MANAGEMENT AND RECOVERY OF AN URBANIZED CATCHMENT

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ABSTRACT:

This paper deals with a management study of Servidão Stream Catchment (Rio Claro City, São Paulo State, Brazil) degraded by an intense urbanization process Through a digital treatment of thematic cartographic documents (dranaige, altimetry slopes, litology), utilizing a geographic information system, a zoning of adequate uses for this area was generated Legal recommendations were also incorporated Comparisons between the recommended uses and the catchment's land use, allowed to identify inadequate uses A public consultation, was simultaneously carried out, giving us some elements to the catchment's recovery

MOTS CLÉS Zonage, récupération, bassin, qualification, enquête

RÉSUMÉ:

Les attributes physiques du Bassin de Servidão (Ville de Rio Claro, État de São Paulo, Brésil) ont été analisés et integrés par le système d' information geographique (SIG), pour l'établissement des programmes d'aménagement et de récupération Ce bassin a experimenté un intense procès d' urbanization dans les dernières décades Le traitement des parametres caractéristiques du terrain (drainage, sols, lithologie, déclivité, élévation) plus des aspects de la législation, a permit la délineation d' un zonage plus convenable du bassin Le résultat d'une enquête sur le terrain a offri des elements complémentaires pour l'aménagement du bassin

1. INTRODUCTION

The urbanization process, in the most of the regional cities, has been characterized as dominant and disperse on other land uses, withdrawing areas destined to agriculture, mining and permanent preservation areas

The Servidão Catchment, in Rio Claro City, constitutes an exemple of this fact, where the urbanization invaded areas destined to natural permanent preservation The Brazilian Forestal Code, at his article 2º, regulates this areas with criteria that would be valid for all ocupation forms However, when it deals with urban areas this Code is not so rigid, becoming very difficult the conservation of this areas and others ones interesting to biological conservation

The environmental analysis is recognized as the basic tool for the establishment of goals to the management and the recovery of degraded areas, based on ecologic issues It is, too, a primary requisite to monitoring the catchment' occupation, even compromised with others uses. This work involves, firstly, the environmental qualification of a urban catchment, in order to support the recommended uses planning and the recovery strategies.

2. STUDY AREA

The Servidão Catchment is situated in Rio Claro City, São Paulo State, between the latitudes 22º20'00" - 22º28'00"S, and the longitudes 47º32'00" - 47º36'00"WGr, enclosing an area of 21 27 Km^2 (Figure 1)

With 8,7 Km longer, the Servidão Stream, in his major part, drains arenaceous deposits (88 55%), at altitudes varying of 600-650 meters (15 55 km^2, or 73 63% of total catchment).

Slow slopes predominates, as 0-0.6 grau (31.19%) and 1 4-3 0 graus (28.63%).

3. MATERIAL AND METHODS

The physical attributes's characterization and integration was supported by a geographic information system (SGI). Simultaneouly, a number of domiciliar interview was carried out, aiming the perceptive analysis of environmental problems confronted and preferences of consulted upstream dwellers.

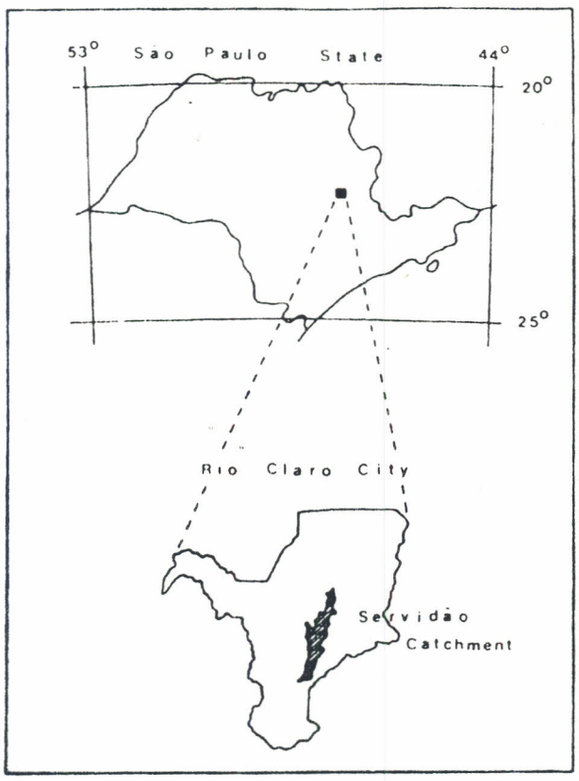

Figure 1 - Location of the Servidão Catchment

3.1 Collection of data

Terrain physical attributes data were surveyed through panchromatic aerial photographies (land use) and compiled of literature (dranaige, contour curve, lithology).

3.2 Equipments and software:

The configuration of digital system constitued: a microcomputer 486, a A0 format digitizer table; a plotter; a high resolution color monitor; the Geographic Information System (SGI), developed by National Institute of Space Research (INPE).

3.3 Digital cartography

The process of automatization of thematic charts involved operations with the data digitalization, the overlaying of informations and the generation of basic and derived charts.

Dranaige, altimetry, slopes: Altimetry and slope data were generated by a terrain numeric model (MNT) from SGI-INPE, based on planialtimetric charts, at the scale 1:10.000.

Lithology: Lithology of area was compiled from the published disponible charts (São Paulo, 1979; Cottas, 1983), and complemented with panchromatic aerial photographies.

Permanent preservation areas. These areas were derived from manipulation operations by the information system, from drainage information. These operations involves the generation of a *distance map*, wich consist on a fractionated raster image, considering, in that case, the strip of 0-30 meters from the water course margins.

It was efectued, beyond this treatment, an environmental-social survey by stream dwellers.

The visited area compreended 4,43 Km^2, i.e., 20.81% of catchment (Figure 2), where the domiciliar interviews, classified by Whyte (1978) as an interrogation terrain method, was applied. The characteristics and advantages of this methods are described by Bentham & Moseley (1982).

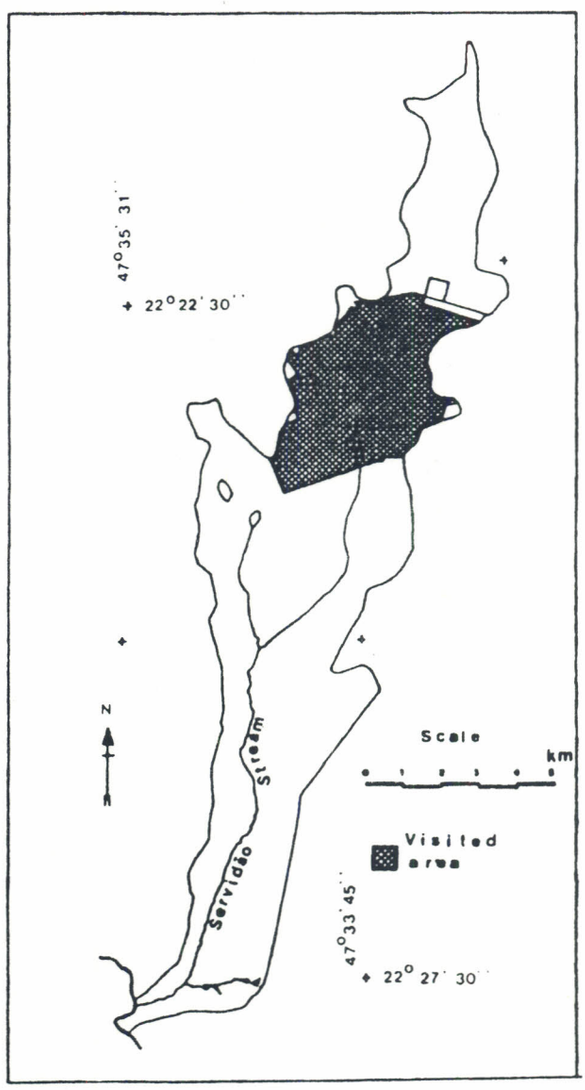

Figure 2 - Visited area

The public consultation experience involved 18 districts:
- Vila Operária
- Jardim Portugal
- Jardim Floridiana,
- Vila Saibreiro

Santana
. Alto do Santana
. Vila Martins
. Jardim Chervezon
. Jardim Floridiana
. Jardim Santa Clara
. Jardim Hipódromo
. Parque das Indústrias
. Jardim Independência
. Vila Alemã
. Jardim América
. Conjunto Habitacional Arco-Íris
. Jardim do Ipê
. Vila BNH

4. RESULTS AND DISCUSSION

4.1 Land use in the catchment

The land use survey, based on aerial photographies of 1988, has showed a predominance of the residencial use (Table 1).

Table 1 - Land use in the catchment (Km^2 and %) - 1988

Use class	Area Km^2	Area %
Riparian vegetation	0.07	0.33
Brushwood	0.56	2.65
Small wetlands	0.27	1.28
Forestry	0.32	1.52
Culture	0.56	2.65
Pasture	0.41	1.94
Few constructed area	6.84	32.42
Moderate constr. area	1.12	5.31
Densily constr. area	8.24	39.05
Green areas	0.12	0.57
Recreation areas	0.09	0.43
Bare soil	0.43	2.04
Industrie	1.29	6.11
Institution	0.09	0.43
Cemetery	0.08	0.38
Main avenue	0.56	2.65

The permanent preservation areas corresponds to 1.30 km^2 (6.22%) of the total catchment area. They have been occuped, mainly, by a few or none construction (21.13%), and, too, by a densily constructed urban area (12.68%). It was accounted, in 1988, only 2.35% of residual riparian vegetation, 4.69% of brushwoods, and 8.45% of small wetlands. Industrial and institucional uses were verified on 0.94% and 0.47% of these areas, respectively. The restant was occuped with derelicted pasture and culture, at the Southern of the catchment.

4.2 Environmental qualification by upstream dwellers

The environmental quality may be expressed by a combination of features, which, during the interviewing process, are associated by people when they expose their values and preferences.

The analysis of 12 parameters concerned to the environmental quality by the public consultation, allowed to identify the districts where a major relative number of environmental problems (de 9 a 12) were perceived by dwellers: Vila Operária, Jardim Portugal, Jardim Primavera, Vila Saibreiro, Jardim Chervezon, Jardim Floridiana and Jardim América. 88.17% of total of the interviewed dwellers asserted to be satisfied with his neighbourhood (district), while 9.80% showed unsatisfied.

For the totality of the districts, the responses, more frequently, were related with desires to the: (1) vague terrain cleanness, (2) safety and medical assistence, (3) recreation areas (parks, squares, clubs), (4) both transit and street noise controls, (5) open spaces, and (6) transport system.

4.3 Recommended uses to Servidão Catchment

The natural resources management, at a catchment level, constitutes a intensively researched theme, and very experiences have been accumulated since the catchment conception, as a planning unity, was recognized and accepted by authorities and researchers. The necessity of informations' integration, viewing the catchment planning and management, has left researchers to employ a several geographic information systems, as for agriculture planning (Ventura et al., 1988, Donzelli et al, 1992, Assad et al., 1993).

In this case study, the digital treatment of physical attributes data (altimetry, declivity, lithology, drainage), and the legal requirements as a reference (permanent preservation areas, along the water course), resulted in the generation of a synthetic chart indicating the potential or recommended uses for the studied catchment, ilustrated on Figure 3. Table 2 shows their quantification.

Not or few construction area: This class corresponds at upstream zone, which the function of environmental protection is desired, in order to present a major proportion of parks, squares, and a limited index of constructions.

The absence of open spaces was, in fact, often perceived by many consulted dwellers, mainly in the peripherical districts as: Parque das Indústrias, Jardim Independência, Jardim Santa Clara, Jardim Chervezon, Jardim América, Jardim Hipódromo. A number of dwellers, residents in Vila Saibreiro, Vila Alemã, Vila Operária, as well in Jardim Portugal, Jardim Floridiana, Jardim Primavera indicated, too, the insuficience of green areas in his district. This suggest that the proportion and function of the actual recreation systems, approved to land division has not been adequate to the claimed urban space by the local communities.

This conclusion is reinforced by suggestions of features to improve the district quality, which the more frequently response, was the increase of green and recreation areas. The greatest part of the visited residences did not presented some disponible terrain for any kind of vegetation cover. Only in the districts Jardim Primavera and Santana, it was encountered a relatively major frequence of disponible terrain with a predominantly shrub or arboreal vegetation cover. This recommended use corresponded, in 1988, to 1.61 Km^2 of the catchment area, which 1.13 Km^2, were occuped, however, by a more densily constructed area (Table 3).

Table 3 - Servidão Catchment's land use, in 1988, compared to the recommended uses classes (km^2)

	Recommended uses (km^2)				
Actual use	Not constructed area	Moderate constr. area	Densily constr. area	Conserv / Recreat.	Forestry.
Not or few construction	1 61	1 45	2.56	0.24	-
Median construction	0 35	0 62	0.12	0.01	-
Dense construction	1 13	5.58	1.08	0.11	0.43
Industrie	0 76	0 13	0.30	-	0.06
Institucion	-	-	0.06	0 01	-

Some strategies for the catchment recovery would compreended the following actions

- Organic planning of the Servidão Catchment
- Proposition of mitigative measures for the compromised areas with a unrecommended use
- Recovery of the permanent preservation areas along of Servidão Stream and humid depressions
- Industrial and urban effluents traitment
- Definition of the support programs (administrative, technical, scientific, educational) for the development of the catchment recovery
- Valuation of recovery costs

Dwellers of the most peripherical districts, which absence of recreation areas near residence was evidencied by interview process, could dispose of naturalistic edges at the borders of the districts It is possible to create scenic environments, based on natural aspects of terrain, as the small humid depressions Green belts may be utilized at the interfaces districts-industries, as well as orchard-parks constitutes an other option to that districts

Finaly, in view of a major relative percentage of consulted dwellers presents bus as the principal mean of conveyance, it is suggested an exclusive stripes system, and for the cycle tracks too, on districts Jardim Chervezon, Parque das Indústrias, Jardim Independência, Conjunto Habitacional Arco-Íris, Jardim Hipódromo, Jardim Santa Clara, Vila Martins and Vila BNH

5. CONCLUSION

This paper has demonstrated an experience with both a systematic treatment of physical attributes data and a perceptive analysis approaches, aiming to the environmental qualification Based on the first methodology, the most recommendable uses for the Servidão Catchment was presented. Through the interview process, it was identified some key elements that influences the environmental perception, as the social and district landscape attributes The recognizing of these elements has showed primordial to stablish the priorities and strategies to the catchment recovery

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