

Dependência Inter-urbana entre as Cidades Amazônicas: Crescimento Urbano, Deficiências em Infra-estrutura e Redes Sociais

Sandra M. Costa¹
Eduardo S. Brondízio²

RESUMO

Este artigo examina o processo de urbanização na Amazônia brasileira com especial atenção para a formação de redes inter-urbanas e suas conexões com o sistema urbano regional. Baseando-se na integração de dados históricos do Censo, microdados censitários e trabalho de campo, o artigo analisa as cidades Amazônicas considerando o período de fundação das cidades, funções e serviços urbanos, tamanho populacional e empregabilidade. O artigo também estuda a emergência de uma rede subregional inter-urbana utilizando-se de dados sobre movimento populacional e transporte. Três questões principais sobre urbanização amazônica são discutidas: 1) a ausência de infraestrutura urbana não é seletiva, afetando cidades independente da idade de criação, tamanho e localização; 2) Como resultado, redes sub-regionais inter-urbanas emergem marcadas pelo aumento de cidades que são nós de serviços em diferentes áreas da região; 3) elevadas taxas de urbanização dependência de repasses de verba pelo governo, ausência de indústrias e uma economia informal dominante apontam para perspectivas futuras limitadas em termos de qualidade de vida condições urbanas.

Palavras-chave: urbanização, região Amazônica, rede urbana, sistema urbano regional.

¹ Professor and PhD at Post-Graduate Course in Urban and Regional Planning, Instituto de Pesquisa e Desenvolvimento (Institute for Research and Development), University of Vale do Paraíba, Brazil – sandra@univap.br

² Professor and PhD at Anthropological Center for Training and Research on Global Environmental Change (ACT) and Department of Anthropology Indiana University, United States – ebrondiz@indiana.edu

INTRODUCTION

Since the Second World War, Brazil has followed worldwide trends of increasing urbanization and urban population growth. By 2007, over 80 percent of the Brazilian population was living in cities, and about 30 percent of those were living in cities with less than 50,000 inhabitants. This process has affected the Brazilian territory as a whole, but during the past three decades has particularly impacted the Amazon region. In spite of the lasting reputation of the Amazon region as a wilderness and a rural environment that is losing its rainforest, Amazônia has been for the most part urbanized. Since 1980, the region has shared the reputation of an urban region and the largest continuum rainforest in the world, with over 50 % of its population living in cities. (Becker 1985) described the Amazon as an “urbanized forest” and reinforced the necessity of discussing urban space as an important part of its environment. Even though its urban population has been concentrated in cities that do not offer adequate civil services, such as water and sewage systems, they are still cities (Becker 2005, 73). As new urban centers multiply across the landscape in previously inaccessible “terra firme” (upland) forest areas, the urban reality becomes increasingly marked by “many imperative urban problems that stay unaddressed in Amazonia, including deficient infrastructure, social and medical services, rapid shantytown growth and pollution” (Browder and Godfrey 1997, 3).

Even now, few authors have studied the characteristics and development of urban Amazonia (Wagley 1953; Becker 1978, 1985; Correa 1987; Sawyer 1987; Machado 1989, 1994, 1999; Browder and Godfrey 1996, 1997; Perz 2000; Castro 2006). In spite of the recognized importance of the topic and clear trends indicating the expansion of deprived urban conditions, there is a lack of discussion about how urbanization and urban expansion dynamics are expressed differently across the region.

Even with poor urban infrastructure and a lack of services, population movement between small, medium, and large cities continues to grow, both in terms of ‘fixed date’ and commuting movement³ associated with urban mobility. A number of questions emerge in relation to the quality of urban life, the growth of inter-urban networks, and its impact on the region’s environment. What makes these cities attractive to people? Do their services and infrastructure improve over time? How and what forms of inter-city sub-regional networks are developing between small, medium, and large cities⁴? How are these networks shaped by regional infrastructure

³ Commuting movement (“Movimento Pendular” in Portuguese) is defined by IBGE as the one that captures the movement of people between municipalities (or states) for the purpose of work and/or study.

⁴ We consider the following categories for Amazonian cities according to urban population size: small (<20,000), medium (>20,000 to 200,000), and large (>200,000). Most of the urban population within our medium size category, 63% in 2000, were living in cities larger than 40,000 inhabitants.

and land ownership arrangements around urban areas (including conservation reserves)? What are the consequences for the regional environment?

Amazonian cities share, independent of age, similar realities in terms of unplanned expansion of urban areas (commonly along river-ways and low lying areas with characteristic urban infrastructural problems) and lack of services and an employment base. However, trends in urbanization and levels of inter-urban and rural-urban networks continue to increase. The expansion of these networks is not only a result of increasing physical connectivity and communication between these areas, but also a result of opportunities available for rural (e.g., access to services, informal employment) and urban (e.g., access to rural resources) populations alike. As such, the complexity of relationships between rural and urban, and small, medium, and large cities defies simplifications such as the common dichotomy of urban and rural (Padoch et al 2008). It also requires attention to emerging sub-regional socio-demographic and economic networks and their various forms of regional integration (Guedes, Costa, and Brondizio 2009.; Garcia et al. 2007).

In this paper, we examine the process of regional urbanization with particular attention to the formation of inter-urban socio-demographic networks and the subsequent linkages of those networks into regional systems. Our analysis is two-fold. 1) the regional level is examined in terms of the diversity of cities of varying urban functions, population sizes, and regional articulation, or disarticulation (as posed by [Browder and Godfrey 1997]), and 2) the subregional level is examined in terms of emerging inter-urban networks linking cities of different sizes through transportation, population movement, and communication systems. We use a combination of census information (census data since 1950 to 2000) available at the level of states and municipalities, as well as micro-data from the 2000 census. We complement our analysis with ethnographic research carried out in cities such as Belém, Santarém, Altamira, and Ponta de Pedras in the state of Pará, Brazil.

We focus our analysis on three main arguments regarding Amazonian urbanization. 1) Urban conditions and infrastructure in the Amazon are non-selective, affecting cities in spite of age, size, and location. 2) As a result of growing physical and functional connectivity as well as the deficient services and economic conditions, the region is experiencing the emergence of subregional inter-urban networks marked by the rise of node service cities of medium and large sizes in different parts of the region. Our argument is that deficiencies in urban infrastructure and services increase the level of inter-dependency between cities (and between rural and urban areas) and reinforce the emergence of subregional urban systems. 3) High rates of urbanization, dependency on federal subsidies, lack of a transformative industrial basis, and a dominant informal employment sector points to a pattern of continuing urban problems and limited prospects for short-term improvements in the quality of life.

THE URBAN CONTEXT IN THE BRAZILIAN AMAZON

The Brazilian Legal Amazon, defined for planning and administrative purposes by the federal government in 1966 by Law No. 5173, includes 760 municipalities currently distributed across nine states: Pará, Amazonas, Mato Grosso, Rondônia, Roraima, Amapá, Acre, Maranhão and Tocantins. The Amazon Region has been considered “urbanized” since at least 1980, and from 1970 to 2007 the urban population in the region has increased by 430% (IBGE 2007). In the 2007 census approximately 84% and 69% of the population of Brazil and the Amazon was located in urban areas, respectively. However, from 1950 to 2000, while the number of municipalities in Brazil has increased by 191.5%, the Amazon region experienced an increase of 280%, with the majority of this growth taking place after 1988, coinciding with the country’s new constitution. Trends in urbanization continue to intensify during the 1990’s and 2000’s. Figure 1 provides a temporal and spatial perspective to the distribution and urban population size for the Brazilian Amazon since during the past four decades.

The kinds of urbanization trends in the region, particularly the spread and predominance of small towns, have been described by some as a “ruralization” process which is marked by the spread of unstructured small towns along colonization and agrarian expansion areas (Martine and Turchi 1988; Garcia et al. 2007; Machado 1999; Silva 1993). Perz (2000) compares indicators of environmental quality for urban populations in 1980 and 1991 and shows, as expected, that these indicators tend to deteriorate proportionally to the pace of urban growth. Several authors have also highlighted that the underlying processes of regional urbanization have not resulted from a concern with urban development, but from a deliberate strategy to stimulate regional economic expansion and to absorb demographic pressures that were originally external, but are increasingly more internal to the region (Becker 1978, 1985, 2005; Sawyer 1997; Godfrey 1990; Browder and Godfrey 1990, 1996, 1997; Amaral et al. 2001; Monte-Mor 2005; Vicentini 2006). As a consequence, throughout their development cycles, these cities have received waves of small farmers leaving disregarded agrarian settlements for urban areas (Ludewigs et al n.d.) and groups of migrants attracted often predominately by public institutions and subsidies and also by a tertiary sector in development (Sawyer and Carvalho 1986; Dufour and Piperata 2004).

Under these conditions, the extent to which urban is “urban” in the Amazon has been a point of contention. Becker (2005) argues that population size and rate of growth are not enough to define a level of urbanization if attention is not paid to the values of urbanization provided to society in terms of social and economic opportunities, including services, employment, and safety (for instance against land expulsion). This helps to explain Becker’s characterization of the region as an

'urbanized forest'. In general terms, however, Amazonian cities have assumed multiple forms: from the metropolis, such as Belém and Manaus, to node cities, such as Santarém, Marabá, and Sinop that interconnect rural areas to old and new cities to larger economic systems, to a variety of small rural towns. Santarém and Sinop, for instance, functions as an important hub connecting soy bean producer to export routes, while Marabá plays a similar role for cattle ranching.

The formation of a regional urban system has affected parts of the region differently, despite general similarities in terms of rates of growth and unplanned expansion of urban areas throughout. As noted by Browder and Godfrey the region has "...multifaceted, and internally varied linkages to national and global spheres" (1997, 443), and has been marked by problematic development and characterized by a growing informal sector and imprecise rural-urban distinctions. Browder and Godfrey (1997, 445) propose a pluralistic theory of disarticulated urbanization, which considers the non-existence of a regional urban hierarchy. In other words, regional urbanization has resulted in a nontraditional urban network. They assume that the settlement systems of the Amazon region are disarticulated from any single master principle of spatial organization, and that its spatial organization is "largely asymmetrical and provides scant evidence of orderly, nested hierarchies predicted by Central-Place Theory." Corrêa (1987, 42), on the other hand, argues that an Amazonian urban network exists, but is not related to the traditional models of urban hierarchy, such as the model by (Christaller 1966). Correa suggests that the rule of order and size of cities is not a base to consider the existence of an urban network in Amazônia. He suggests that the urban network of Amazônia "reflects (and reinforces) the regional social and economic realities, incorporating different spaces at different moments of history" (Corrêa 1987, 42). City development in the region has typically occurred through different economic and political periods, from missionary, military, and trading posts to private company towns and official settlements established by government agencies, to spontaneous settlements and incipient frontier villages (Sawyer 1987; Corrêa 1987). In each state the urban network has had a tendency to organize, at least in part, in relation to the location of the state capital (Machado 1999). However, these networks have been increasingly formed at longer distances and often bypass the state capital in their relationship to global markets, while increasing the role of medium-sized cities along road corridors that serve as nodes of services and population movement.

While we agree with the characterization of the region as a space of disarticulated urbanization, at least at a macro-regional level, our analysis here indicates an articulation of sub-regional urban networks characterized by medium cities (and in some cases state capitals) as their nodes. During the past two decades, a complex system of tiers of urban networks has emerged and continues to expand at the sub-regional level. On the one hand, networks connecting rural/rural and

rural/urban areas have developed and intensified as a result of better transportation and communication and a growing market for forest and other resources, while, on the other hand, networks linking small towns to medium and large cities have developed as people move and circulate in search of services and economic opportunities.

These small and median cities are predominant throughout the Amazon; for example, the 2000 Brazilian population census (IBGE 2000) counted more than 638 administrative seats of municipalities with less than 20,000 inhabitants, or about 85% of the total administrative seats in the region. However, the regional urban population is greatly polarized, as 41% of the region's urban population reside in 1% of Amazonian municipalities, or those considered large (>200,000 inhabitants). The level of articulation between small and larger cities thus is variable and largely dependent on modes of communication and transportation, including road infrastructure and river transportation, communication services, and demographic and economic flows. Small cities have, in general, fragile and weak transformative economies, high dependency on federal subsidies, jobs located predominantly in public service, low competence in offering basic services such as infrastructure, education and public security, and predominance of rural activities functioning largely as part of an informal economic system (Guedes, Costa, and Brondizio 2009.; Costa and Brondizio n.d.). Increasingly, a significant part of these economies are associated with federal cash transfer programs, such as *Bolsa Família*, which represents the leading form of income for families living in many small cities in the region (Brondizio n.d.).

Nevertheless, these cities continue to grow because they offer a safeguard against landlessness and a base for rural families to access urban services and employment opportunities that are absent or even more precarious in rural areas. In many cases, cities become re-defined as rural villages (Perz 2000; Roberts 1992). However, simplifying these dynamics through a dichotomous view between urban and rural areas or small and large cities overlooks the complex systems of economy, livelihood, and development affecting urban and rural families alike (Padoch et al. 2008). Furthermore, such a view overlooks the importance of medium-size cities distributed across the region in serving as nodes for subregional urban networks that increasingly define the Amazon's rural and urban socio-demographic and economic spaces, as well as the regional environment and resource uses. For example, Browder (2002) notes several key differences in land use patterns between urban-based farm owners and rural-based farmers, proposing that land ownership is increasingly controlled by urban residents, thereby "suggesting that rural property ownership and land use are becoming part of complex urban-based household strategies" (2002, 22). These trends create a significant development puzzle for the future of the region: how to improve livelihoods and economic sustainability in spite of continuous

population growth, lack of a transformative economy, and recurrent debt and service deficits that create a growing dependency on federal subsidies for municipalities and cities of all sizes.

DATA: ANALYZING URBANIZATION AND INTER-URBAN LINKAGES

We analyze Amazonian urbanization at two levels of analysis: regional and sub-regional. Analysis at the regional level includes 760 cities that are part of the Brazilian Legal Amazon (see figure 1) and urban centers that differ substantially from one part of the region to another (Guedes, Costa, and Brondizio 2009.). Analysis at the sub-regional level is comprised of cities (excluding capitals) that are considered to be nodes of inter-urban networks and the cluster of cities influenced by them.

We use a combination of historical and decadal demographic census data collected at several levels of observation (urban, rural and total population) and analysis (municipality, municipal seat, state, and regional) since 1950 and organized within a Geographic Information System framework (ArcGis 9.2). We use these data sets to highlight urban demographic changes, including the historical foundation date for municipalities of the Brazilian Legal Amazon available from the National Alliance of Municipalities (CNM 2007). We also use the 2000 demographic census micro data for household-level variables such as access to infrastructure and public service (i.e., electric energy, public electric light, pavement, water system, pipe water system, sewage system, waste collection), immigration between cities (e.g., fixed date migration), and commuting movement (i.e., considering place of studying and working). Additionally, we utilized the Annual Report of Social Information data (RAIS) of the Brazilian Ministry of Labor and Commerce data collected for 1985, 1990, 1995, 2000 and 2005 to discuss forms of employment. We used MS Excell 2003 and SPSS 16.0 for data processing and graphing.

REGIONAL AND SUB-REGIONAL URBAN DEVELOPMENT

Population, Infrastructure, and Economic Development

While urban populations in the Amazon have typically been concentrated in large cities (the nine capitals of Brazilian Amazonian states alone contain about 37% of the urban population), a growing percentage of residents reside in medium urban centers. For example, in 2000, 32% of the population living in urban centers were residing in medium-size cities (IBGE 2000). The pace of the creation of new small cities and subsequent municipalities has rapidly increased within the Brazilian Legal

Amazon (Figure 2), particularly after 1960, when the Amazon Region was the target of public policies aimed at occupying and incorporating the region into the national political-economic system and demographic framework (Browder and Godfrey 1997; Corrêa 1987; Becker 1985; Machado 1999).

It is important to note that the Brazilian Institute of Geography and Statistics (IBGE) defines urban areas as all administrative seats of a municipality, without distinction to city function or dimension (e.g., population size)⁵. Additionally, after the Brazilian Constitution (1988), the state became responsible for approving the emancipation of municipalities, rapidly speeding up the process by which municipalities were created and explaining why more than 58% (444) of the municipalities in the Brazilian Legal Amazon were created after 1980 (Table 1). While the majority of inhabitants populate large and old cities (founded before 1920), the number of people living in small and newer cities (founded after 1990) is also increasing. Recently founded, these cities are generally located near roads in the states of Tocantins, Maranhão and Pará, have precarious infrastructure and are predominantly based on rural economic activities.

The youngest municipalities (i.e., those emancipated in the 1990s) are less urbanized than the ones created between 1970 and 1980 in areas designated to attract population. However, they are not significantly different from "historical cities" of the region, still characterized by a demographically relevant rural population (Figure 3). The roots of today's largest Amazonian cities first developed during the colonial period of regional occupation (between 1600 and 1750), including those of Manaus (with 99.3% of the municipal population living in the urban area), Belém (99.3%), Cuiabá (98.5%) and São Luis (96.27%). These cities not only continue to dominate the region in terms of population size, but also in terms of economic, political and cultural importance.

Municipalities created during later periods (such as between 1900 and 1950), include those predominantly rural as well as completely urban such as Ananindeuá (99.7%), which is part of the Belém Metropolitan Region, Boa Vista (98.2%) and Macapá (95.5%), capitals of the states of Roraima and Amapá, respectively, and Várzea Grande (98.1%), one of the largest cities in the state of Mato Grosso. Subsequently (between 1971 and 1980), cities such as Sinop (90.4%), created specifically as an agricultural service city and currently an important soybean production and export municipality, and Vilhena (94.4%) were formed as part of regional connections to an expanding global commodity economy for logging, minerals, beef, and grains. This trend continued between 1981 and 1990, particularly in the states of Mato Grosso and Tocantins, where respectively 23.5% and 55.8% of

⁵ It was established in 1938, by the Federal Government, using the Federal Law number 311, which transformed all seat of municipalities as cities, and it includes cities with less than 1,000 inhabitants.

new cities appear, especially with the creation of Tocantins as a state in 1988. In 2000, its capital, the city of Palmas founded in 1997 as a purportedly planned city, has 97.6% of its population living in the urban area. These trends indicate the rising importance of post-1970 agrarian-based cities along road corridors along with the continuous importance and dominance of historical state capitals connected to rivers and roads. However, variability in terms of city infrastructure within each age cohort of city formation appears as much significant as between age cohorts.

Yet, the level of urbanization tends to reflect the importance of a city within an urban network and its ability to attract surrounding rural and migrant populations⁶. In 2000, for instance, approximately 11% of the Brazilian Amazon population was comprised of immigrants arriving before July 1995⁷. Most of them, however, originated within the Amazon itself [i.e., 77.3% of internal migrants against 22.7% coming from other regions or abroad] which indicates the growing importance of internal migration during recent decades. Of this (77.3%), and supporting our central argument of inter-urban dependency, over 70% migrated between urban areas and the remaining part from rural areas within the region. Of the five cities within the Amazon receiving the highest influx of immigrants, Manaus (Amazonas state) received the largest number of immigrants, followed by Barra do Garças (Mato Grosso state), Tocantinópolis, Trizela do Vale and Pedra Preta (all located in Tocantins state). The latter three municipalities, as common for the state of Tocantins, were founded after 1970.

The figures above suggest a lack of correlation between age, population size, and migration rates, as well as the spread of urbanization to new parts of the region. Similarly, in terms of city infrastructure, we did not find any significant correlation between city age and the level of urban infrastructure (Table 2). For instance, only 5 cities, or 0.7% of Amazonian municipalities, had 90 to 100% of households connected to a water system.

According to the 2000 census (IBGE 2000), 16.5% (or 123) of administrative seats of municipalities in the Brazilian Amazon had more than 60% of their households connected to a water system (55.3% of them were founded after 1980). In terms of sewage systems, the cities of the Brazilian Amazon are generally in similar conditions; only one large city, Cuiabá, the capital of Mato Grosso founded in 1719 had around 50 to 60% of its households connected to a sewage system. Other large cities such as Belém, Manaus, Rio Branco and Imperatriz have between 10 and 50% of its houses served by a sewer system. As a whole, 96% of Amazonian cities, no matter their age, have less than 10% of their houses connected to a public sewage system. Paved roads and streets are additionally limited among Amazonian cities:

⁶ We are not discussing here the causes of migration, only how it indicates level of inter-urban connectivity and inter-dependency and reflect rates of urbanization in terms of number of migrants and number of inhabitants.

⁷ We assume as migrant the non-inborn person who arrived in a urban area since the date of the previous census

over 70% of Amazonian cities have less than 20% of their households located on streets with pavement. Regarding city trash collection, we found that the biggest cities, for example Belém, Manaus, Palmas, and Cuiabá, offer a better waste collection service (more than 80% of households with this service), but some younger and smaller cities, such as Primavera do Leste and Sorriso, also have relatively good waste collection systems. While access to electricity has been improving during the last decade, 40% of Amazonian municipalities cannot offer electricity to at least half of their urban houses.

These results reinforce the fact that urban conditions and infrastructure are not selective in the Amazon. All types of cities, big or small, old or young, with various levels of urbanization, lack even minimum public infrastructure such as sewage and garbage collection, pavement, and to a lesser extent water and electricity, for their residents. Earlier census data (1980 and 1991) show that urban environmental quality among Amazonian municipalities was also poor and, in many cases, deteriorating (Perz 2000), a trend still observed since 2000.

The lack of infrastructure and a transformative economy generating tax income for municipalities to provide services have reinforced the growth of subregional (and regional) inter-urban networks. Cities that can offer job opportunities, even in the informal sector, and more access to basic health and education services as well as bank or similar services attract populations from rural areas and surrounding cities. In assessing the distribution of employment sectors among Amazonian states, we found that no more than 53% of the active economic population was employed in the formal sector by 2005 (Table 3). Many, if not most, formal employment opportunities in urban areas are offered by state and municipal public administrations, in some cases reaching over 90% of formal employment registries. Even in the state of Amazonas, with the largest amount of industrial employments (25.6%) in the region (linked to the heavily subsidized Free Trade Zone of Manaus) 30% of the state's formal employment is found in the public sector (RAIS 2005). By 2005, according to RAIS, at a regional level 62% of all workers⁸ were employed in the so-called informal sector, thus lacking registration, pension, and workers' rights. This is a reality already pointed by (Becker 1985), (Godfrey 1990), (Browder and Godfrey 1997), and (Perz, 2000). Paradoxically, however, informal employment represents activities associated with the most important regional economic sectors: mineral extraction, agropastoral activity, forest production, fishing, and extractivism.

URBAN-URBAN AND RURAL-URBAN NETWORK CONNECTIONS

⁸ This category does not include all individuals of the economic active population. According to IBGE, this category [workers] includes people with or without wage, which in 12/31/2000 were executing any sort of service across different economic sectors.

The inter-urban connectivity created through physical and communication infrastructure, service dependency, and population movement continues to increase in importance throughout the region. As part of this process, medium-size cities have increased their sub-regional influence over time. In a region deprived of infrastructure, services, commerce, and employment, cities that are better structured in terms of economic and social opportunities inevitably attract an influx of immigrants, both permanently and seasonally, from surrounding areas. Commuting movements represents an important aspect of inter-urban (and rural-urban) linkages in the Amazon (Figure 4). While a small percentage of the total Amazonian population (1.6%) commutes to other urban areas for work and study, families of these commuters use these networks to access services such as health, commerce, and banks (Padoch et al 2008; Brondizio, Siqueira, and Vogt n.d.). Such linkages increasingly mark family networks between cities. While large capital cities such as Belém, Manaus, São Luis, Porto Velho, Cuiabá, and Palmas capture close to 50% of all commuting movement within the Legal Brazilian Amazon, the rising importance of medium-size cities also is apparent, particularly of the cities of Ananindeua, Castanhal, Altamira, Santarém, Paragominas and Marabá (state of Pará), Imperatriz, Balsas, Santa Inês, Pedreira and Açailândia (state of Maranhão), and Araguaiana (state of Tocantins).

Taking the state of Pará as an example, we can see that the strongest relationships among small and medium cities stem from cities that are inter-connected through road networks. For instance, in 2000 the city of Altamira received population from 41 municipalities involved in commuting movement. Of this, 53% from municipalities surrounding Altamira and interconnected by roads (e.g., Brasil Novo), but also from adjacent municipalities located at significant distances, such as Guarantã do Norte, Peixoto Azevedo, and Matupá in the state of Mato Grosso (Figure 5). The same scenario we found for Altamira also can be seen among municipalities such as Santarém, Paragominas and Marabá, which exert an ever-increasing role on surrounding areas and municipalities by providing education, employment, and services, despite their relative size and economic development compared to larger, capital cities (Guedes, Costa, and Brondizio 2009).

Understanding the formation of inter-urban networks also requires attention to local-level connectivity between urban and rural areas. In spite of the non-selective nature of urban conditions in the region, small cities tend to have less of an ability to provide services and employment: a weak to non existing industrial economy, high dependency on federal subsidies, jobs predominantly in public service, and low competence in offering basic services such as infrastructure, education, and public security. As small cities are marked by predominantly agricultural and extractivist economies they are structured around an intrinsic connection to rural areas (Padoch et

al 2008; Brondizio, Siqueira, and Vogt n.d.), which in turn depends on markets available in medium and large cities. However, even with a lack of basic infrastructure and other economic benefits, like medium-size cities, small ones also continue to grow at a significant rate throughout the region. While they play various roles for different sectors of the surrounding population; rural families report visiting urban areas daily or weekly, not only for market but to assess the various welfare programs in which they are increasingly dependent (ibid.). In many cases, small and medium urban areas also offer a place for rural families to invest as they seek security from landlessness, a place for their children to study and seek employment, and shelter if displaced during events associated with environmental change such as accidental fires, drought, or flooding (Brondizio and Moran 2008).

DISCUSSION AND CONCLUDING REMARKS

Deforestation and the potential impacts of global climate change continue to merit close attention to the Amazon. In this paper, however, we join other researchers in calling more attention to the importance and role of urbanization and its dynamics in the region. The quality, generalized problems, and future consequences associated with phenomenal rates of urban expansion mirrors few other regional problems in terms of magnitude. Urbanization, in all its dimensions, is a fundamental aspect of the broader social and environmental equation shaping the region's present and future. Our analysis aimed at providing a two-fold perspective to urban dynamics in the region, thus linking processes at sub-regional and regional levels.

Our analysis of the larger regional urban network, so far, reinforces the theory of disarticulated urbanization proposed by Browder and Godfrey (1997). We agree that traditional models of urban hierarchy (e.g., relations among small, medium, and large; national and global cities) are insufficient to explain the Amazon urban network. However, our data sets indicate the formation of inter-urban networks characterized by interconnected transportation and communication systems, demographic and economic flows, and the emergence of node service cities of medium and large sizes. The increasing movement of people between cities and the flow of services and economic relations points to the emergence of a sub-regional urban hierarchy in the Brazilian Amazon. We also consider it is time to take a closer look at the importance of small and medium cities within the Amazonian urban network, which represented in 2000 more 99% of the region's seats of municipalities. The usual concept of a city (a central place offering a variety of services and urban functions) does not fit the majority of Amazon cities where there is little or no investment in infrastructure and services following population growth and increasing

influx of migrants. At the same time, their importance as 'cities' to the regional population cannot be disregarded.

While the environmental consequences of these trends are significant, we focused our attention on the social impacts resulting from these changes. The present quality of public urban services and the lack of conditions among Amazonian cities to cope with the pace of economic and demographic changes feed a vicious cycle of dependency on government subsidies and an increasing inability to sustain an increasingly urban-based society. We argue that the growing deficit between demands and services and the quality of those services will further reinforce inter-urban connections and inter-dependencies between rural and urban, small, medium, and large cities in the region.

In spite of their different histories and ages, Amazonian cities have more in common with each other than can be perceived. The majority of cities and towns have inadequate infrastructures to offer to their respective population, such as water and sewage systems. They also have a heavy dependency on government subsidies and an inability to generate and reinvest resources locally. By 2000, more than 90% of municipalities had less than 10% of households connected to public sewage systems and around half offered limited access to treated water. Poor access to water is a problem even for cities such as Manaus and Belém. For a region where the majority of the population lives in urban areas, the implications of these deficiencies to health, pollution of the surrounding environment, and the overall quality of life are significant, particularly as the population continues to increase. However, while the regional scenario appears hazy it is important to recognize the role of state-level agencies and other actors that have been working to improve access to treated water and electricity.

Currently, the Brazilian government has created programs, such as aiming at expediting development and economic growth (i.e., *Programa de Aceleração do Crescimento* – PAC), which includes components to improve urban infrastructure. The scale, direction, and quality of investments, however, remain unclear at best and prospects for implementing actual changes have decreased since the October 2008 global economic crisis. The Amazon region also has received investments aimed at expanding access to electricity (The "Light for All" program, or *Luz Para Todos*) which when actually implemented are enormously important to urban and rural households alike. However, while these initiatives can help to solve current infrastructure constraints, ultimately, the long-term prospects for a better quality of life for Amazonian residents will depend on the capacity of municipalities to generate resources through services and transformative industries while decreasing their dependency on federal subsidies.

With an urban population increasingly dependent on the informal economic sectors, the reality is that a large proportion of families depend on welfare programs,

and the majority of cities depend on Federal and State Government subsidies to order to combat their infrastructure deficiencies. Given this scenario, prospects for change and improvements are limited. The situation of small and medium cities, no matter their age, illustrates this regional reality. Even when they witness strong economic activities based on forest and agro-pastoral sectors within their municipalities for instance, their ability to harness benefits locally are extremely limited. At the same time, these cities are experiencing significant population growth and the spatial expansion of urban areas. This scenario show us we still need to understand what function small and medium size urban centers in the Amazon region serve in the large regional and national economies, and thus, how to account for their needs.

In other words, many municipalities in the region are experiencing increasing production and export, from forest, fisheries, mining, or agropastoral activities, for example, yet, they have no ability to capture even the slightest return, either in the form of taxes or in the form of employment in industry dedicated to product development, transformation, and marketing (Brondizio 2008). For most municipalities, public services represent the most significant employment sector while welfare programs such as *Bolsa Familia* and retirement comprise the most significant sources of household income. Municipalities throughout the Amazon continue to suffer the consequences of a regional economy based on low value resource export and the absence of transformative industries, while at the same time increasing their responsibility to provide services to a growing population.

In order to cope with such economic disadvantages, Amazonian families, rural and urban, are increasingly articulating their lives by expanding their social networks to multiple cities to compensate for local deficiencies through access to resources and services from this expanded social network. People move more frequently between rural and urban areas, and between small, medium, and large cities. Rural areas have also become an increasingly important part of this network of movement, representing a point of departure and return and also a safety-net of resources and economic opportunities, in many cases supporting families living in urban areas (Padoch et al. 2008; Brondizio, Siqueira, and Vogt n.d.).

While it takes little effort to observe that for most of the region the so-called rural-urban continuum is a present reality, it creates different demands for services. Whether Amazonian cities are able to improve their services and infrastructure over time still remains to be seen. The non-selective nature of regional problems and the strong dependency of cities in federal subsidies indicate a pessimistic scenario. A comparison between our results and other efforts (Perz 2000; Browder and Godfrey 1997; Sawyer 1987; Becker 1978, 1985) indicate that the regional urban infrastructure continues to be deficient at best, and worsening in many cases. Yet, cities still offer an attractive prospect to many, if not most in the region. Rural families and those from smaller cities benefit economically and socially from urban

connections. They access particularly health, education, and informal employment, opportunities that are even more precarious in rural areas. To many, cities emerge as an *"El Dorado"* of modernity, a prospect to a larger connection to the globalized world, and eventually a chance to improve their lives. Any attempt to understand and contribute to the future of the region requires close attention to these processes.

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Inter-Urban Dependency among Amazonian Cities: Urban Growth, Infrastructure Deficiencies, and Socio-Demographic Networks

ABSTRACT

This paper examines the process of urbanization in the Brazilian Amazon with attention to the formation of inter-urban networks and their linkages to a regional urban system. Based on the integration of historical census, census micro-data (2000), and field research, it examines Amazonian cities in terms of their foundation history, urban functions and services, population size, and employment. It also examines the emergence of subregional inter-urban networks through transportation and population movement. Three main arguments regarding Amazonian urbanization are discussed. 1) The lack of urban infrastructure in the Amazon is non-selective, affecting cities notwithstanding age, size, and location. 2) As a result, subregional inter-urban networks are emerging marked by the rise of node service cities in different parts of the region. 3) High rates of urbanization, dependency on subsidies, lack of industries and dominant informal economy points to limited prospects for short-term improvements in urban conditions and quality of life.

Keywords: urbanization, Amazon Region, urban network, regional urban system.

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Figure 1 – Distribution and population size for urban centers of the Brazilian Amazon 1970-2000 (Based on IBGE census data 1970-2000)

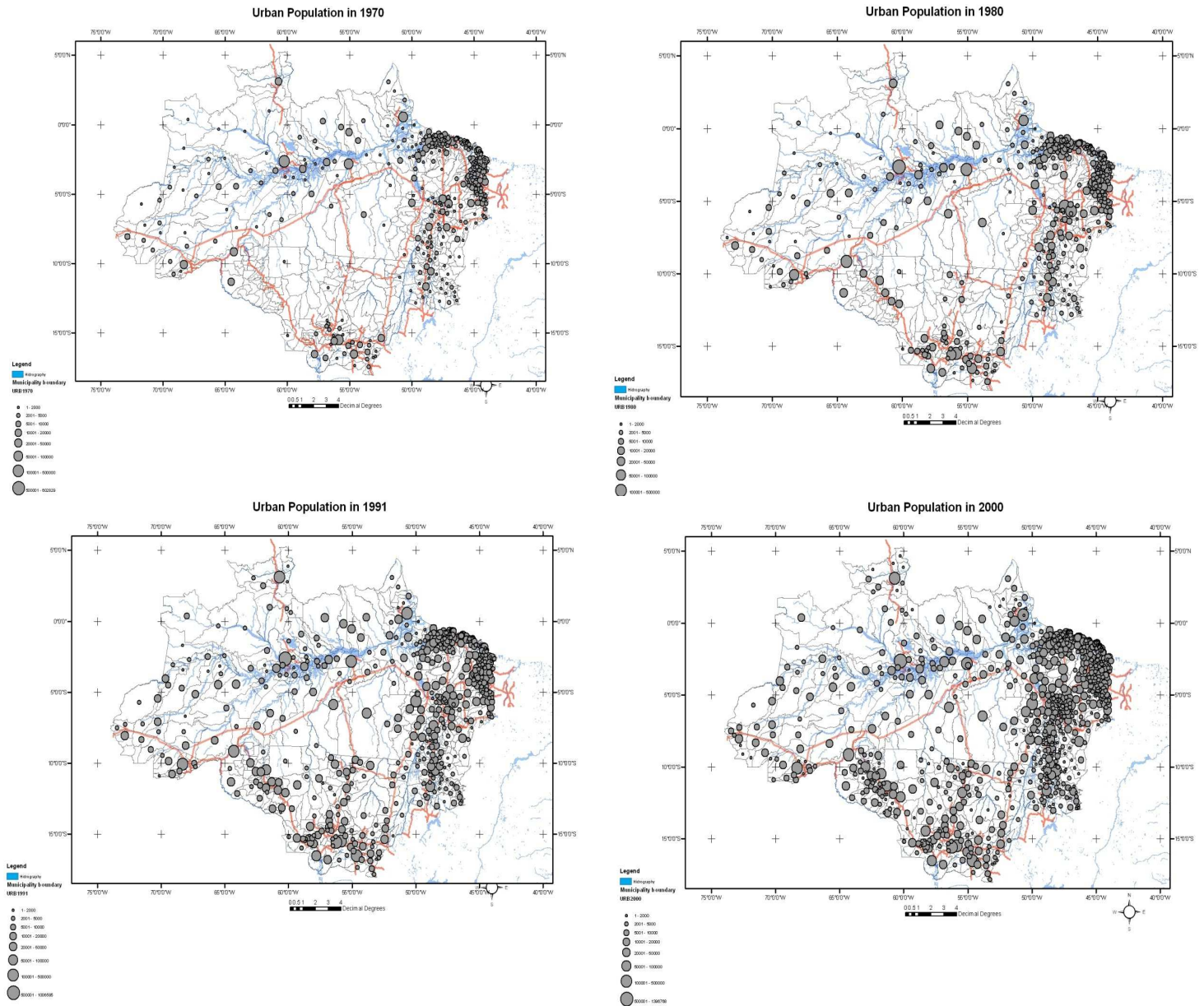


Figure 2 – Foundation of Amazonian municipalities since the 1600s (Cumulative frequency)

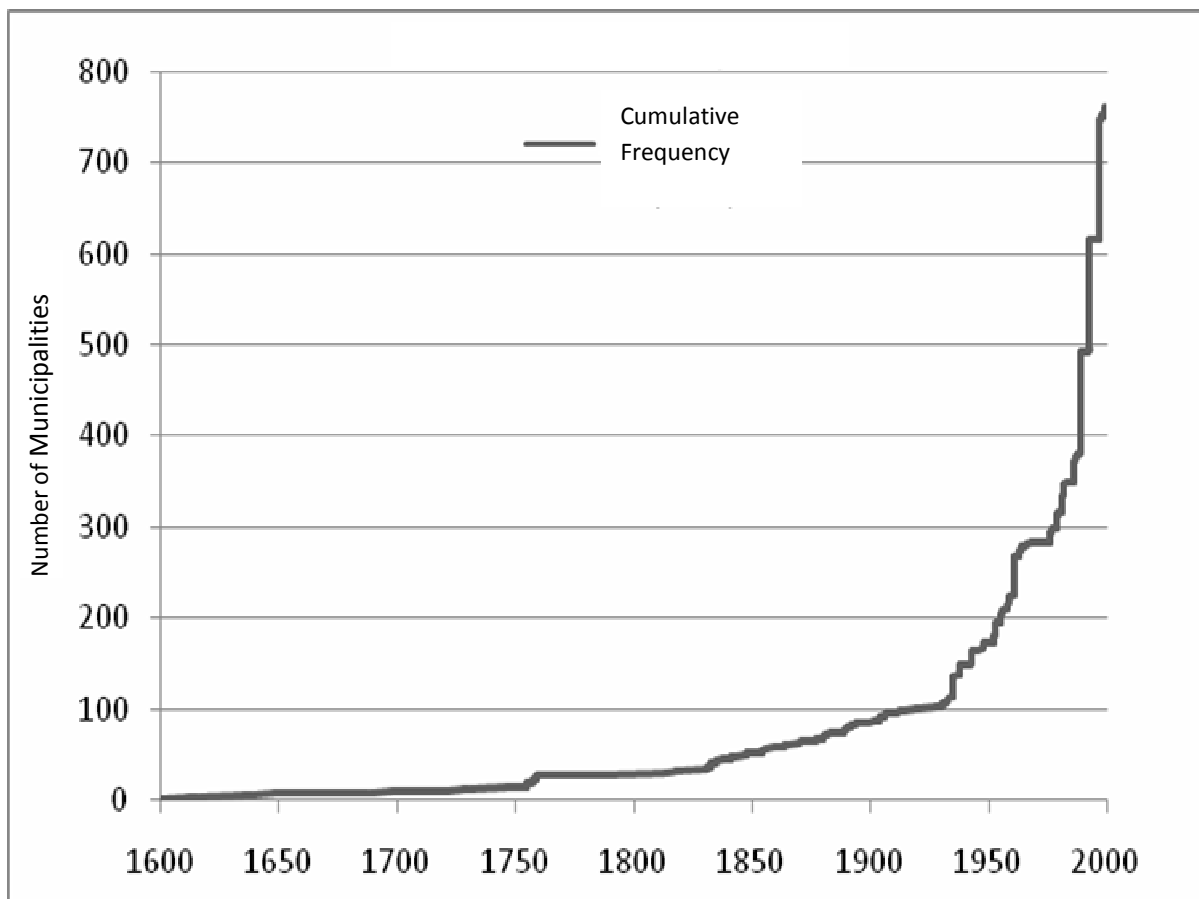


Table 1 – Age of Cities and Urban Population

		Foundation					
		<1920	1920-1960	1960-1970	1970-1980	1980-1990	>1990
Urban Pop.	Total	6,535	2,991,019	532,104	666,067	1,850,094	1,132,611
	%	47.7	21.8	3.9	4.9	13.5	8.3
Population size	< 20,000	9.25	15.36	8.15	3.76	23.98	39.5
	20,001 to 50,000	40.28	20.83	6.94	4.17	25	2.78
	50,001 to 100,000	30	15	5	30	20	0
	> 100,000	47.06	41.18	0	0	5.88	5.88

Table 2 - Distribution of Urban Infrastructure of Households (%) in Municipalities (%) of the Legal Brazilian Amazon, from IBGE Micro Data of the 2000 Census (IBGE 2000)

Percentage of households	Electric Energy	Public Electric Light	Pavement	Water system	Pipe Water System in at least one room	Sewage system	Waste - City collection
0 - 10%	0.8	4.0	47.7	15.1	15.3	96.1	32.3
10 - 20%	4.2	8.6	24.6	12.1	25.7	2.1	17.3
20 - 30%	12.6	15.0	14.6	15.5	19.3	0.8	12.5
30 - 40%	17.0	16.6	7.8	16.5	14.1	0.4	10.6
40 - 50%	18.1	16.3	2.8	13.5	9.5	0.4	9.1
50 - 60%	15.9	15.5	1.7	10.8	5.1	0.1	6.4
60 - 70%	11.7	10.7	0.4	7.8	6.2	0.0	5.2
70 - 80%	10.8	8.0	0.4	5.2	3.2	0.0	3.8
80 - 90%	5.8	4.6	0.0	2.8	1.7	0.0	2.7
90 - 100%	3.2	0.7	0.0	0.7	0.0	0.0	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from Brazilian Demographic Census - microdata (IBGE, 2000)

Figure 3 – Period of foundation and level of urbanization in 2000 for municipalities of the Legal Brazilian Amazon

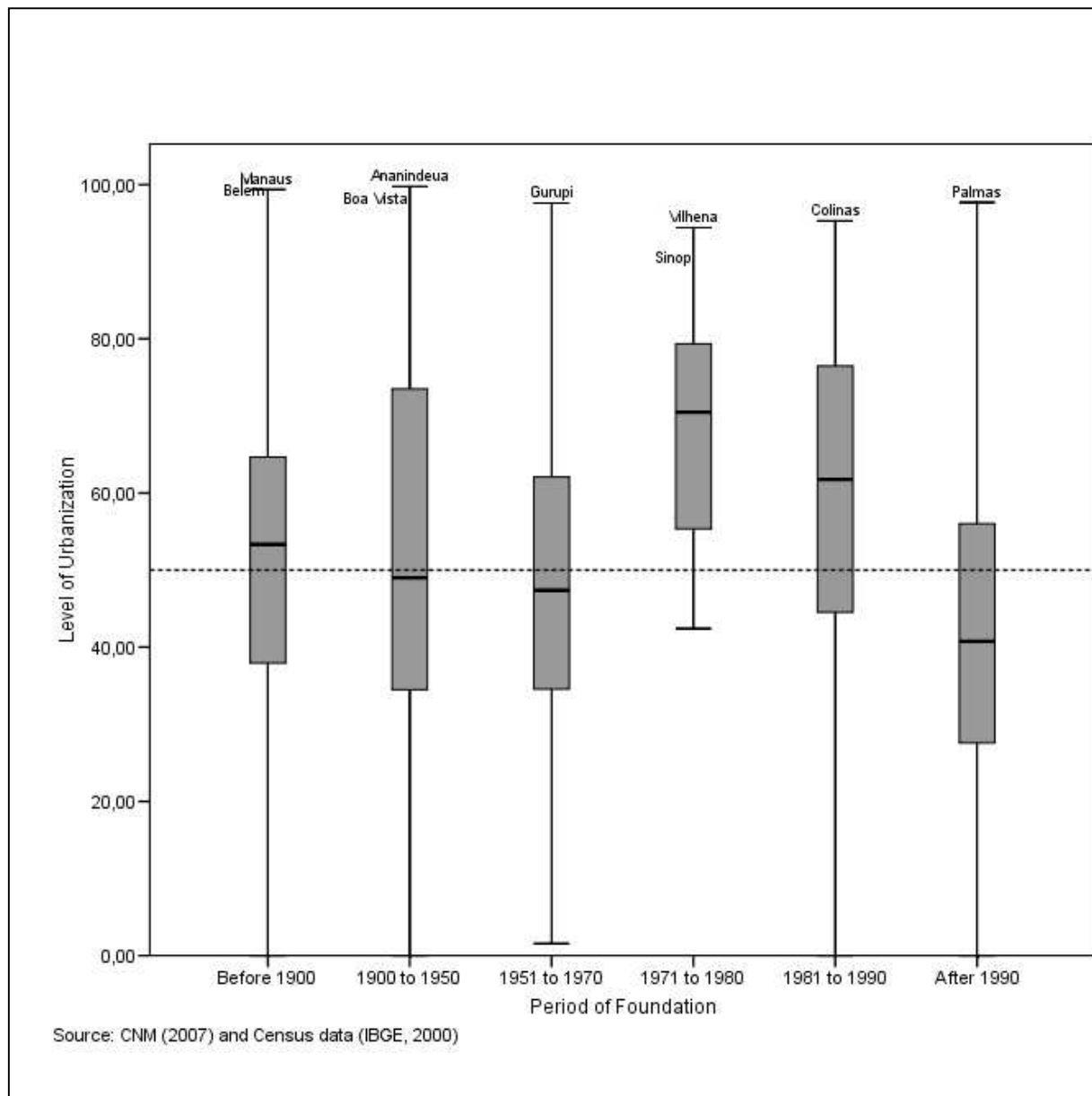


Table 3: Employment sectors (%) in 2005 for 8 Amazonian states according to RAIS (Annual Report of Social Information)

IBGE ECONOMIC SECTORS	RONDÔNIA	ACRE	AMAZONAS	RORAIMA	PARÁ	AMAPÁ	TOCANTINS	MATO GROSSO
Mineral extractive	0.3	0.1	0.2	0.1	0.6	0.9	0.3	0.3
Industrial sector	9.2	4.9	25.6	4.1	10.9	3.4	4.1	11.9
Public services	1.2	1.5	0.9	3.0	0.7	1.3	1.6	0.9
Construction	2.3	5.1	3.2	4.7	4.4	3.7	3.9	3.1
Commerce	19.2	16.9	12.9	22.8	17.7	19.2	12.8	21.3
Services	19.8	16.8	25.9	27.7	24.9	24.9	13.2	23.2
Public administration	45.4	51.9	30.9	36.0	37.7	46.1	58.9	29.4
Agropastoral, extractivism, hunting and fishing	2.7	2.8	0.5	1.7	3.2	0.5	5.1	9.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: RAIS / MTE, Brasil.

Figure 4 –Percentage of commuting movement to different cities in the Legal Brazilian Amazon region

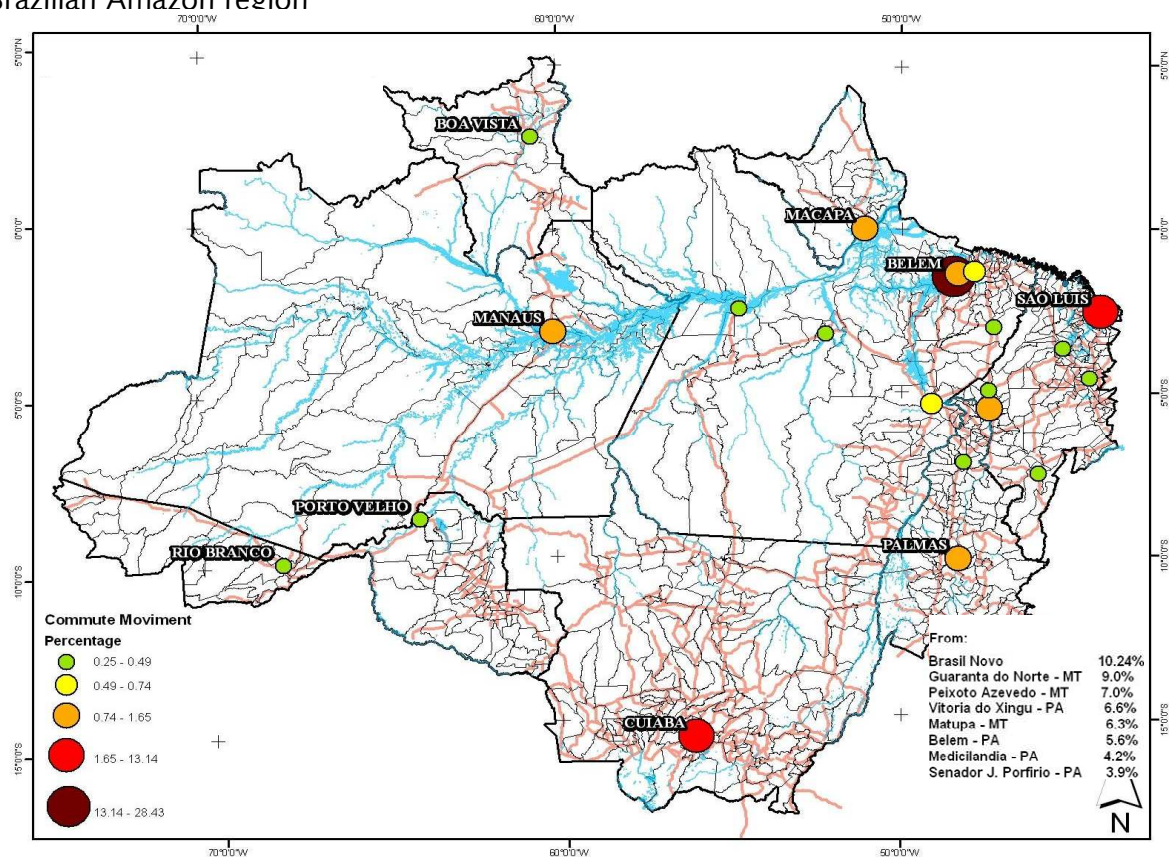


Figure 5 – Commuting movement flows to and from the city of Altamira, Pará

