08 – Decree No. 18.287/10)*	1.56	40.38	43.72	56.28
26	Parque da Cidade (Decree No. 17.883/09 - 17.902/09)**	120	28.14	48.91	51.09
27	Pq. Pirajibu (Decree No. 16.432/09)**	46.8	48.44	53.53	46.47
28	Pq. Da Biquinha (Law No. 9.956/12)*	2.88	86.80	67.02	32.98
29	Pq. Ouro Fino (Law No. 9.963/12)**	9.69	47.6	79.25	20.75
30	Pq. Antônio Amaro Mendes - Jd. Brasilândia (Law No. 8.440/08)*	3.35	22.08	75.16	24.84
31	Pq. Municipal Profa. Margarida L. Camargo (Law No. 7.155/04)*	1.91	11	58.56	41.44
32	Pq. Miguel Gregório de Oliveira (Law No. 6.443/01)*	15.25	26.69	82.66	17.34
33	Pq. Steven Paul Jobs (Law No. 10.070/12)*	0.28	96.42	94.79	5.21

The parks in Sorocaba feature heterogeneity of sizes. Of the 33 parks identified, 14 (42%) are smaller than 5 ha, 5 (12%) range between 5.1 and 10 ha, 11 (33%) vary between 10.1 and 50 ha, 2 (6%) between 50.1 and 100 ha, and 1 (3%) has size greater than 100 ha. This scenario emphasizes the fragmentation identified by Mello (2012), also present in medium and large cities in Brazil and Latin America. In the metropolitan region of Santiago, Chile, Paecke et al. (2011) found that only 3% of the green areas are larger than 1 ha.

However, some cities display a different scenario. Galvão et al. (2003) cite that the three largest parks account for 88% of the total area of parks in Curitiba City, Paraná State, Brazil. The other parks feature of average size of 20.4 ha and although the authors point to the small territorial extension of the parks in Curitiba, in terms of nature conservation, the parks have land area much higher than those identified in Sorocaba. In Santo André City, São Paulo State, Lavendowski et al. (2007), identified 10 parks with a total area of 53.2 ha. In Osasco, São Paulo State, Shibuya and Kakizaki (2011), identified six parks that account for an extension of 23.98 ha.

Regarding vegetation in parks, in Recife, Pernambuco State, Brazil, Meunier (2009) shows the existence of eight parks that represent only 0.2% of the area of the municipality, which are cited with low arboreal density.

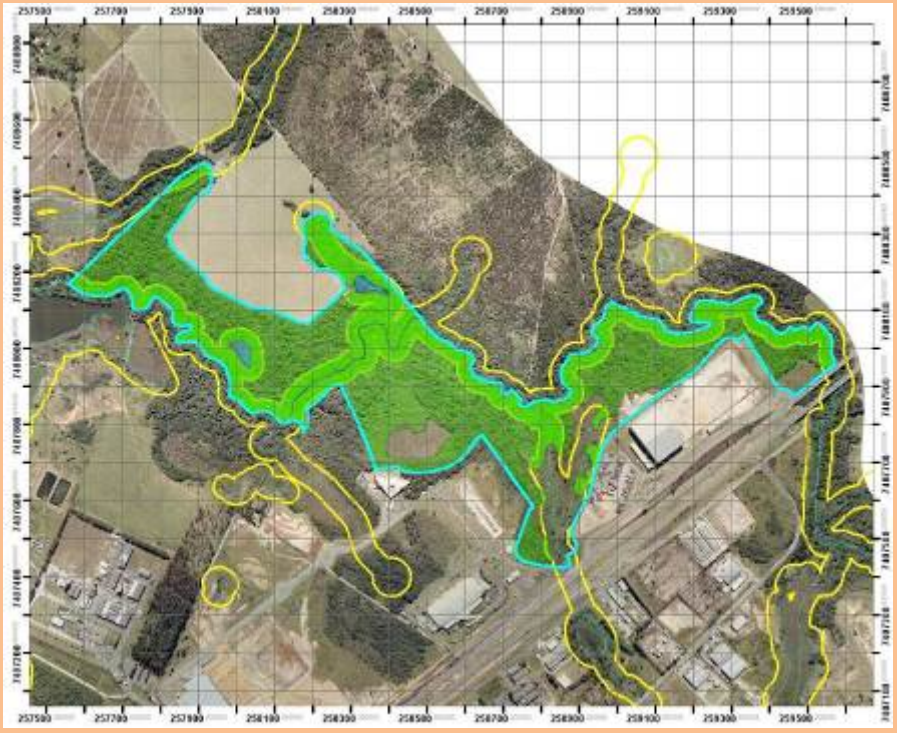
In Campinas, São Paulo State, Santin and Cielo (2009) report that the vegetation in municipal parks and gardens amounted to 38.01 ha equivalent to 1.87% of the vegetation cover, with areas ranging from 0.86 to 4.38 ha.

In Sorocaba, the native forest cover of the parks is highly variable, however, its entirety corresponds to 232.89 ha, which represents just 3.1% of remnant native vegetation cover in Sorocaba identified by Mello (2012).

Stage 2 allowed to eliminate 14 (42.5%) of the areas analyzed based on the size criterion (Table 1) for presenting areas smaller than 5 ha and other 14 (42.5%) for not reaching the minimum percentage of native vegetation cover according to their size (Table1). The five selected areas in stage 2 were Pq. Chico Mendes Municipal Natural (Fig. 5), Pq. Municipal Braulio Guedes da Silva (Fig. 4), Pq Pedro Paes de Almeida (Horto Municipal José Levy Prado) (Fig. 3), Pq. Municipal Natural "Biodiversity Corridors" (Fig. 2), and Pq Municipal Mario Covas (Fig. 1). Their respective qualitative assessments are listed in Table 4. These five selected parks alone account for 47% of the total forest cover areas called "parks", and they are the spaces that best fit with the concept of "park" as a CU.

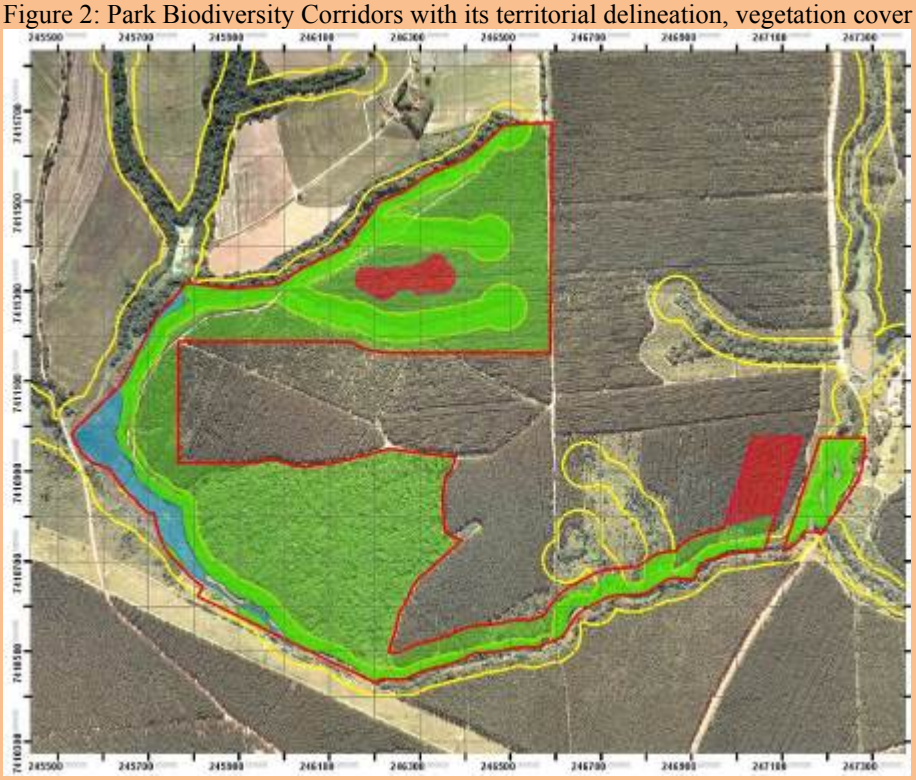
The five selected areas were analyzed through the index constructed based on the current environmental reality of Sorocaba, in stage 3.

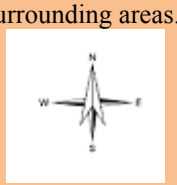
Figure 1: Park Mario Covas with its territorial delineation, vegetation cover and surrounding areas.



Municipal Park Mario Covas
Area: 526,677 m^2
Vegetation cover: 437,856 m^2
Lake area: 526,677m^2

Figure 2: Park Biodiversity Corridors with its territorial delineation, vegetation cover and surrounding areas.



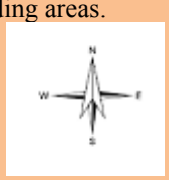


Municipal Park
Biodiversity Corridors
Area: 624,768 m^2
Lake/marsh area: 32,368 m^2
Land use change: 3,299 m^2

Figure 3: Park. Municipal Horto with its territorial delineation, vegetation cover and surrounding areas.

Municipal Garden Park Pedro Paes de Almeida
Area: 217,533 m^2
Vegetation cover: 156,716 m^2

Figure 4: Park Bráulio Guedes with its territorial delineation, vegetation cover and surrounding areas.



Braúlio Guedes da Silva Park
Area: 93,760 m^2
Vegetation cover: 67,085 m^2

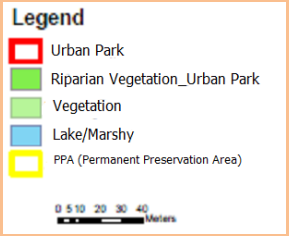
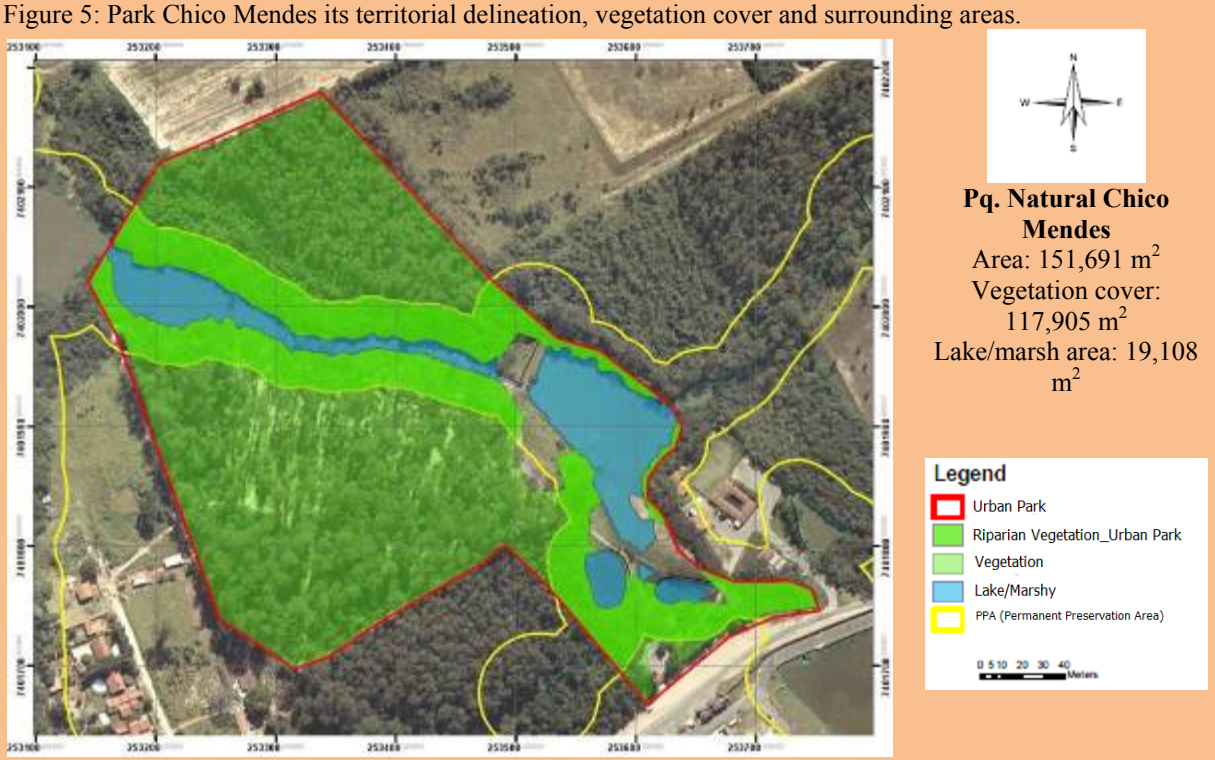


Figure 5: Park Chico Mendes its territorial delineation, vegetation cover and surrounding areas.



The result (Table 4) showed that Park Mario Covas (Figure 1) is better qualified with an index of 89 out of 100. This value shows the importance of this area in the current reality of Sorocaba. However, this space passes through what Vallejo (2009) considers lack of territoriality, given the absence of transversal public policies. This area has not had preparation and implementation of a management plan, not does it show minimal structure for receiving the public and research development. This park is located in a region of great environmental importance because it is one of the only water sources of the municipality where water is collected for public supply, besides it suffers great pressure from factories in its surroundings. Since 2005, a management plan and its effective implementation have been expected.

The Park Municipal Natural "Biodiversity Corridors" (index 73.5) is the only park created as a CU according to SNUC. It has a large area (62.47 ha), however, with percentage of native forest cover (49.62%) close to the cutting line, according to the proposed method. In spite of the large area, the area of native forest cover is relatively small (31 ha), much of the area is covered by urban forest and devoid of vegetation.

The Park Bráulio Guedes da Silva (index 61.1) features natural preserved characteristics, without direct use by the public. Despite its small size, it presents a small fragment to the Northwest, and another to the Northeast, although disconnected from each other due to the presence of a large avenue (Fig. 1).

The Park Chico Mendes (index 57.8) has features of heavy use, with early-stage vegetation on regeneration in the understory of *Eucaliptus* sp in most of its area.

The last classified park, the Park Horto presents part of its area with heavy use, where there is a swap meet, however, it has a large area of native vegetation in medium stage of regeneration and with great potential for connectivity with other

areas with its territorial extension and percentage of significant vegetation.

Table 4: Result of qualitative assessment of selected areas characterized as potential for in SNUC in the municipality of Sorocaba, based on the index built in this work.

Index / Park	CHM	HOR	BRG	BIO	MAC
1. Native Arboreal Vegetation in fragment	18.85	23.85	19.98	13.45	25.65
2. Succession stage of vegetation	3.33	6.66	6.66	6.66	6.66
3. Territorial area	4	4	2	8	8
4. Land use in surroundings	1	1	1	8.2	10
5. Protection for springs	4	10	10	10	10
6. Connectivity	7.8	3.33	5.5	10	10
7. Function	3.33	3.33	10	10	10
FINAL SCORE:	**46.9**	**57.8**	**61.1**	**73.5**	**89.0**

Note: **CHM** – Park Chico Mendes; **BRG** – Park Bráulio Guedes; **HOR** – Park Horto; **BIO** – Park Corredores da Biodiversidade; **MAC** – Park Mario Covas.

The data show that there no standards, rules, or conditions to establish the concept of "park" in Sorocaba. Paecke et al. (2011) identified the same problem in Santiago, Chile, and the authors cite this lack of standardization also occurring in Canada, the United Kingdom, Germany and the United States. Costa (2011) underlines that this situation was identified in the Federal District, Brazil, and considered inappropriate the use of the concept "park" in a generalized way.

Concerning size, we observed the existence of areas ranging from 0.28 ha to 1,074 ha using the same terminology. The percentage of forest cover is another discrepant variable, and there are cases of 0% (Park Maestro Nilson Lombardi) and 96.42% (Park Steven Paul Jobs), which in turn has the smallest size (0.28 ha).

The use of the proposed criteria showed that 85% of the spaces established as "park" in the municipality of Sorocaba cannot fit in the category of whole protection of a CU "Municipal Natural Park" (BRASIL, 2000) as they do not have natural features relevant for conservation.

Thus, this study points to the need to use separate terms for areas with different characteristics and differentiated management objectives. In this sense, the municipal public power should rethink the areas generically called "parks" and categorize them into two large groups. The first, comprised by the 28 areas eliminated in this study, should be identified urban parks, squares and the like. The second group, composed by the five selected areas in this study, as protected areas. Still, maybe some of these five areas do not have all the necessary features for deploying a full protection CU, as is the case of the Municipal Natural Parks (BRASIL, 2000). However, these areas can be reviewed and reconsidered as protected areas with potential for the deployment of CU (Municipal Natural Parks) or sustainable use (Municipal Forests and others).

In practice, the use of management norms and rules of these spaces can restrict the generalization of the term "park", allowing the population to claim for effective public policies for the deployment and effective management of these spaces.

The deployment of parks that do not meet directly the public interest should be avoided, as is the case of Park Pirajibu. Its creation carved out one of the banks of a major river, the Pirajibu River; however, field observation showed that the evacuated bank

shows the least native vegetation and natural attributes relevant to its preservation, and that there is on this bank the deployment of an emissary sewer collector.

In most cases, the parks have their territorial origin in the green areas from the parceling of the soil. The Master Plan of the municipality determines the institution of 12% of the area for expansion of green areas, which cannot be built up and should serve leisure and recreation of the population, and in some cases, there is the deployment of leisure equipment, hiking trails, bike lanes, playgrounds, sports courts, which are motivators to institute these places a "park".

Many parks are still PPA (Federal Law No. 12,651, May 25, 2012), which, according to the legislation, already receive severe restrictions of use, and in some cases, they are donated to the Municipal Government to avoid urban territorial taxation, is the case of the Park Bráulio Guedes da Silva. Therefore, once accepted the donation, emerges the legal duty of effective management of the areas.

In some cases, there are parks that are deployed for environmental compensation, in this situation we observe two examples the Park Mario Covas and Park Municipal Natural "Biodiversity Corridors", which was funded by the private sector.

CONCLUSION

The results and analyses lead to the conclusion that the method used was suitable for the proposed analysis, however, the method was built considering the remnant natural areas in Sorocaba, and that its use in other cities requires adjustments, that is, the environmental context of the municipalities analyzed. The index showed coherence by ordering respectively the space with physical and biological features with closer to the concept of CU, according to SNUC, even those with greater influence of the urbanization effects.

The index was effective and useful to show priority areas for conservation. The use of the method was simple, easy to apply, without the need for in-depth studies that require time, resources, and specialized researchers.

Sorocaba has no terminological and conceptual distinction in its current municipal legislation for the spaces characterized as "park" that show features relevant to the establishment of CU from spaces with urban characteristics.

Thus, it is urgent the implementation of clear technical standards for creation and implementation of protected green spaces to fulfill the urban function and for those with potential for the deployment of CU. Also important to regulate the different possible types that show conceptual variables between these two extremes.

It is essential that the legal act for the deployment of a park be followed by regulations to ensure the proper management of these areas through the budgeting of minimal financial amounts (variable according to its territorial extension). It is required technical studies proving its relevance against other existing spaces, infrastructure, ensuring the elaboration and implementation of a management plan at its deployment.

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