

# **Strategic framing of urban areas and water basin in Environmental Planning: Case of Vale do Rio Ribeira de Iguape, São Paulo, Brazil**

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## **Abstract**

Considering physical image of water basin for institutional improvement, research has answered seven basic questions formulated on how the image of water basins can be framed in the concept of collective resources. The main aim was to distinguish cities arrangement associated with different environment elements for integrated management. However, method composed has illustrated a simple set of techniques with holistic approach based on symbolic use of four primary elements. In each case the element analyses has adopted spatial patterns of rationalized lines, which were later integrated for a general view to interpret the actual systems. The urban component associated with the natural elements has revealed a hierarchical order of urban nucleus and by understanding gross vector pattern linked with treated Satellite imagery (Landsat-7 UTM RGB-453). Resulting imagery has clearly revealed elementary forms of spatial categories, clusters of the urban structures and intensity of interconnection of subsystems within the basin.

Keywords:

Environmental Planning; Collective Resources; Natural Resources; Remote Sensing:

## **INTRODUCTION**

Urban studies seem to be a crucial point in the actual arena of environmental management. Several Hydrographic Management Units are facing serious environmental problems in Brazil. This is due to uncontrolled urban expansion and conurbation phenomenon in water basins. Research has focused on systems of interconnected resources expecting their perception to shape policies and projects for adequate measures and prevent negative effects of cities on natural resources.

In this case, our intention is to illustrate the technique based on ideas concerning social and environmental elements, involving shapes and figures needed for strategic planning. We have taken visual elements into spatial consideration, however, based on symbolic use of primary elements. In the attempt to explore the pattern and processes involved in the actual formation and distribution of land and water resources, seven fundamental questions have been used for sequential approach.

## **METHOD**

Spatial subsystems are associated to pattern and processes in landscape features, having in its background the modeling structures that not only correspond to social economic interventions, but also to future dynamics of which several aspects are aligned to. In this way, symbolic representation of visual objects (points, lines and areas) was selected to simplify the complexity of forms, mainly pertaining to four structural elements that are needed for integrated analysis.

Four primary elements (land, water, fire, and air) were selected for integrated analysis. Rationalized patterns of each were overlaid in the process of analysis. The resulting figures were merged with the satellite image for elementary understanding of its landscape. In this way, entire urban occupations were zoned in hierarchical order according to spatial categories, considering their level of connectivity with natural and social elements. In this case, any water basin is expected to comply

with the seven fundamental questions adapted from Healey (2002), on capturing the qualities of place.

## RESULTS AND DISCUSSION

Where is the hydrograph unit? Where are its cores and borders located? Where are the limits and how are they distributed with their spatial qualities? Who does the hydrograph belong to and who has power to shape its trajectory? Can a hydrograph as such have a trajectory for its sustainable development? How can we grasp what the basin is and what it could be? Can what we grasp be useful and meaningful enough to inspire, mobilize and aid the community as a whole in their actions?

### Where is the hydrograph unit?

The basin is located on the eastern coast of Brazil, in São Paulo and Paraná States. Situated below the Tropic of Capricorn, less than 200 km from the metropolitan region of São Paulo city ( $23^{\circ} 45' S / 46^{\circ} 45' W$  e  $25^{\circ} 30' S / 50^{\circ} W$ ). Vale do Rio Ribeira de Iguape-SP corresponds to the part inside Sao Paulo State (Figure I), occupying two-third of the entire basin with approximate area of 25,000 km<sup>2</sup>. in this state, the region is known as in this State as the number eleven Hydrographic Management Unit for Water Recourses.



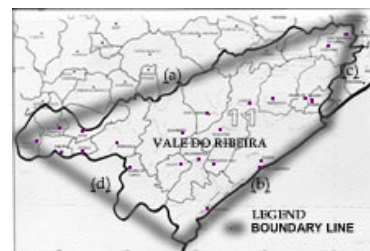
**Figure I.** – Localization: Vale do Rio Ribeira de Iguape

### Where are its cores and borders located?

Characterized by four different lines: (a) mountain line; (b) ocean line; (c) interregional and (d) interstate line. By using traced lines, the hydrograph limits were rationally defined and configured in this work to represents the borders as shown in (Figures II and III), with appropriate scale to be overlaid on several other maps (geologic, seismic, rainfall and vegetation and etc), for specific observations.



**Figure II.** Vale do Rio Ribeira de Iguape



**Figure III:** Four boundary lines

### Where are the limits and how are they distributed with their spatial qualities?

Research has selected four factors: the municipal boundaries, the main rivers, the major access routes and whole environment separating urban centers. Their systemic structures were associated to the physical and social environment in which the natural and cultural qualities were symbolically treated in accordance with the elementary theory representing Land, Water, Fire and Air respectively (Figure IV). The four elements have led to a set of maps elaborated and overlapped for

integrated analyses. In each, we have perceived the standard pattern of all lines by observing similarities and differences.

Considering the aspect of continuity, municipal boundaries have been interpreted using the gross pattern of the social subsystem. In this manner, the same three rationalized lines (Figure V and VI), have synthesized the model structure, conformity can be observed in the pattern lines of 1 and 2, whereas line 3 is completely different.

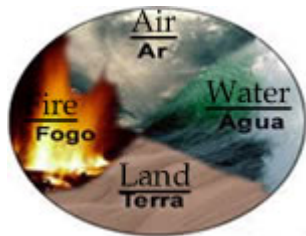


Figure IV: Four Qualities

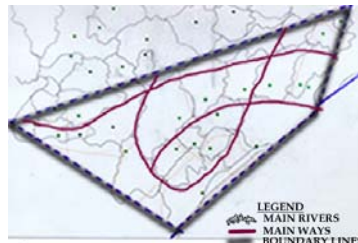


Figure V: Municipal areas

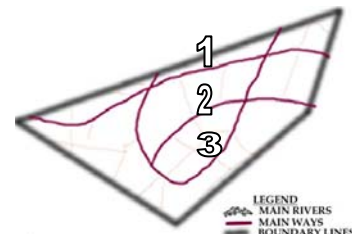


Figure VI: Land Lines

Considering the distribution of the Waters, the main rivers (Ribeira de Iguape, Ribeira, Juquiá, Lourenço, Pariqueira-Açu and Jacupiranga) were rationalized. Representing natural systems, Waterlines have on the whole interpreted not only the flow and direction, but also their link with the landscape. In this region twelve aquifers were noticed with the “T” pattern formed by three lines (Figure VII, VIII). Water zones were derived from the combination of Waterlines with rainfall lines (Figure IX).

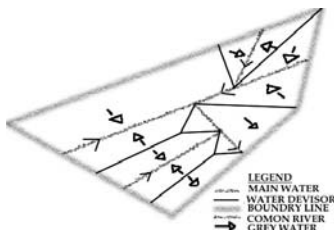


Figure VII: Water Lines

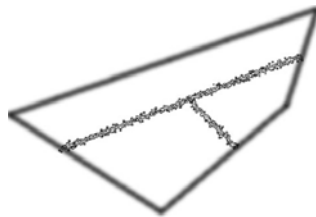


Figure VIII: Water Segments

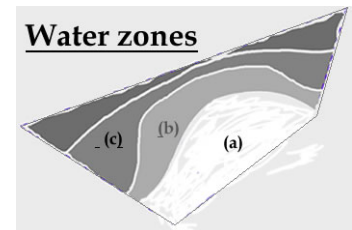


Figure IX: Water Zones

As in the patterns of Land and Water, the rationalized lines of Fire has considered railway and highway (Figure X). The former linking the Atlantic coast and the later, connecting southwest and northeast borders. The most important is the highway, passing through the core, as a result, dividing the basin in two parts. This line is shaped to contemplate continuous neighboring areas, which are embodied in its line space.

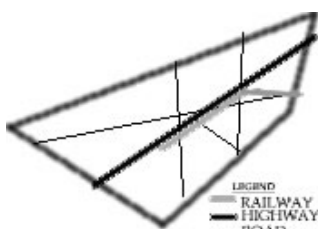


Figure X: Land ways

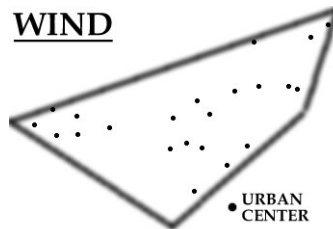


Figure XI: Urban distribution

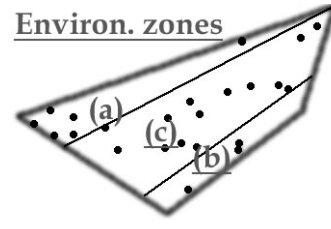


Figure XII: Environmental zones

No Air lines were found, but dots representing nodal point of the areas where 23 cities are located. (Figure XI). Integral image has revealed a leaf-like form in the heat of the basin and different urban clusters framed in three zones (Figure XII). The Coastal Zone consisting of three urban centers: i)

Iguape, ii) Ilha Comprida, and iii) Cananéia. The Mountain Zone with 06 urban centers: i) Tapiá, ii) Itaoca, iii) Ribeira, iv) Apiaí, v) Barra of Chapéu and vi) Itapirapua. Intermediate Zone with 14 urban centers arranged in hierarchical order according to three categories (Axle, Stalk and Leaf): i) Register ii) Juquia, iii) Cajati, iv) Miracatu v) Jacupiranga, vi) Pariquiera-Açu, vii) Sete Barras, viii) Eldorado, ix) Sao Lourenço, x) Juquitiba, xi) Tariri, xii) Pedro Toledo xiii) Iporanga and xiv) Barra de Truvo.

### **Who does the hydrograph belong to and who has power to shape its trajectory?**

Although this regional unit belongs to the State, the municipal bodies hold the most of the power. Next is the structure of environmental bodies of different sectors participating in public politics and the individual citizens in equal share participating with opinions and having power to reproduce current social political and economic models. For Environmental Planning, public actions depend on Legal and Economic Instruments such as: Management Plan, Law for Budgetary, Organic Law for Cities, Law of Land and Occupational Use and Environment Programs and Development Projects.

The current territorial division in Hydrographic Units consists of an organic and integrated structure directed by organisms and institutions of different sectors: i) representatives of the State / Federal Agencies; ii) municipal Government; iii) representatives of the civil sector and iv) environmental bodies of city council.

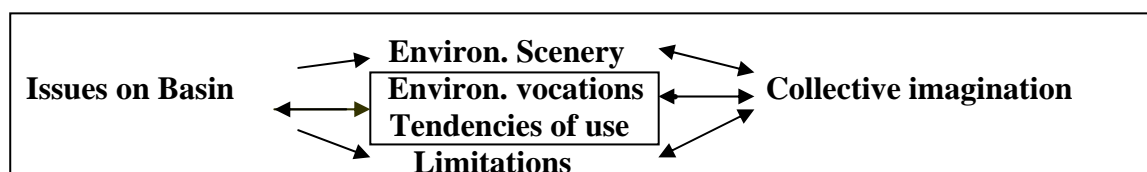
### **Can a hydrograph as such have a trajectory for its sustainable development?**

Industrial, urban, agricultural and mineralogical activities were considered in the exploration of natural resources. Water lines have led to mining area creating several towns along its way. On the other hand urban cities were divided into municipal connecting rural areas for raw materials. For development to be sustained in all activities, maintenance of elementary resources is required.

Out of the four primary elements we have focused on the complementary structures, the air and fire to subdivide the basin into the three major zones (the mountain, the coastal and the middle zones). In this case, we have seen water as good sources for urban development. On the other hand, flood phenomenon is a major problem associated with any trajectory. In the three zones, Land resources suggest easy maintenance of biodiversity relating to both cases of urban and conservation units. The core of the basin is highly important for multiple activities, in addition to tourism and commercial development supporting any other. However, municipal government in the coastal zone could invest in the preservation areas in order to develop several projects.

### **How can we grasp what the basin is and what it could be?**

According to the history of this region, ever since XVII century, minerals have initially motivated development, opening grounds for rural agriculture that was installed together with urban and commercial activities. Spatial of social and economic relations are included in the resulting image determined by the four elements interconnected with the urban nuclei interwoven by means of systems.



**Scheme I:** Areas of analysis for technical perception of hydrographic basin

The picture of satellite images (Landsat UTM – RGB 453) compared has also confirmed a leaf-like pattern different to that of the image derived from elementary composition of the four elements (Figure X). The later was considered to be the key structure of the former. In this way, the image derived could be used for the speculation of the actual urban areas and the future expression of the entire observation. Explicit analyses may follow three different observations (Scheme I), Analysis of *limitations* focusing on combined structures of Waters and Lands lines. Features in the net structure of access routes and environmental scenery were observed on the urban formation of and vocations associated with the clusters and vectors that were merged on remote satellite image.

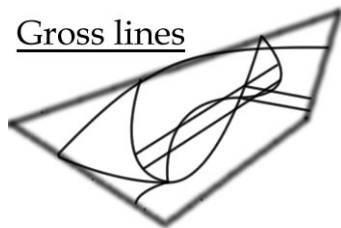


Figure XIII Gross Lines

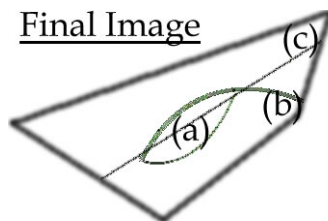


Figure XIV: Primary structure.

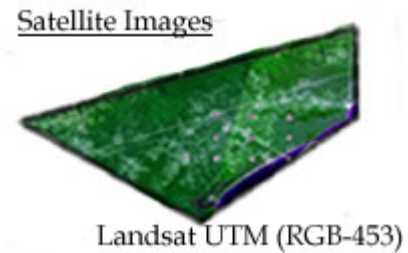
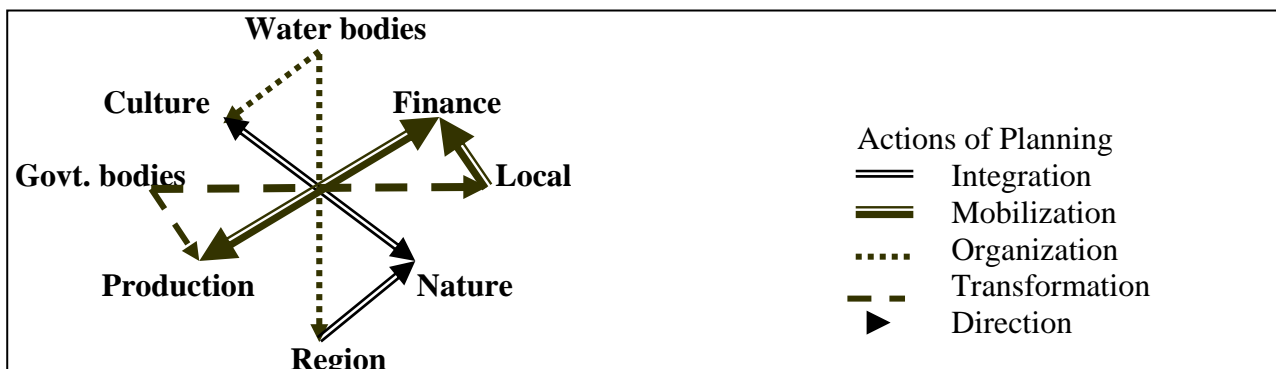


Figure XV: Soil Image

**Can what we grasp be useful and meaningful enough to inspire, mobilize and aid the community as a whole in their actions?**

The decision of water bodies exerts affect on human subsystems, subsequently on natural resources. Likewise, action by local Government transforms the landscape with great influence on production. In this context, there are the two convergent lines of articulation with greater influences connecting images as collective resource (Scheme II), the line of the mobilization that starts from the locality and goes to production process materialized, and the line of integration of the regions that involve the integration of nature and the community.



Scheme II - Joint action for integration, mobilization, organization and social transformation.

## CONCLUSIONS

The broad-spectrum subsystem pattern is complex, however, distinguished lines may simplify forms and spatial features. It is necessary to understand the simple elements, their structures, how they determine original access routes and concepts. If this can be perceived and be used for the construction of ways just before development, it may become means of transformation even for institutional organizations.

Margins are final notes of feasible image, in their differentiation and recognition, separating objects (Lynch, 1997). Composition of maps and resulting figures of this case, do not represent a landscape plan; they are mostly concerned with the expression of the physical, economical, social and political characteristics as in the local and regional scale (McHarg, 1971). It is the totality of the space that gives meaning to places; though, it is the individuality of the place, or rather the organization of places that gives forms to the landscape.

In this case, it is exactly from the global understanding of the four elements; we can really illustrate how the landscapes are structured and especially how their image can be used as raw materials for analysis. Here the local territorial figure is associated to the municipality (Santos, 1999). However, The sustainable development depends not only on the success in perceiving natural resources, but also of the essential use of the natural resources.

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