

The demographic composition of urban sprawl: local and regional challenges concerning global environmental change in Brazilian metropolitan areas*

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SUMMARY

Changes in the environment, especially in view of expected climate change, are forcing contemporary society to face new challenges. On the one hand, there are attempts by the natural sciences to understand more clearly the causes and future scenarios associated with these changes. On the other hand, in the human sciences, there is a demand for models to orient the study of the relationships between environment and society on a global scale. In this regard, urbanization may well be one of the most obvious points of tension, as it is one of the most radical human interventions in the geographical landscape. But, even more importantly, the urbanization process condenses the principal contradictions of modern society to a set of values that increasingly go beyond political borders and standard dichotomies (rural/urban or natural/social, for example). This article uses the concept of peri-urbanization in order to investigate how this process might be taking place in the Metropolitan Region of Campinas, State of São Paulo, Brazil. For this purpose, the municipality of Paulinia and the District of Barão Geraldo, in the municipality of Campinas itself, were analyzed as important vectors of the region's recent urban expansion, as they portray this process very clearly. The objective is to contribute to the current debate on urban planning which seeks to relate events on the local scale to overall impacts on the environment.

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INTRODUCTION

Changes in the environment, especially in view of estimated climate change, are forcing contemporary society to face new challenges. On the one hand, there are attempts by the natural sciences to understand more clearly the causes and future scenarios associated with these changes. On the other hand, in the human sciences, there is a demand for models to orient the study of the relationships between environment and society on a global scale. In this regard, urbanization may well be one of the most obvious points of tension, as it is one of the most radical human interventions in the geographical landscape. But, even more importantly, the urbanization process condenses the principal contradictions of modern society into a set of values that increasingly go beyond political borders and standard dichotomies (rural/urban or natural/social, for example). But how can today's urban environmental questions be conceived, both those that are restricted to **local** contexts, and those considered potential risks to the **global** environment? What new dimensions and new dilemmas are emerging as specific challenges for the human sciences in the current discussion on social vulnerability and the tensions between climate change and social evolution?

According to estimates, there was a 70% increase in the emission of greenhouse gases (GHG) between 1970 and 2004, the main increase being in those produced by transportation and industry, 120% and 65%, respectively (IPCC, 2007: p. 2). These emissions are especially concentrated in urban areas. In worldwide terms, approximately 80% of emissions can be attributed to urban areas. In Brazil, however, urban areas account for only about 20% to 25% of emissions, due to the overwhelming contribution of deforestation in the Amazon. But if Brazil's main participation in the emission of GHG is in the deforestation process in the Amazon, what dilemmas does urbanization represent in the context of global environmental changes? Serious attention must be turned to the social, economic and political changes that have been taking place in Brazilian urban contexts if we are to advance in the scope of this discussion. The present article investigates recent perspectives in the discussion on urbanization, space and environment, considering the challenges that face urban planners. For this purpose, we will first treat the concept of peri-urbanization as one of the approaches concerned with the relationships between urban expansion and environmental pressures.

To illustrate some of the questions mentioned in the literature, a socio-demographic characterization of an area of study in the Metropolitan Region of Campinas (State of São Paulo, Brazil) will be presented. This characterization focuses mainly on what can be identified as "peri-

urban" areas; their main aspects will be described and the application of the concept of "peri-urban" to Brazilian reality will then be discussed. Data from the Brazilian Demographic Census of 2000 at the intra-municipal level will be used to call attention to urban expansion and its interfaces with the concept of peri-urbanization. The discussion will conclude by listing factors that show why using integrated and multi-scale approaches to plan for the sustainable future of Latin-American cities is important, especially in the light of the challenges presented by global environmental changes.

ELEMENTS FOR CONSIDERING PERI-URBAN AREAS

Conceiving cities as the habitat of modern man, the Chicago School placed the systematic study of the urban context as an object of study. This may have been the first time that a systematic study of the dichotomy between center and periphery was proposed. More recently, the term peri-urbanization has been used to explain structural changes in the arrangements of production and location in the urban spaces of a number of regions in the world. In approaching the processes that lead to urban expansion in developing countries, these studies deal with new challenges in terms of environmental dilemmas.

According to Allen (2003: p.136), "[P]eri-urbanization consists of a phenomenon that presents characteristics such as reductions in aspects traditionally considered 'rural' (loss of fertility of the soil, of arable land, of natural landscapes, etc.) and/or the absence of features considered 'urban' (low density, difficult access, absence of services and infrastructure, etc.)." The term peri-urbanization refers more to the expansion of built-up areas in outlying regions of cities and less to the complex concept of peripherization of the population³. One of the problems brought up in the discussion of peri-urbanization is the increasing difficulty of using traditional criteria to define analytic categories such as "rural" and "urban," since, in many places in the world, the boundaries between these two contexts have become fluid and undefined. Areas that were once traditionally used for farming activities, for example, are now occupied by industries, especially by agribusiness enterprises, with low residential densities. The boundaries that used to separate urban and rural areas with some degree of certainty are gradually becoming less and less visible.

Peri-urbanization is usually associated with processes of rapid urban growth, but the literature

³ The concept of peripherization is generally related to the centrifugal forces that push the poorest strata of society toward areas that are more and more distant from urban centers where the land is cheaper and where both basic infrastructure (such as water supply, sewage collection, etc.) and services (such as education, health resources, etc.) are absent or very inadequate.

usually seems to refer to contemporary processes in Asia and, even more so, in Africa. McGregor, Simon and Thompson (2006) published a number of case studies in search of some convergence in the process of contemporary urbanization. They recognize, however, that texts on situations in Africa and Southern Asia are the most common, with very few studies referring to the concept of peri-urbanization in Latin-America. When the term peri-urbanization is used in Latin America, it is often as a synonym for peripherization or sprawl, or even in a straightforward geometric sense (TORRES, ALVES and OLIVEIRA, 2007). This approach recognizes that today's spatial patterns of growth are not merely reproducing phenomena of the 1950s or 1960s (something new is happening), but is not clearly situated in the more recent discussion of peri-urbanization. Martine (2008) asserts that peri-urbanization is now the "dominant form of urbanization," which he defines as "the non-contiguous and patchwork form of urban expansion and leapfrog development which springs from land speculation, changing production modalities, and the spread of automobile transportation (MARTINE, 2008, p. 7). One element of this process is urban sprawl, and its spread from post-World War 2 North America to Europe and developing countries (HOGAN and OJIMA, 2008). But other processes are also at work.

The discussion of peri-urbanization may reflect both different historical processes and factors related to the evolution of theoretical concepts. Latin America's comparatively precocious urbanization preceded the era of globalization, which has disarticulated the organic relationship of city and periphery, today most acutely felt in Asia and Africa. It also preceded the most decisive phase of demographic transition (OJIMA, 2009). For much of Asia and, especially, Africa, as opposed to Latin America, this means that much urban growth takes place without having provoked rural-urban migration. Other concepts, such as in situ urbanization (Zhu, 2000) have been used to describe the appearance of city growth in rural areas. Not only is the rural-urban distinction fading (CHAMPION and HUGO, 2004), as cultural and economic characteristics are hard to distinguish, but new morphologies are being established. According to Allen (2003: p.136), an environmental approach for peri-urban areas should consider criteria that are broader than those generally used to identify urban or rural areas. According to an evaluation by the United Nations (UN, 1998), the most commonly used criteria to distinguish urban from rural areas are the size of the population, demographic density, housing density (constructed area), characteristics of the infrastructure, administrative boundaries, and predominant economic activities.

It is peri-urban areas which have undergone the most drastic changes in their formal

characteristics and would thus seem to be subject to much more uncertain social, economic and political forces. For this reason they are especially vulnerable areas and should be analyzed with care, especially in terms of defining appropriate public policies for these changes. From an institutional perspective, these tensions are especially complex due to overlapping control or to omission by public authorities. Among other aspects, this is due to the fact that peri-urban areas almost always lie between two distinct political jurisdictions (two different municipalities, for example) and regional and environmental planning does not always take inter-municipal concerns into account. This problem is particularly serious when one observes demographic movements that occur between such adjoining municipalities, because in the everyday lives of the local population, administrative borders have little or no meaning at all. From an environmental approach, then, the definition of what can be classified as rural or urban matters little. What is essential is to understand the logic and mechanisms that orient changes in these areas so that reasonable regional planning can be carried out.

City-regions are more evident in this new context than monocentric cities (SCOTT et al., 1999). City-regions seem to arise from a less urgent need for and dependence on specific polarizing urban areas where the center spreads like a blot of ink in a process of urban expansion and conurbation. Using a biological metaphor, it is no longer a question of parasitic relationships of peripheral municipalities with their regional center, but of symbiotic relationships where a central municipality (or municipalities, since there is not even always a single center) cannot survive without the dynamic relationships with and between its surrounding municipalities.

According to Scott et al. (1999, p. 7), one of the main characteristics of this context of urbanization

is a pronounced change in the spatial morphology of global city-regions. Whereas most metropolitan regions in the past were focused mainly on one or perhaps two clearly defined central cities, the city-regions of today are becoming increasingly polycentric or multi-clustered agglomerations.

In socio-spatial contexts of reorganization of urban structures, certain consequences emerge that may in principle appear to be opportunities, but they indirectly bring up new challenges that will have to be faced. The environmental question is among them because directly (local) or indirectly (regional or global) this issue is becoming one of the most important defining forces of contemporary society. This is one of the reasons why one must first understand the processes that are taking place in certain

areas and then set up agendas of research that include the specificities of trends in Latin-America and the specific challenges that are emerging in these contexts.

A CASE STUDY: PRELIMINARY NOTES

In order to illustrate and to reflect on the relationships between urban expansion and environmental change in the light of the concept of peri-urbanization, we will take the case of an area in the Metropolitan Region of Campinas, Brazil, which seems to reflect at least some of the discussions found in the urban planning literature. The study area is located on the boundary between two municipalities in this metropolitan region (one is Campinas itself and the other is Paulinia) and in recent years it has gone through major changes in its sociodemographic characteristics and in land use and land cover. This area can be visualized in Figure 1, and includes part of each municipality, Paulinia and Campinas, and, in the latter case, only the district of Barão Geraldo. The District of Barão Geraldo is significant for a number of reasons, among them being that the State University of Campinas (UNICAMP) is located there, as well as one of the campuses of the Catholic University of Campinas, and a high-tech industrial complex. Today this region of Campinas constitutes an important vector of urban expansion, especially in terms of its low-density pattern of occupation and a strong presence of middle- and upper-income population (PIRES, 2007).

The adjoining municipality of Paulinia is especially important because it is home to the Planalto Oil Refinery (REPLAN), the largest refinery in Brazil, operated by the federally-owned Petrobras Company; this complex contributed appreciably to the growth of the municipality. Until the mid-1980s Paulinia was considered an area of national security and military control resisted urban expansion. This unusual fact guaranteed a potential reserve of new plots of land in a highly valued area with intense economic development. The area, then, with the Technological Complex at one end and the refinery at the other, came to be in a very strategic position.

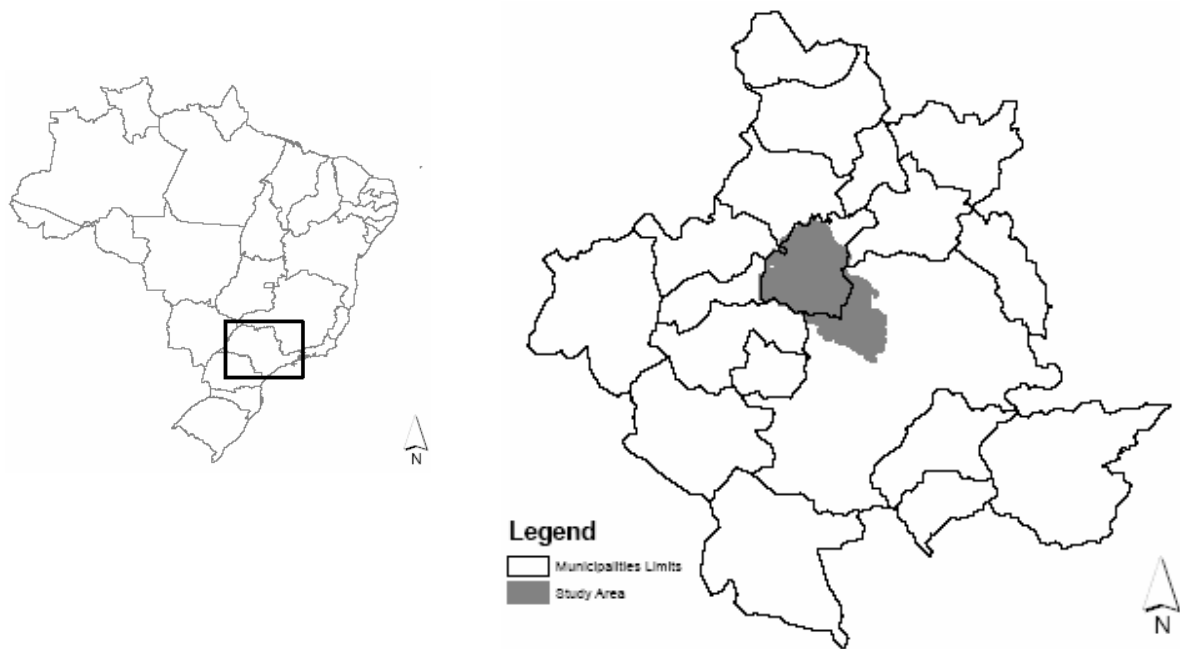


Figure 1 - The Metropolitan Region of Campinas and the study area (District of Barão Geraldo in the municipality of Campinas and the Municipality of Paulínia), 2000.

Source: Brazilian Census Office (IBGE), Malha Digital Municipal 2001

Another matter that deserves attention in this region is a change that took place in the political-administrative boundary between the municipalities during the 1990s. During this period, one neighborhood of the Municipality of Campinas (the District of Betel, near Barão Geraldo) became a part of the municipality of Paulínia.

Figure 2 illustrates this change, where the census sectors identified in red were transferred from Campinas to Paulínia in 1993, with political pressure from a movement of residents of this neighborhood. This situation partially reflects the discussion that the urban literature indicates as one of the difficulties in the management and consequently the planning of peri-urban areas. The resulting tension between the institutional jurisdictions in these areas had the effect of creating sectors where municipal administrations became unable to address adequately the wishes and demands of the resident populations.

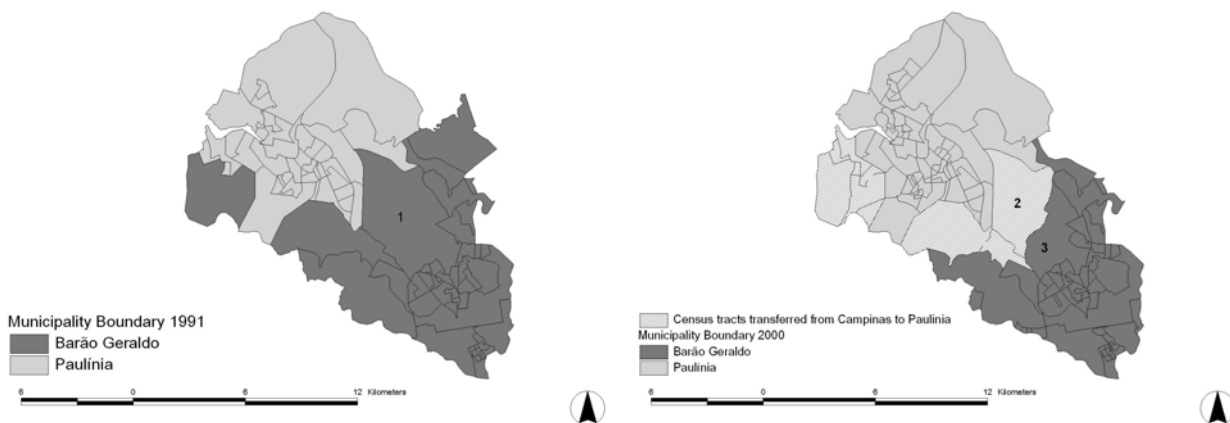


Figure 2 – Study region (Paulínia and the District of Barão Geraldo in Campinas) in 1991 and 2000, showing the census tracts transferred from Campinas to Paulínia.

Source: Brazilian Census Office (IBGE), Digital Map of Census Tracts, 2001.

Figure 2 shows the relatively large area (38 square kilometers) transferred from the Municipality of Campinas to Paulínia in the 1990s due to this situation. The census tracts in red in the figure correspond to this area. Most of it was classified by the Municipality of Campinas as rural in the 1991 Demographic Census and as urban by Paulínia for the 2000 Census. Tracts 2 and 3 in Figure 3, of the 2000 Census, refer to Tract 1 in 1991, which is broken down below.

Figure 3 shows the classification of census tracts⁴ according to their rural or urban location. Although one tract (Census Tract 2 in Figure 3) is classified as an undeveloped urban area (within city limits and defined, therefore, as urban), there were already indications in 2000 of the process that has become more intense during the present decade, namely, a trend toward urban expansion onto areas that were still characteristically rural in the area between the two municipalities.

⁴ According to the definitions of the Brazilian Census Office for classifying areas according to rural or urban, sectors can be classified as either: 1) Urbanized area of a village or city; 2) Non-urbanized area of a village or city; 3) Isolated urban area; 4) Rural: urban extension; 5) Rural: village; 6) Rural: Settlement; 7) Rural: Other agglomerations; and 8) Rural: except for rural

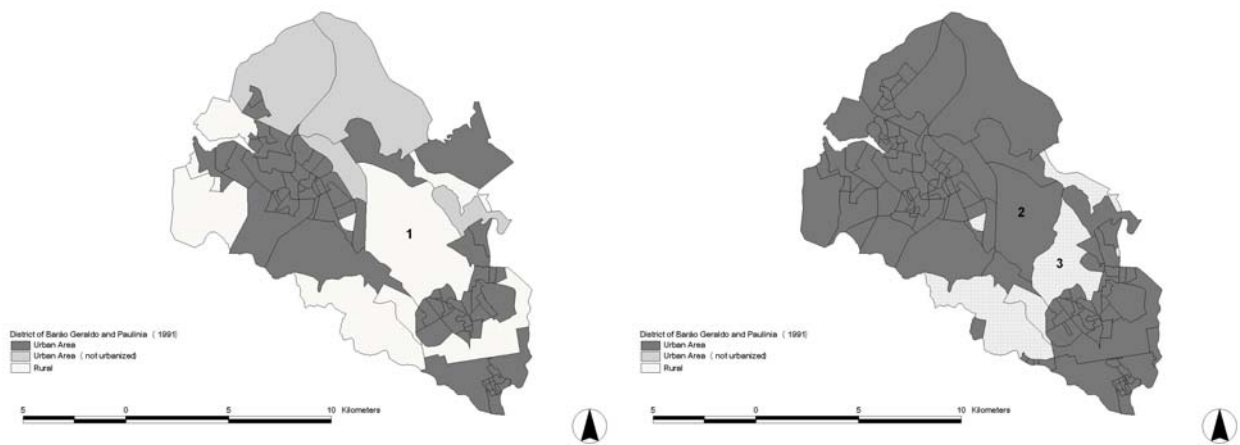


Figure 3 - Classification according to rural-urban location for the study region (Paulinia and District of Barão Geraldo, Campinas), 1991 and 2000

Source: Brazilian Census Office (IBGE), Digital Municipal Map and Digital Map of Rural Census Tracts, 2001.

This transitional region also has important characteristics in social and political terms, for having recently changed jurisdictions. There is still some tension in the defense of the interests of the population that resides in this area. In fact, the social movements of residents and other social actors in the region deserve close attention since, in large measure, they brought about not only the change in the political-administrative boundaries, but still condition the process of more recent urban development⁵.

agglomerations.

⁵ In regard to this topic, research is underway that is expected to contribute to this debate (SILVA, 2008).



Figure 4 - Number of permanent private households by census tract in the study region (Paulinia and District of Barão Geraldo, Campinas), 1991 and 2000.

Source: Brazilian Census Office (IBGE), Digital Map of Census Tracts 2001 and Aggregates of the Sample by Census Tract.

This urban expansion can be seen in Figures 4 and 5, where these tracts that were transferred from Barão Geraldo to Paulinia, especially those shown in the other figures, are undergoing major changes in their patterns of use and occupation. These areas have seen considerable demographic growth and, especially, residential growth. Specifically, the number of permanent private households rose 156% between 1991 and 2000⁶, while the resident population went up 105%. Most of this growth (70%) took place in Sector 2, which belongs to the municipality of Paulinia.

⁶ For calculations, the data related to Sector 1 in 1991 and that of Sectors 2 and 3, aggregated for the 2000 census, were considered.



Figure 5 - Number of persons living in private permanent households in the study region (Paulinia and the District of Barão Geraldo, Campinas), 1991 and 2000.

Source: Brazilian Census Office, Malha Digital de Setores Censitários, 2001 and Aggregated from the sample by census sectors.

Encouraged by local authorities, investments in real-estate were much more evident after this area was transferred from Campinas to Paulinia. But much of the area's power to attract has to do with the district of Barão Geraldo and, especially, with the State University, the Technological Complex and the services available at Shopping D. Pedro, the largest shopping mall in the Campinas Region (and perhaps in all of Latin Ameica). Figure 6 illustrates the proximity of these points of reference and the main highways in the region, which are also features that attract new residents to the region.

Figure 6 shows the points of reference that are most attractive in the region and that consequently present new challenges for urban planning, due to urban expansion into areas that had previously been classified as rural. Since the area is at a political and administrative border, the challenges are more significant: any planning for the region depends on the articulation between two distinct municipal administrations. In addition, due to indefinition and slowness of action, public measures often leave room for decisions to be made by other actors, such as the real-estate market.

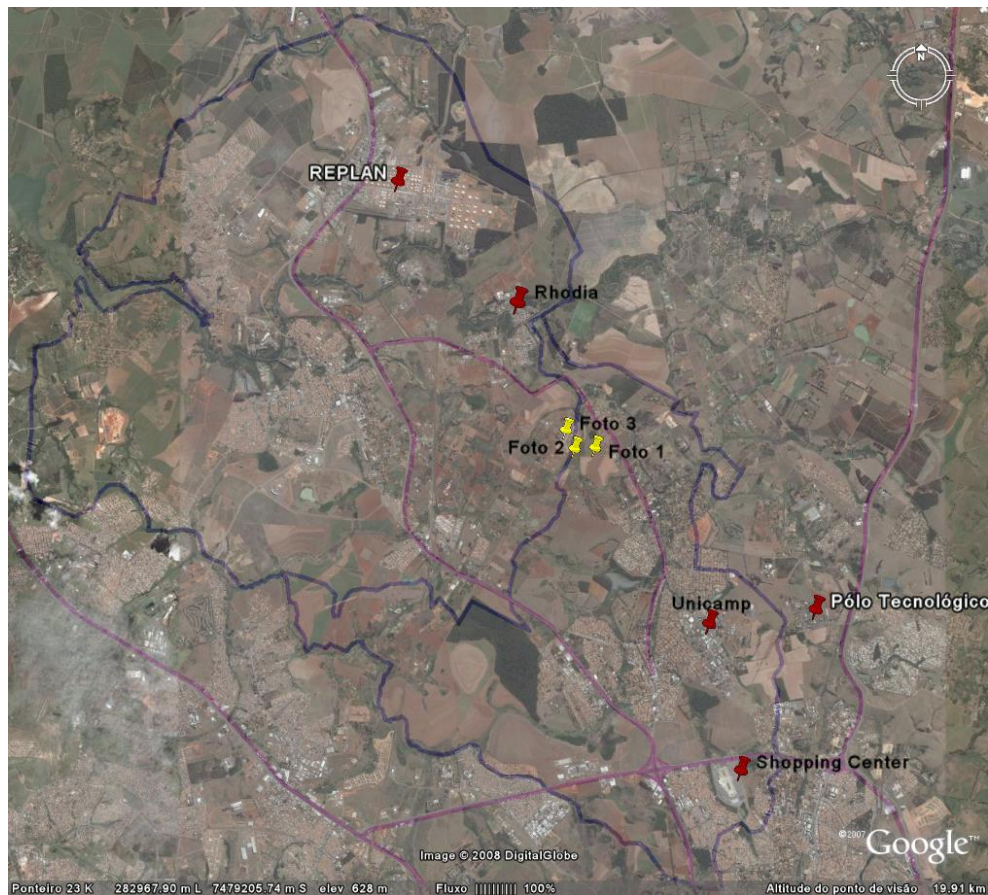


Figure 6 - Points of reference and location of Photos 1, 2 and 3 in the study region (Paulinia and the District of Barão Geraldo, Campinas), 1991 and 2000.

Source: Google Earth, 2008.

Figure 7, below, shows three photographs, all taken in July 2008, which show how the lack of intermunicipal planning can cause serious problems. Photograph 1 was taken facing Paulinia, with Barão Geraldo behind the photographer (the location of the shots can be seen in Figure 6) and shows that the lane on the Campinas side of the highway leaves very little room for automobile traffic, with irregular paving and no shoulders, and even including an area reserved for sugar cane crops. The expansion of housing projects in their final stages can be seen in the background. In Photograph 2 we see the continuation of this access road, but seen from the Paulinia side. Only about 100 meters from the spot where Photograph 1 was taken, the characteristics of the infrastructure are very different from those shown in Photograph 2. This point is the exact line between the municipalities, and shows how the priorities of investment and the pattern of occupation are quite different from one municipality to

the other. Photograph 3 suggests expectations by Paulinia for urban expansion in this region.

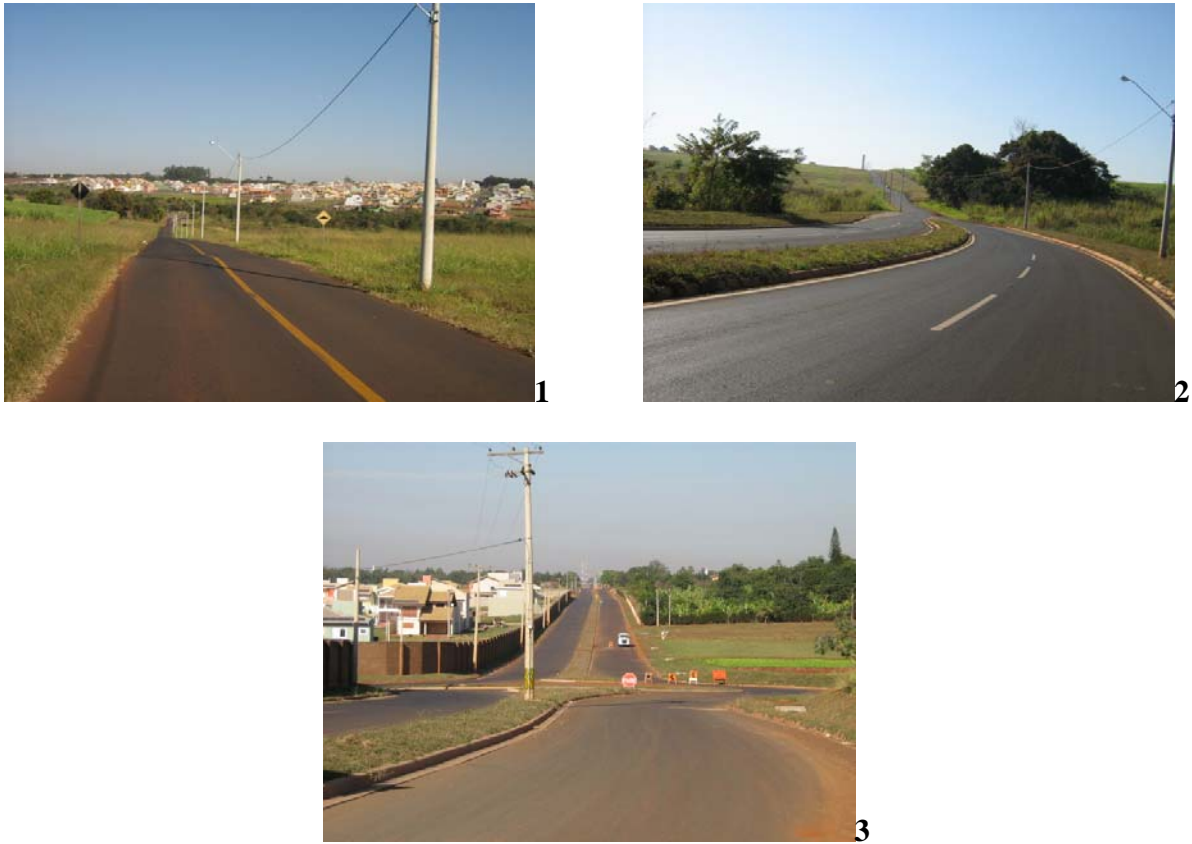


Figure 7 - Photographs of the region under study (Paulinia and District of Barão Geraldo, Campinas), 1991 and 2000.

Source: Ricardo Ojima, July 2008

FINAL CONSIDERATIONS

One problem that has received very little attention in urban studies is the relationship between local challenges and issues that have regional or even global importance. Specifically, if an urban area is more fragmented and has a lower demographic density, there is a proportionally greater need to use automobiles, and this causes increased GHG emissions. There is no doubt that an adequate public transportation system would contribute significantly to the reduction of individual transportation. But what actually happens, especially in Brazil, is ever increasing incentives for individual transportation.

In most industrialized and many developing countries, transportation is among the top five energy-consuming sectors of the economy. For example, for decades the transportation sector has

accounted for between 25 and 27 per cent of total US energy consumption. From 1980 to 2000, transportation energy use in the US grew an average of 1.5 per cent annually (De Cicco and Mark, 1998, cited by Ruth and Rong, 2006, p. 27).

According to Ruth and Rong (2006, p. 26), economic growth is usually associated with increased need to move goods and people through space and, therefore, tends to aggravate problems in developing countries, where high economic growth rates are the other side of the coin of increased energy consumption. This relationship could be one of the main points of convergence when one studies processes that have taken place in recent urbanization and that have a strong relationship with climate change.

One of the first studies in this debate emphasized that if 60% of future urban development follows more compact patterns than the present-day trend of urban dispersion, it would be possible to eliminate the emission of 85 million metric tons of CO² per year by 2030.

The savings over that period equate to a 28 percent increase in federal vehicle efficiency standards by 2020 (to 32 mpg), comparable to proposals now being debated in Congress. It would be as if the fleetwide efficiency for new vehicles had risen to 32 mpg by 2020. Every resident of a compact neighborhood would provide the environmental benefit expected from, say, driving one of today's efficient hybrid cars. That effect would be compounded, of course, if that person also drove such an efficient car whenever he or she chose to make a vehicle trip. Smart growth would become an important "third leg" in the transportation sector's fight against global warming, along with more efficient vehicles and lower-carbon fuels (EWING et al., 2007, p. 9).

Such urban planning on a local scale to attain the established goals of GHG emissions might be a reminder of the famous dictum to the effect that one should "Think globally and act locally." But the issues involved are not restricted to global impacts, because, on the local scale, planning will also bring benefits to transportation, water supply and sewage collection. On a regional scale, this will mean lower demands for energy, streamlining of public investments, and other factors. It is therefore important to make these factors clear so that the respective issues can enter agendas for research and for the development of public policies.

It will also be necessary to continue conceptual work on the new urban morphologies. In this regard, a more explicit comparative and historical view, which considers the different experiences of Latin America vis-à-vis Africa and Asia, would contribute to our understanding. The new political and economic forces which dominate the 21st century will be played out in territories molded by 19th and 20th century experiences. If we are to identify the common threads in this story, it will be useful to

give due attention to these differences.

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