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**TERRITORIAL AND LANDSCAPE DIVERSITY AND THEIR RELATION TO THE  
URBAN OCCUPATION PATTERNS:  
A COMPARATIVE STUDY**

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**Abstract:**

We believe Brazil has a great territorial and landscape diversity which results in different formal patterns of built and non-built urban environments and differentiated morphological structures. However, the diverse urban forms are a direct consequence of the natural, social, economical and cultural aspects and that the understanding of regional characteristics and social contradictions is possible through the analysis of the existing reality.

This paper presents two portions of the Brazilian territory which have had an occupation strategy, held by the government in the same time period: the end of the XIX<sup>th</sup> century. One of the selected case studies is the city of Domingos Martins, located in the Atlantic Rainforest, in Serra Capixaba, and the other is the district of Calama, in the Equatorial Forest domain, in the riverside of the Madeira River.

Both of those regions had intense migratory processes, but we may find deep differences when we consider the territorial occupation intentions, the urban design patterns and the landscape changes.

In spite of the fact that the urban centers included in this analysis have a small scale dimension and maintain a close relation to the rural activities, the strong territorial diversity found locally enables us to study specific morphological aspects of each case through the understanding of: the natural ecosystems, the geomorphological profile, the environment resources, the distinct dimensional characteristics and the socio-cultural conditions.

Through this analysis, our work presents the historical evolution, the existing urbanistic and architectural patterns and their impacts over the landscape. In this way, we intend to discuss the phenomena, both physical and cultural, which led to different urban occupation spatial forms, trying to relate them to the natural landscape change.

**Key-words:** landscape diversity; urban occupation patterns; landscape change; morphological analysis, morphological typologies

## 1. THEORETICAL AND METHODOLOGICAL REFERENCES

According to José Lamas, urban landscape morphology is a scientific field that studies the processes which originate and explain urban form (Lamas, 1992). In that way, we have established two theoretical and methodological approaches to develop our work:

-The study of the relationship between the natural domains and the urban landscape morphology.

-The study of the relationship between the socio-economical activities, the public policies occupation strategies and the land property system.

These approaches were already discussed in recent publications which were, however, directioned to a morphological analysis done to Rio de Janeiro, in an intra-urban scale (Tângari, 1999). For this paper, we focused in a regional scale analysis made for different territorial and regional contexts.

### *1.1. The relationship between the natural domains and the urban landscape morphology*

Based on the relationship between the natural domains and the urban landscape morphology, we need to start a morphological study by having an accurate look on the main natural aspects with a direct consequence on the urban form: the soil, the climate, the topography, the water systems and the vegetation surfaces. The combination of these elements helps to explain the diversity found in different territories.

In order to understand the characteristics of the Brazilian landscape diversity and consequent urban morphological profiles, we took under consideration the comprehensive analysis done by Aziz Ab'Saber about our natural domains, which include six different ecosystems as shown in Figure 1 (Ab'Saber, 2003).

As described by Ab'Saber, these domains correspond to a combination of elements and are separated by each other by the transition areas, the white portions on the figure. An important aspect to point out is the high concentration of population along the coast, in the Atlantic Rainforest domains, and more sparse concentration in the other ones, mainly in the Amazonian region. These conditions are explained by the socio-economical and historical aspects of the occupation process, as discussed below, and are a witness of the regional differences found in Brazil.

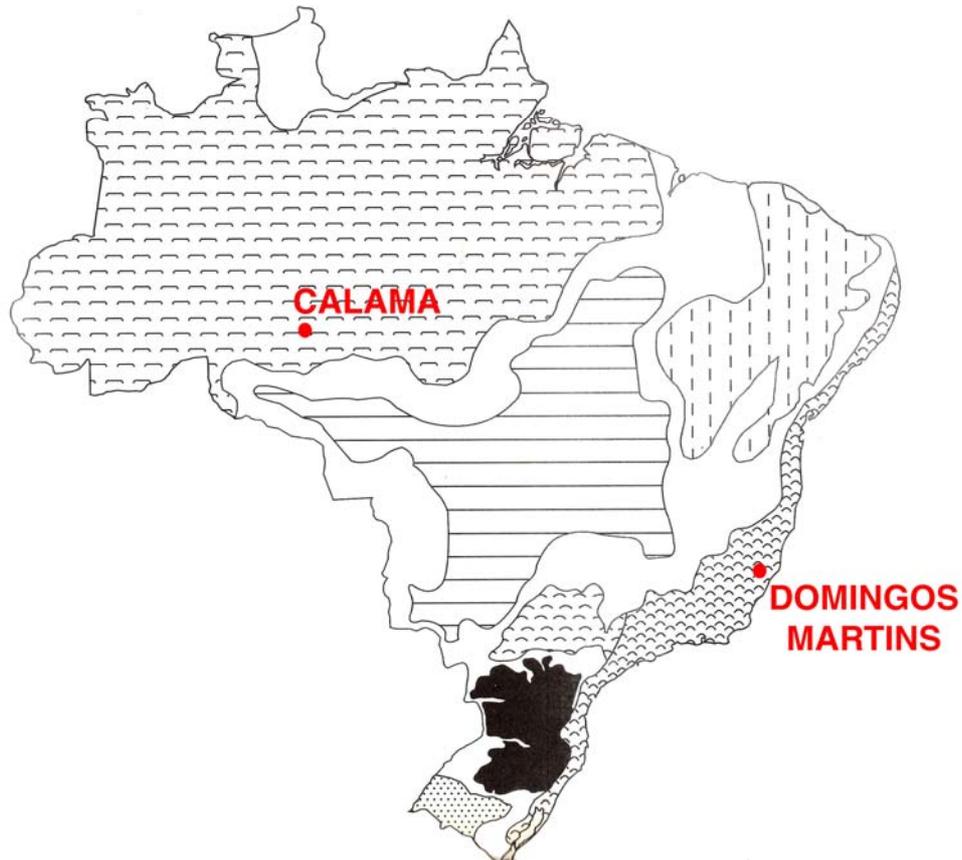


Figure 1 – Brazilian MorfoClimatic Domains  
Source: Ab'Saber, 2003



**I - THE AMAZONIAN:**  
LOW LANDS COVERED BY THE EQUATORIAL FOREST



**II - THE CERRADO:**  
EXTENSIVE PLAINS COVERED BY CERRADOS AND GALLERY-FORESTS



**III - THE COASTAL HILLY SURFACE:**  
EXPRESSIVE CONCENTRATION OF HILLY SURFACES COVERED BY THE ATLANTIC RAINFOREST



**IV - THE CAATINGAS:**  
LOW LANDS SURROUNDED BY HILLS AND HIGH PLAINS COVERED BY THE CAATINGAS



**V - THE ARAUCARIAS:**  
SUB-TROPICAL HIGH PLAINS COVERED BY ARAUCARIA PINES



**VI - THE PRADARIAS:**  
SUB-TROPICAL LOW PLAINS WITH MIX PRADARIAS.

## *1.2. The relationship between the socio-economical activities, the public policies occupation strategies and the land property system*

Several authors, such as Milton Santos and Silvio Macedo, sought to distinguish the landscape diversity through the building processes used by society, when defining the terms “natural landscape” and “artificial landscape” or when explaining the environment changes over time (Santos, s.d.; Macedo, 1993). In the same way, Miranda Magnoli pointed that the landscape analysis requires a systemic approach needed to understand how each part fits its place, in time and in space, with its specific characteristics which reflects the whole (Magnoli, 1983).

Based on those concepts, as important as the natural domains described before, we consider the socio-economical environment which is, in many situations, a result of specific territory occupation strategies, dictated by the public sector, and a determinant of the settlement patterns found. In this way, it is important to point out that the Brazilian urbanization process has followed urbanization moves, related to the economical destination of our resources, conditioning population flows since the colonial times.

The other important aspect we need to discuss is the land property system which was based, since the XVIth century, on a privilege concession procedure, not necessarily related to the adequate destination or environmental conditions. The unbalanced land distribution in Brazil has led to deep differences in urban and rural areas and has had a direct consequence on the resources utilization and social conflicts.

In the Brazilian national context, the public sector has been responsible for the occupation strategies which were conditioned to the economical cycles: the wood extraction, the gold commercialization, the sugar cane and coffee plantations, the rubber extraction and the industrialization process.

In each case, specific occupation strategies and population flows were promoted. In a general way, over the colonial period, we observed a continuous migration movement from the coastal areas, where the harbor structures were located, to the inner portions of the country's territory, where the extraction and agriculture activities were held, through the existing routes and transportation systems – boat and animal transportation, from the XVIth to the XIXth century, railway lines, from the XIXth century to the beginning of the XXth century, and the roads, from the middle of the XXth century on.

In despite of the local differences found, in any of the time periods described, a similar land distribution systems were used: a formal lot parcelling procedure and the consequent property division process, affecting the activities and the population distribution.

## **2. CASE STUDIES**

### *2.1. Calama and Domingos Martins, two Brazilian cities*

The relationship between the landscape domains and the urban landscape morphology as well as the relationship between the socio-economical activities and the land property systems, discussed before, are clearly observed in our case-studies.

In order to verify our theoretical and methodological approaches, we selected two small-size cities from different landscape domains: Domingo Martins, which is located in Espírito

Santo State, in the Atlantic RainForest region, and Calama, situated in the Equatorial Forest region, between the states of Rondônia and Amazônia, at Madeira's right riverside.

Both cities are a result from government policies developed to enable territorial occupation strategies, during the end of the XIX th century.

### 2.1.1. Domingos Martins



Figure 2 – Domingos Martins region  
Photos by Jonathas Magalhães, 2005

The Serra Capixaba presents physical characteristics of heterogeneous landscape unities where we may find different topographic situations (from 30 a 1.200 m high). These conditions along with the water bodies presence and the climate performance were determinants for the ecosystems productivity and the land settlements patterns.

The high rainwater levels have contributed to important river sources formation whose basins constitute nowadays the main water supply for the state capital, Vitoria, and its metropolitan region.

In Serra Capixaba, population and economical activities are concentrated along the river basins and valleys surrounded by hills and the Atlantic Rainforest remains. The urban settlements are isolated from each other and are surrounded by diverse agricultural plantations.

The proximity of the highway, in the last fifty years, has caused intensive urban development along its parcourse, being responsible for the growth of urban centers which offer commercial and service activities.

The region of Domingos Martins was included in a public program, held by the imperial government, which aimed fo occupy the hilly region of the Espirito Santo State, due to the need to control the gold mine production which came from Minas Gerais State to Rio de Janeiro to be shipped to Portugal. By the end of the XIXth century, the slave labor activities were extinguished and the Brazilian administration decided to promote formal settlements in this region, through land property donation to european immigrants (Silva, 2005).

### 2.1.2. Calama



Figure 3 – Calama region  
Photos by Jonathas Magalhães, 2006

In the Equatorial Forest region of Rondonia state, the settlements have taken place either along the Madeira riversides or close to the highways. They are isolated from each other and are surrounded mainly by wood extraction and cattle raising activities.

The city of Calama has emerged with the rubber extraction cycle, approximately at the same time as Domingos Martins. This portion of the country has already been the objective of interest by the Portuguese empire, in the middle of the XVII<sup>th</sup> century, since it was a strategic region to link the central area of Brazil to the Atlantic Ocean. However, the Madeira River waterfalls acted as a strong barrier to the boat transportation systems. By the end of the XIX<sup>th</sup> century, there has been a tentative to build a railway line called Madeira-Mamoré to enable crossing over the water falls barrier. At that time, small centers such as Santo Antonio and Porto Velho were founded. With activities held along the Madeira riversides, Calama became an important logistic stop to load the boats which came from the Amazonas and the Madeira Belém rivers searching for rubber.

It is curious to observe that Domingos Martins is located at 517m high and in a distance of 35 km distant from the ocean. Calama is situated at 60m high and 2000 km far from the ocean.

### 2.2. Analytical categories

By selecting the case studies in two different domains, as described before and presented in Figure 1, we can compare the different approaches and settlement patterns in both cases. In our analysis, we discuss three morphological aspects: the territory occupation, the architectural typologies and the environmental and landscape changes. Through the observation of satellite images, from Google Earth, it is possible to compare the two areas. These images are presented in three scales: the first set of images was taken from 4500 m high and includes the urban limits; the second one was taken from 100 m high and shows the urban block configuration, and the third set, from 10.000 m high, enables us to see the surroundings and to analyse the fragments, the corridors and the matrixes, which were defined by the occupation pattern.

### 2.2.1. Territory occupation

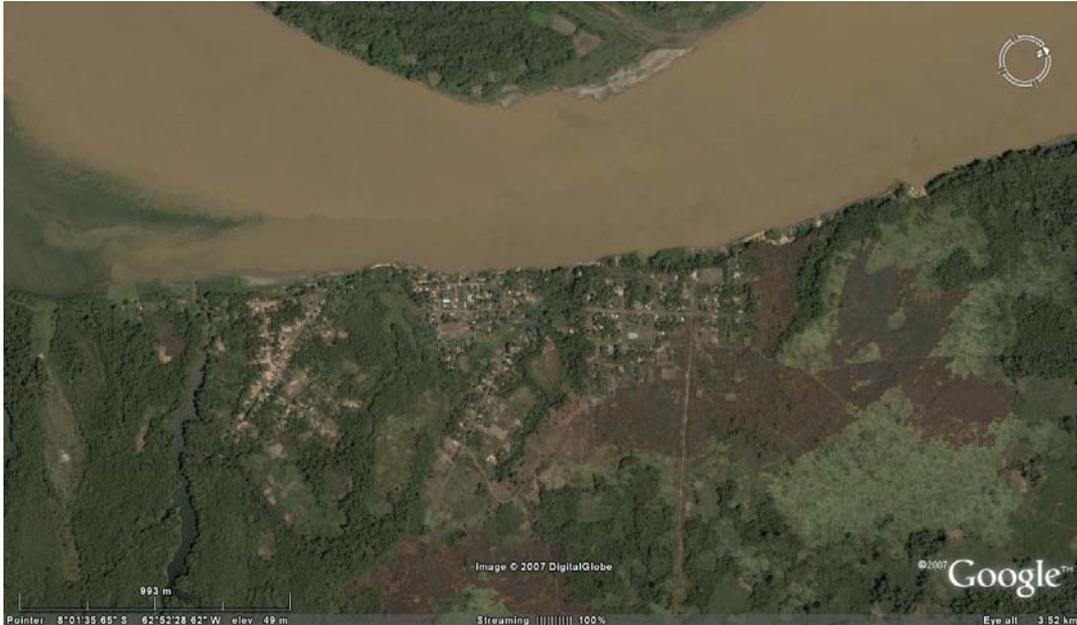


Figure 4 – Calama, 4.500m high  
Google Earth, 2007



Figure 5 – Domingos Martins, 4.500m high  
Google Earth, 2007

The images show how the relief influences urban growth in Domingo Martins, where we observe that the wider valleys were firstly occupied and then the new settlements took place along the narrow valleys. Calama's settlement expansion over the Amazonian plains is fewly conditioned by the relief and is spread out in a less dense situation. The growth pattern in this case follows the river and the surrounding forest characteristics.

### 2.2.2. Urban blocks and architectural typologies



Figure 6 – Calama, 100m high  
Google Earth, 2007



Figure 7 – Domingos Martins, 100m high  
Google Earth, 2007

The cities have originated from the blocks located in the middles of images shown in Figures 7 and 8. In both cases, it is possible to see that the central blocks are rectangular and the other ones have different shapes, when located close to the city limits. There is a higher density in Domingos Martins, since the buildings are very close to each other with a low incidence of open spaces inside the block.

It is important to notice that although Calama is a pedestrian oriented city, without vehicular traffic, the street and the block patterns are very similar to Domingos Martins.



Figure 8 – Calama’s architectural and block types  
Photos by Jonathas Magalhães, 2006

Calama is located in a region called “terra firme” by the local population due to its morphological characteristics. These are higher lands which are not flooded during the rainy season. The architectural building types preserve the tradition of an elevated ground floor. The wooden pieces are a common building material. We could find all over the city exotic vegetation elements in the frontal gardens and along pedestrian streets. The pressure over the land values shows no influence on the use of new typologies.



Figure 9 – Domingos Martins’s architectural and block types  
Photos by Jonathas Magalhães, 2005

Domingos Martins undergoes a continuous renovation process. We may say that, since its foundation, the city was built and re-built several times. The pressure over land values led to vertical building typologies. It is important to point out that, since its creation, the urban fabric followed the portuguese pattern: corridor streets, row buildings with few open spaces and narrow sidewalks. This historical occupation and building processes unable the local population to look for more adequate alternatives such as less dense occupation patterns.

### 2.2.3. Environmental and landscape change



Figure 9 – Calama, 10.000m high  
Google Earth, 2007

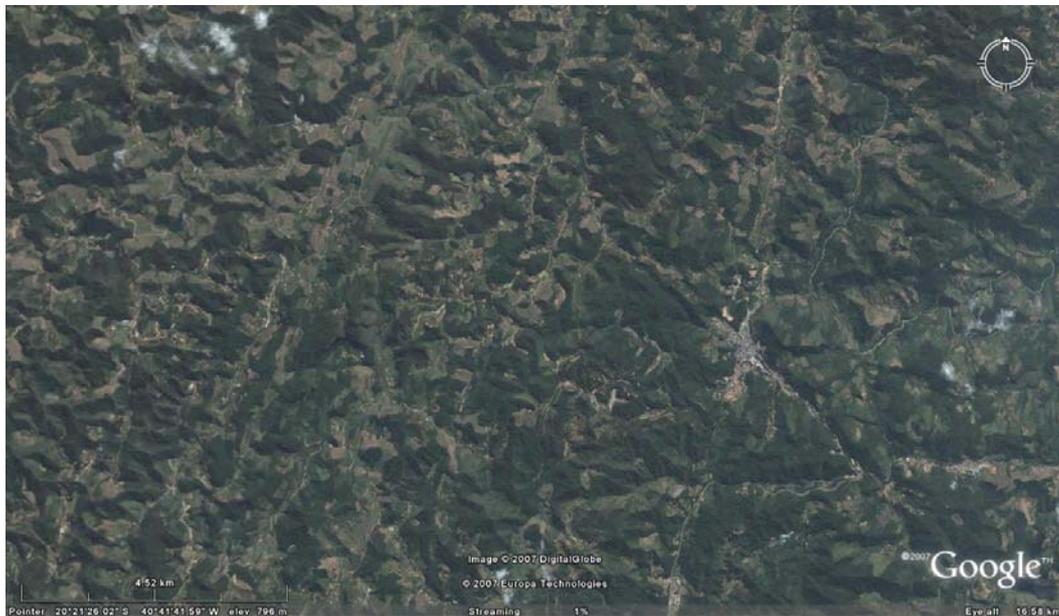


Figure 10 – Domingos Martins, 10.000m high  
Google Earth, 2007

In both images, we may observe the contrast between Calama's surrounding, formed by a large green matrix, composed by natural vegetation, and Domingos Martins's surrounding, showing remaining fragments of the Atlantic Forest. In the last case, these remains, located in the top of the hills, integrate themselves to cattle raising and agriculture activities.

If we analyse the regional characteristics, we identify the growth moves and the natural barriers. In Domingos Martins, the urban expansion follows the river valley, in the southwest direction, and the urban fabric is almost integrated to the neighbor city of Marechal Floriano. In Calama, the settlement growth, which follows the riverside areas, has the water bodies as natural barriers. Presently, a road is being implemented and we may say that the growth pattern will change. This shows that the physical aspects are easily solved in the territory occupation process, when social-economical reasons are preponderant.

### **3. FINAL CONSIDERATIONS**

The intention of this paper was to clarify and better understand the complexity of morphological analysis which must consider, in our point of view, diversified regards to reach the adequate comprehension about the processes which originated and formed our cities and our landscapes. We also tried to demonstrate how the economical objectives influence the territory occupation patterns by considering, even in a non-intentional way, the landscape domains which, in their turn, will directly interfere on the morphological constitution of a specific environment.

In our case-studies, we started by studying the origins of the historical occupation process and the public policies which involved the formation of Domingos Martins and Calama, during the end of the XIX<sup>th</sup> and the beginning to the XX<sup>th</sup> centuries.

It is easy to identify that the two cases present few common aspects, other than having the same population size and belonging to the Brazilian territory. The socio-cultural influences, the urban growth pressures, the economical conflicts and environmental problems are particular to each case and respond to the different morphological characteristics.

The morphological analysis helps identify the processes to be considered in the land use and occupation planning activities since they reveal the historical, socio-cultural and economical aspects. In our point of view, the results of morphological studies focus on physical and spatial issues however they enhance the understanding of the pressures, the interests and the contradictions of several actions over the territory.

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