

Population and Environment in Brazilian Ecosystems

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development

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The challenge of development in the Brazilian Center-West¹ represents an aspect that challenges the nation, that of finding alternatives to the existing economic social model, thus, changing a reality characterized by the presence of a fragile, heterogeneous social system that is further weakened by a precarious distribution of income. This situation is in contrast to general deprivation of the population and promises of new technology and swift transformations. Given the lack of an unequivocal strategy of development and a pact of priorities for social action, the project of social action and changes in the economy are more and more subject to external, global and world interests. Thus, concerns relating to the impact of demographic and economic occupation of the environment stand out and have emerged in recent decades.

In truth, as political aspects of the concept of sustainable development are acknowledged and clear political defense of the ecosystem is recognized, as was made clear in the World Conference Rio-92 and became a force to be reckoned with, it has also become clear that there is a need to develop common agendas, both global as well future, of mutual interest among peoples of different nationalities. In fact, the previous decade became a period in which the notion of sustainable development (Motta, 1997) extended to the economic, social as well as the ecological sphere (ecosystems and natural resources). The idea of sustainability (Lima and Queiroz Neto, 1997) was further associated with distinct spheres of collective threats not only to the ecosystem but also to health concerns (Hogan, 2001) as well as to productivity and capital gains. Nonetheless, the major challenge has not been met given that sustainability in developing countries continues to be viewed as a result of the economic backwardness of these countries, indicating a false trade off between agriculture sector production and conservation. This attitude should be contrasted with the absence of an effective definition of rights, national social interests and equivalent financial support from developed nations on a global scale, if it is understood that these are principles that have, historically, been responsible for the destruction of the world ecosystem.

In this context, an analysis of recent demographic and economic indicators of the Center-West is challenging in that these indices have been applied to an area of low economic and population density. In other words, although the Center-West represents less than 1/5 of the national territory, the equivalent of 1.612 million Km² (four times the area of the state of California or three times the territory of France), with only 6.85 percent of the population of Brazil, which is a little more than 11 million inhabitants in 2000² and contributes 6.44 percent of

the national Gross Domestic Product (GDP), based on the figures for 1999.³ In this context, although given the geographic conditions of the Center-West and its complex but relatively fragile biomes, such as the pantanal (a sprawling wetland) and **cerrados**⁴ (**scrub deserts**), and a general social and political perception, specifically of the limits of natural resources (Hogan, 1998), commitment to its future potential use have not become pivotal in the decision-making process by social agents and local institutions.

A clear notion of the occupation of the Center-West, in conjunction with a technological concept of development and the uncontrolled accumulation of capital presupposes conditions of "unlimited" expansion and economic exploitation as well as the population of the region being assimilated. That is, important aspects dealing with inadequate use of the soil and subsequent deterioration of the natural ecosystem are subject to private interests that are geared to increased production and agricultural productivity, which appears to be happening, specifically in the areas in which the cerrados are predominant. (Cerrados being the largest regional biome⁵ traditionally considered an area of stunted vegetation and poor soil fertility⁶.) In these areas, research and socioeconomic debates that have occurred in the last three decades have centered on agriculture and modern technology, recognizably more related to a model of social exclusion and large land ownership present in the region. This phenomenon was given positive official approval in that it was considered a process that improved the existing panorama in that it was modern replacing the natural productive and social conditions existing at that time. In that sense, the work of the WWF (1995:47) states that historically, agriculture (food sector) economic expansion developed in the cerrados was characterized by a predatory economic model that involved extensive exploitation, low density, and fostered slow depletion of the environment. The World Wildlife Fund has defended a policy of change in production practices. This aspect reinforces conventional models of economic growth, although this may not have been intended, the main emphasis being the conditions of substitution of input in manufacturing the product. In the case of productive occupation of the cerrados, specialists point out that this process conveys ideological overtones in that it is presented as an instance of successful technological modernization of the Green Revolution⁷. This, in turn, gave rise to important transformations by changing the landscape of the rural area in economic terms with the mechanized cultivation of soybeans and corn being introduced as an outstanding feature of this process (Shiki, 1997).

In regions like the Center-West that have great undiscovered natural resources, that at this point have not been inventoried, in addition to the low level of social and economic occupation of the area as well as a lack of perception of the future threat to the environment that development causes, this context serves as a back drop to the not as yet settled question of national autonomy versus international interference. This controversy is further distorted by an ideology that perceives plundering the land as a social ancestral heritage. In other words, by heeding the interests of private select groups, adequate attention was not given to international interference also present in the production process and was subordinate to the technological package. This limited perception of reality creates a crisis in the productive and intensive modernization model

currently being implemented in the short and long term with ensuing environmental (soil erosion and compaction, contamination and depletion of springs, diminishing biodiversity and biological imbalance), social, and economic problems.

Understanding the challenges of sustainable development in the Center-West is developing on two strategic fronts. The first being an effective international contribution to preservation of nature and the second an investment in future potential heritage. In other words, the thesis being presented here is that policies favorable to sustainable development of the region should not be based on expansion and productive exploitation of the food sector, nor on the models being put into practice, whose benefits are, at best, questionable. Two basic plans are deemed necessary. On the one hand, in order to obtain international resources administered autonomously by the region, comprehensive knowledge based productive activities capable of adding value and jobs in addition to investments in improving the quality of life of the population and the ecosystem should be put into effect. On the other hand, resources need to be found to develop technology that takes advantage of the principal sources of renewable resources in the near future that are still abundant in the Center-West: sun, water, and biodiversity. However, it should be made clear that this paper does not intend to discuss productive arrangements in the present structure of the basic sector (food) of the region. Although this debate is relevant in that it permits a discussion of soil management that is less aggressive to the natural environment. The debate possesses a significant number of analysts. The goal at this time is to encourage a different type of debate: not one that excludes but one that encourages an innovative concept of the forthcoming development of this region.

1. Analytic cross section

An evaluation of the conditions of sustainable development in a given region requires in advance a definition of the units of analysis that provide an understanding of the frame of reference that is being established. Given that the concept in question involves several areas of knowledge it becomes relevant to establish the components of intervention, in other words, components that are essential in establishing a dialogue. In this case, at least three communication channels need to be interrelated: the economic structure, social indicators and the environmental component.

Among the many combinations of possible and available information, it is possible to work with ones that bring together the smallest level of common spatial aggregation as well as the entire geographic segment that expresses the phenomena being studied. In this paper the proposal aims at combining territorial units based on economic and social indicators, considered natural units, represented by the two principal biomes that are being analyzed. Socio-environmental interaction, as presented here, is justified due to the interface between economic factors and social spatial structure that have an impact on the internal and external environmental organization.

The macro region of the Brazilian Center-West will be considered the largest unit of analysis in that it typifies the principal tendencies occurring in the two

biomes being analyzed.⁸ The Center-West epitomizes, historically, the largest and most representative production area and demographic occupation of *cerrados* in Brazil. It should be remembered that most marshlands are in Brazilian territory, approximately one third in the state of Mato Grosso and two thirds in the state of Mato Grosso do Sul.

Differentiating between the two biomes will also be a procedure followed and the objective is to identify their heterogeneous characteristics although they will not be part of the analytic cross section presented. They do not constitute appropriate units of analysis that would assist in understanding their socio-environmental reality, given that the greatest negative impact on the ecosystem of the *pantanal* is a result of activities carried out in the surrounding area. It should also be pointed out that the social structure that appropriates and controls the productive process of the biomes in question is not organized within it. This in turn constitutes a multidisciplinary challenge in understanding this context.

Finally, municipal districts will be dealt with separately given that from an economic point of view they represent a cross section of the structure of the cities and areas of influence in the region. It is this complex network of the economy and the links that it provides that is also responsible for absorbing significant groups of the population, heterogeneous in nature with a tendency toward localized demographic saturation.

A municipal cross sectional analysis allows the study to link economic and demographic data that call attention to heterogeneous facets of the region, fundamental to a thoughtful analysis on the specific regional development. The municipal area is the unit that methodologically best facilitates an understanding the urban structure, the availability of infrastructure, inter-relatedness, and functional differences that develop into the idiosyncratic nature of the particular productive structure. Thus, based on the magnet cities (significant economic and demographic centers of the region) it is possible to identify pivotal questions involved and the principal direction of socio-economic development as well as intra and inter state and regional diversity, an aspect that is not mandatory in defining sustainable development policies.

2. Regional characteristics

The Center-West, in the last two decades, has been characterized as an economy based on widespread cattle raising, milk production and crop production of basic foods (called food sector). This production is also supplemented by isolated mining projects and in recent years intensive large-scale monoculture crops, such as soybeans and corn. Productive systems responsible for the production of unprocessed material for agricultural industry and unprocessed or limited processing of for-export grain, meat and minerals are responsible for unleashing the process of regional agricultural industrialization undertaken by "modern" districts of elevated productivity with concomitant links backward and forward. The result has been the transformation of the agricultural economic base that stimulated networks fostered in the industry and trade sectors.

In general terms, the phenomenon of productive transformation in the Center-West, although retaining its idiosyncratic nature, can be divided into three

phases, according to Castro and Fonseca (1995:02). The first phase begins toward the end of the sixties when the soybean pioneers arrived in Mato Grosso state, initiating a period of adjustment of the soybeans to the climate of the cerrados when grain improvement projects were implemented, principally in the state of Goiás. The second phase, occurring in the eighties, represents the expansion and consolidation of intensive production of soybeans and corn that is dominated by trade on the commodities market. It is possible to state that the final phase, consolidated by the beef-grain complex, started in 1985, is characterized by the shift to the Center-West of industrial conglomerates of the Southeast and South of Brazil with increased participation of international capital.

The combined activity of the state and private capital altered the economic and social context of the Center-West. This fact influenced the demographic dynamics, modified the economic profile of the labor market, and created much needed storage facilities. In so doing, research and rural extension were directed toward the interests of big business, thus enabling intra regional commerce and establishing regional conditions for the integration of national and international markets. This being the case, a favorable atmosphere for large agribusiness firms was established in the region, concentrating in certain areas and at the same time allowing some economic groups of regional importance to develop at the national level.

Thus, regional integration was favored, although concentrated in some areas and made up of a select group of regional poles to attract major private investments, establishing food-processing industries while consolidating the production of grain with indices of high productivity. Despite the presence of these industries, the economy is primarily based on grain production, cattle raising, mining, and forestry. This, in turn, is manifested by the number of products for export being limited to grain and meat.

A document by the World Wildlife Foundation (WWF: 1995), states that the process of land use in the cerrados, clearly applicable in the Center-West, can be divided into three sub areas or zones of development, based on the level of organization of the agriculture. One of these sub regions is based on modern commercial cattle raising techniques (The Green Revolution) and is firmly established in the region; the second area of development has begun to expand recently and consists of a low level of technical input; the third area of development consists of rudimentary agriculture.

Economic expansion was influenced by migratory influxes, as suggested by the demographic censuses (IBGE, 1980 - 2000). Given the decreasing rate of development, as compared to the period between 1960 to 1980, the area continues to show a population growth above the national average. The sixties presented the height of population growth and since that time it has slowly decreased. The exception being the state of Mato Grosso which continues to show rising population growth rates that reflect a recent phenomena of economic expansion. It should be noted that the greatest levels of population growth in the period between 1960 to 1980 is registered in the Federal District (Brasília) with a drastic reduction in the following decade.

As can be perceived in the previous table, the average rate of yearly increase in population growth is declining, maintaining however, an increase in urban

population growth. This aspect will be discussed further when the units of analysis are separated in order to exemplify population density in a limited number of areas. In other words, although apparently there is an observable pattern and similar tendencies, this growth has heterogeneous characteristics. It should also be noted that populations are heavily concentrated in the state capitals, specifically in the Brasília-Goiânia axis.

Table 1
Population annual growth
Center-West Region (Brazil) 1980-2000 (%)

Region and states	Total Population		Urban Population	
	1980-1991	1991-2000	1980-1991	1991-2000
Center-West	2.98	2.37	4.28	3.11
Mato Grosso Sul	2.26	1.73	3.87	2.37
Mato Grosso	5.38	2.38	7.73	3.29
Goiás	2.34	2.46	4.02	3.42
Federal District	2.84	2.79	2.63	2.90
Total Brazil	1.93	1.63	2.97	2.45

Source: IBGE. Demographic Censuses, 1980-2000.

The demography of the region constitutes an example of the challenges inherent in an analysis of regional development. This paper seeks to demonstrate that the Center-West should be understood as being intrinsically diverse, having within it individual characteristics that are an expression of the different functions of inter regional division of labor. Moreover, and as suggested by Guimarães and Leme (1998), how the population occupies space and the emergence of the principal productive foundations of the Center-West, remit us to the specificities of the historical process of integration of the different areas of the national economy. Socioeconomic development stimulated by the development of means of transportation and evolving infra structure in the interior also aided agricultural development.

Although when seen as a whole as an expanding frontier, recent transformation in the Center-West, led by so-called modern agricultural production systems, in truth, overlay an inherited spatial structure. In other words, recent spatial structure is overlaid by a legacy of a set, complex urban system of the region that was put in place in the period between 1930 to 1980, and held in place by fiscal incentives, subsidized credit, and agencies that provided support. Without these agencies and direct aid from the state, it is doubtful whether or not the Center-West would have been the setting for such daring transformation. These factors provided the parameters, perhaps were the decisive factors, in creating new economic alternatives and sustainable economic growth. A WWF (2000:17) document suggests that in the seventies and eighties occupation of these areas were a result of identifying regions that had the best infra structure and topography.

Thus, the hypothesis developed in this study interprets regional development as arising from the understanding that its most striking characteristics is to be found in the relationship between infra-structure, urban network and the insertion of the region into the national and international economy. Although made up of a strong food sector base, a spatial analysis of this base does not explain the dynamics and challenges of regional sustainable development. Hence, unlike the majority of studies that seeks to understand regional development based on an understanding of the development of agriculture (or food sector), this paper places priority on regional urban structure and its axis of development. The food sector is only one of the elements of regional development and although it has a significant impact on the environment, it does not explain spatial differences found in this region and does not allow us to advance alternatives to development nor sustainable social inclusion.

3. Recent economic performance and population change

An analysis of the population data of the previous decade shows areas that have had an increase in population and those that have suffered population losses in the region. Attention is thus focused on the heterogeneous nature of the use of urban space as well as the social and environmental challenges of urbanization. Changes in the economic profile of the Center-West, a result of the coming together of the aforementioned factors have caused significant alterations in the dynamics of the region with a substantial increase in the migratory movement.

Although the population has grown in all states of the region as well as in the Federal District, table two illustrates the fact that in terms of Brazilian population growth, there has been a clear decline of this process in recent years. In other words, although the region of Center-West has reached 6.85 percent of the Brazilian population in 2000, the data gives a clear indication of relative decrease, revealing that the period of migration is unlikely to occur again. Given that the Center-West represents one fifth of the national land mass and given current conditions, it is unlikely that it will have one tenth of the entire population. Recent growth is located in the few established urban areas, with significant growth indices only on the Mato Grosso frontier, north of municipal districts of Cuiabá and Rondonópolis toward the area that comprises the transition into the Amazon forest.

An analysis of the demographic performance of the urban population, in each state, indicates that it is also possible to note the same tendency of decline in population growth. Urban regional population movement reveals not only population transfer from the rural Center-West to urban centers, but also an interstate migration that prevailed in the previous decade. The state of Goiás is exemplary. Although it is a consistent area, its participation has been emphasized more so than other states. In other words, considering that new areas of agricultural expansion are not based in this state, there is initial evidence that there is not necessarily an automatic relationship between demography and the expansion of agricultural production. This reinforces the idea that, instead of opening new possibilities of social expansion, modern agricultural production methods that are expanding in the Center-West, in fact, are causing the definitive

closing of the frontier. Standard production methods of the region are characterized by large land holdings, a significant input in mechanization, and a low level of local diversification and are consolidating social exclusion in rural areas where production is increasing. Therefore, as will be demonstrated, an explanation for urban demographic expansion in Goiás is a result of "peripherization", **a process in which the population establishes residence in the surrounding area of Brasília**, and the expansion therefore cannot be attributed to the expansion of the regional food sector.

Table 2
Percent of national population. Brazil 1980-2000
Center-West and states

Region and states	Total Population			Urban Population		
	1980 %	1991 %	2000 %	1980 %	1991 %	2000 %
Center-West	5.73	6.42	6.85	6.01	6.90	7.32
Mato Grosso Sul	1.17	1.21	1.22	1.16	1.27	1.27
Mato Grosso	0.96	1.38	1.47	0.81	1.34	1.44
Goiás	2.62	2.74	2.95	2.62	2.93	3.19
Federal District	0.99	1.09	1.21	1.42	1.37	1.42
Total Brazil	100.00	100.00	100.00	100.00	100.00	100.00

Source: IBGE. Demographic Censuses, 1980-2000.

In the past, the regional population growth rates were linked to large colonization projects, to mining surges and the expansion of the frontier. In the previous decade, the cerrado has become the stage of major rural exclusion, creating rapid population urbanization as well as migration to the rural area. Hogan, et al, (2001:319) suggest that in the decade of the nineties, the Center-West and states that are a part of that region, with the exception of a few areas of North Mato Grosso, no longer appeal to those wishing to migrate. Although still having large movements of population, they are unable to slow the exodus of the population.

The rural population of the region has shown a decrease in absolute numbers, going from almost 2 million in 1980 to 1.54 million in 2000. It should be pointed out that in the case of the state of Mato Grosso, the decrease in the rural population is occurring at a slower rate than in other states; so much so, that in 1991, its rural population growth rate was positive and relatively high (above 2.0 percent per year); only after 1991 when agricultural development increased was it possible to note a decrease in the rural population. The reaction of the population shows that the productive permanence of the population on the land has been significantly reduced, reflecting how land occupation has been heavily centralized over the years and is generally retained by landowners.

An analysis of population distribution based on class and size of the municipal district of the previous decade illustrates the progressive closing of this frontier. The following Table indicates comparative and restricted population concentrations

in the Center-West, principally the urban agglomerations of Goiânia and Brasília and their respective satellite municipal districts, and to a lesser extent, in the few medium sized municipal districts of over 100,000 inhabitants. When only the urban population is taken into consideration, this population density becomes clearer. Goiânia and Brasília, in which are centered the main services and commercial activity, when added to their satellite municipal districts, absorb more than half of the total urban population of the Center-West. Contrary to the prevailing trend, the group of municipal districts with populations of five to 100 thousand inhabitants between 1991 and 2000 has gone from 43.5 percent to 39.5 percent; municipal districts of less than 5 thousand inhabitants, in contrast to the historical trends observed from 1970 to 1991, when the population dropped from 6.9 percent to 3.2 percent, indicating a slight recovery due primarily to the establishment of new municipal districts at that time. Following the historical trend, municipal districts of an intermediate size, 20 to 50 thousand inhabitants, were reduced from 17.2 percent to 14.9 percent, while municipal districts in the 50 to 100 thousand inhabitants went from 6.7 percent to 6.3 percent over the same period of time.

Table 3
Center-West population relative distribution trends
by municipalities class size 1991-2000

Classes size	1991	2000
< 5,000 inhabitants	3.2	4.0
De 5,001 a 10,000	7.4	6.6
De 10,001 a 20,000	12.2	11.7
De 20,001 a 50,000	17.2	14.9
De 50,001 a 100,000	6.7	6.3
De 100,001 a 200,000	2.8	3.7
De 200,001 a 500,000	2.5	2.5
De 500,001 a 800,000	5.6	5.7
Cuiabá - Várzea Grande	6.0	6.0
Goiânia	13.1	14.1
Brasília*	22.0	24.6

Source: IBGE. Demographic Censuses, 1991-2000.

Note: * the three municipal districts of Minas Gerais state are not included in the Metropolitan Region of Brasília.

Effectively, if the population of the four capitals were added together (three states and the Federal District) including their metropolitan agglomeration, in this case Brasília and Goiânia, population growth in the entire region would add up to 50.4 percent in 2000. In other words, more than half of the regional population live in four specific areas of the Center-West, thus concentrating the demand for water, sewage, garbage disposal, housing, etc. and thus creating undesirable levels of stress on the environment. In addition, the type of municipal district of 200 to 500 thousand inhabitants, there is only one municipal district (Anápolis,

GO), located in the Goiânia – Brasília hub, being in 100 to 200 thousand range of inhabitants, presented an increase of 1 percent. It thus stands out among the three most representative regional hubs: Rondonópolis, MT, Rio Verde, GO and Dourados, MS. These three previously mentioned municipal districts represent the major soybean producers of the nation as well as being the largest agro industrial grain and beef producers of the Center-West. The other major producer of soybeans in the country is located in the Chapada dos Parecis (Parecis Plateau), northeast of Cuiabá.

Altogether, it is possible to perceive that the municipal districts with up to 100 thousand inhabitants are the districts with the greatest difficulty in keeping a balance of migration, thus being disadvantaged in regional population representation. Municipal districts that range in size from 200 to 800 thousand inhabitants, including Cuiabá and Várzea Grande, present a relatively stable population growth, as compared to the areas that absorbed the largest number of the population such as the Metropolitan areas of Goiânia and Brasília. These two metropolitan areas grew 13 percent between 1970 and 2000, given that from 1991 to 2000 they grew 3.6 percent. It should be noted that in the case of Brasília its extraordinary development extends beyond the Federal District, having an effect on the growth of its surrounding cities and a part of the state of Goiás, which is also known as the area around Brasília.

This, however, does not mean the smaller centers are not relevant. On the contrary, they continue to provide refuge for large groups of the population of the Center-West (43.5 percent) and are relatively, as was shown earlier, better represented than similar groups on a national scale. Even so, their power to maintain and keep their population is fleeting, since, as a rule, population increase is observed at the time of occupation and decreases immediately following, if the changing economic condition of the region where they are located is taken into consideration.

Thus, based on the indices of the class and size of municipal districts, in addition to the capital cities, only three municipal districts show vigorous economic and population growth and strength. This economic vigor can be attributed to an increasingly diversified production, capable of retaining the population and regional economic development. In addition to these three, as will be shown below, a fourth center is emerging in the north. It is located in the transitional area of the Amazon forest in the state of Mato Grosso, also known as municipal district of Sinop. This area continues to exhibit significant population growth although it has not reached the hundred thousand-inhabitant level. It has the potential, however, of having a strategic polarizing effect on its region, which gives it the status of a rising intermediate center. These four municipal districts are made up of cities whose populations are relatively small. However, should a program of investment in improving the quality of life of the population and should attention be given to the environment, this could be the foundation for regional sustainable development.

On the one hand, a general conclusion may be arrived at in terms of occupation of space. It may be said that the end result of the current process in recent years has helped to consolidate areas that were vigorous and where

investments were made, where incentives to private production were given, not only because of the natural fertility of the soil but also because of policies which benefited the cerrado, and where infra-structure was also provided. Although significant differentials in productivity in these areas were achieved, confirming them as modern areas of the production of goods destined for the commodities market, with an increasing participation in international markets, as can be seen in the areas that produce soybeans. On the other hand, this process brought into focus the internal differences of the region, emphasizing existing imbalances and essentially condemning deprived areas to their own fate, given that the State gave up its right to administer market forces and as such, act as a force in correcting inequities.

Despite the regional impact of the development of intensive agriculture, as is well known, as a result of the action taken by the government, which resulted in the development of the most significant centers, major changes in occupation of space of the Center-West occurred prior to the regional impact of capital intensive agriculture. In other words, not only changes in the infra-structure but also the development of the principal urban agglomerations of Goiânia and Brasília with their considerable impact on the economy and regional infra-structure determined the configuration of the urban system of the Center-West such as it is today.

It was basically this system of the cities, developed from the thirties to the sixties, with an extraordinary amount of spread, but at the same time having clearly defined centers that sustained the advancing expansion and consequently sustained the greatest after effects. Although causing changes in the urban structure was to be expected, the changes of the past few years in the economy of the Center-West were not enough to essentially alter the earlier urban base. At best, the standards of a few intermediate centers were altered but without effectively altering or establishing a new hierarchy of ways of functioning of the principal urban agglomerations. In truth, it must be noted that the pre-existing structure of space occupation was reinforced, stressing and extending the reach of the major centers.

Table four presents a separate view of population development of the Metropolitan Region of Brasília also known as the "Integrated Economic Development Region of Brasília" (Região Integrada de Desenvolvimento Econômico de Brasília - RIDE).

Contrary to a superficial demographic reading of the statistics of Brasília of the previous decade might indicate, the federal capital continues to be an important factor in attracting population to the Center-West and to Goiás. In truth, the Federal District has a unique spatial energy in that it channels the migratory population to areas around the Federal District, specifically Goiás. In fact, indicators show that Brasília presents the largest growth rate. A distinguishing factor being the establishment of new municipal districts at this time which also helps to explain, paradoxically, the negative performance of municipal districts in the area of Goiás. Altogether, the area showed significant demographic growth for the period of time, achieving an average of 3.6 percent per year, adding almost 800 thousand inhabitants or the equivalent of 36 percent of the entire population of the Center-West. From 1991 to 2000, the RIDE area accounts for a total population of the

same magnitude as the total observed in the states of Mato Grosso (the last frontier) and Mato Grosso do Sul. The former, as was to be expected, accounted for significant urban growth with a decrease in rural expansion. The RIDE area grew more than the Federal District and it should be noted that this partially explains the population development of the state of Goiás.

Table 4
Metropolitan Region of Brasília (RIDE), population annual growth
1991-2000 (%)

	Growth rate		
	Total	Urban	Rural
RIDE - Region	3.64	4.00	-0.66
Abadiânia (GO)	2.22	3.82	-0.04
Água Fria de Goiás (GO)	1.31	6.06	-0.62
Alexânia (GO)	2.21	5.92	-5.70
Brasília (DF)	2.79	2.90	0.57
Cabeceiras (GO)	0.50	1.78	-2.28
Corumbá de Goiás (GO)	-7.57	4.25	-13.97
Cristalina (GO)	3.54	5.08	-1.18
Formosa (GO)	2.50	3.77	-3.84
Luziânia (GO)	-4.20	-4.36	-2.19
Mimoso de Goiás (GO)	-3.19	2.20	-5.84
Padre Bernardo (GO)	2.99	4.02	1.53
Pirenópolis (GO)	-1.82	3.35	-6.32
Planaltina (GO)	6.97	7.20	-3.21
Santo Antônio do Descoberto (GO)	4.31	6.02	-7.27

Source: IBGE. Demographic Censuses, 1991-2000.

Note: Municipal districts that make up RIDE, established since 1991: Águas Lindas de Goiás (GO), Cidade Ocidental (GO), Cocalzinho de Goiás (GO), Novo Gama (GO), Valparaíso de Goiás (GO) e Vila Boa (GO).

A similar manner of analyzing the RIDE area was used to analyze the MR of Goiânia. The Goiânia region also demonstrates similar vigor although it may largely be explained by a growing "peripherization" of the capital city. The total population loss is approximately 20 thousand inhabitants while the urban growth adds up to a total of 428 thousand. Adding RIDE to the MR of Goiânia will explain the 53 percent of the entire population growth of the Center-West of this period, concentrated in a radius of 200 Km. Although the municipal district of Goiânia shows a more modest growth rate of 1.91 percent, the surrounding areas present an exuberant growth rate in areas such as Aparecida de Goiânia and Senador Canedo, indicating an urban growth rate of 7.46 percent and 21.48 percent per year, respectively. A general summation indicates that the MR of Goiânia grew at a rate of 3.24 percent per year.

Table 5
Metropolitan Region of Goiânia, population annual growth
1991-2000 (%)

	Total	Growth rate	
		Urban	Rural
MR Goiânia -GO	3.24	3.49	-5.93
Aparecida de Goiânia	7.30	7.46	-12.90
Aragoiânia	3.03	4.65	0.44
Goianápolis	-0.05	1.48	-9.48
Goiânia	1.91	1.94	-2.13
Goianira	4.23	6.63	-14.77
Hidrolândia	2.75	5.93	-0.69
Nerópolis	4.06	4.81	-2.61
Senador Canedo	9.27	21.48	-17.57
Trindade	4.66	5.35	-4.95

Source: IBGE. Demographic Censuses, 1991-2000.

Note: Municipal districts that make up MR Goiânia, established since 1991: Abadia de Goiás e Santo Antônio de Goiás.

The remaining areas of the state of Goiás, only four municipal districts of more than 10 thousand inhabitants, show a total population growth above the state average. The municipal districts presenting population growth above the state average are Caldas Novas (8.3 percent), Mineiros (2.54 percent), Acreúna (2.97 percent) and Vianópolis (2.48 percent). Caldas Novas is a unique case in that we are dealing with a tourist center that is known nationwide. The growth of the other cases such as Vianópolis may be explained by it being close to Goiânia and Brasília, whereas Mineiros and Acreúna are close to a region that is expanding due to soybean cultivation in the Rio Verde area. Among these areas, Mineiros perhaps presents a representative trend and is close to breaking the 50 thousands inhabitant barrier because it is in an area of productive expansion. The municipal districts that are more representative of the trend, which have 50 thousand inhabitants, did not show significant population growth. Attention is brought to bear on the increased growth of municipal districts of the South center of the state and the slowing growth rate of others that were once promising growth areas of the Northeast of the state, as is the case of Porangatu.

Mato Grosso do Sul is a case in point in which the state showed the smallest population growth rate of the Center-West, slightly above the national average. The largest growth rate was identified in the most important municipal districts, Campo Grande and Dourados. These two municipal districts accounted for 56 percent of the total population of 296 thousand that came into the area in the period of 1991 to 2000.

Of the other municipal districts with populations significantly larger than 20 thousand inhabitants, only four indicated growth above the state average: Naviraí (2.0 percent), Nova Andradina (1.9 percent), Sidrolândia (4.1 percent) and Jardim

(1.73 percent). Sidrolândia, Southwest of Campo Grande, warrants added attention in that it is located in an area of significant agro-industrial development.

It should be noted that in the state of Mato Grosso the demographic condition of some of its municipal districts is different from the trends presented earlier. Although the overall population growth rate of the state is similar on the average in the Center-West, it should be noted that several municipal districts perform like frontier areas. Although the urban agglomeration of Cuiabá – Várzea Grande, shown together, have a representative growth rate, it is possible to note greater population distribution in the Northern frontier region. The second largest center of the state, the municipal district of Rondonópolis, developed below the state average and if added to the agglomeration of the capital, they represent one third of the population growth rate of the state, a situation that is quite different from the other states of the region.

Among the most representative centers having more than 20 thousand inhabitants in the year 2000, it is possible to observe that eight of them have significant rates of population growth. The municipal districts of Sinop are noteworthy (7.7 percent), Primavera do Leste (13.7 percent), Sorriso (9.2 percent), Aripuanã (8.2 percent) and Lucas do Rio Verde (12.5 percent), all located toward the frontier, North of Cuiabá and Rondonópolis. Consequently and with the exception of the areas of capital cities, only a few municipal districts located in the area close to the Northern frontier, in the direction of the transitional area between the cerrado and the Amazon forest, had population growth rates above average. This cannot be construed as a general trend and therefore the continuity of a vigorous population growth is not guaranteed, primarily because the municipal districts do not have productive diversity that can absorb a continuously expanding population.

Table 6 presents, separately, municipal districts of the Center-West that have part of their territory constituted by the biome of the pantanal and their respective population growth trends as well as the total population. As can be understood from the point of view of population growth in the pantanal, there appears to be no significant population growth occurring in the area. The entire area grew at a rate of 0.81 percent per year as presented by the last census, indicating a downward growth trend. In general terms, historically, the basic activity developed in the pantanal is raising cattle and thus does not attract large populations. Only two less significant municipal districts have had population growth above the regional average. Specifically, Ladário has been the only municipal district to show significant population growth above the regional average. It should, however, be pointed out that Ladário and Corumbá are located close to each other and if their population gains are added together they would not have significant population gains, although representative in absolute terms, since together they have a population of 110 thousand inhabitants in the heart of the pantanal. In absolute terms, the other municipal district that can be considered representative is Cáceres. Cáceres also did not have a representative population increase. If the population that comprises the municipal districts of the pantanal were to be added together they would add up to a total of 3,5 percent of the entire population of the Center-West, that is, approximately 400 thousand inhabitants.

Table 6

Total population and annual growth 1991-2000 (%) and Gross Domestic Product (GDP) relative distribution trends 1985 - 1998

Municipal districts in Pantanal area

Pantanal and municipal districts	Total population	Total	GDP %	
	Growth rates 1991/2000	population 2000	Center-West 1985	Center-West 1998
PANTANAL	0.81	409404	3.467	1.843
Corumbá – MS	0.88	95 701	1.24	1.25
Aquidauana – MS	1.11	43 440	0.19	0.28
Coxim – MS	-0.93	30 866	0.16	0.21
Miranda – MS	1.47	23 007	0.19	0.13
Rio Verde de Mato Grosso - MS	2.08	18 138	0.09	0.20
Ladário – MS	2.76	15 313	0.16	0.09
Porto Murtinho - MS	0.43	13 316	0.16	0.13
Pedro Gomes – MS	0.29	8 535	0.08	0.07
Cáceres – MT	1.10	85 857	0.73	0.44
Poconé – MT	0.34	30 773	0.13	0.11
Santo Antônio do Leverger - MT	0.03	15 435	0.13	0.14
Nossa Senhora do Livramento - MT	1.70	12 141	0.07	0.03
Itiquira – MT	1.60	9 200	0.08	0.05
Barão de Melgaço - MT	-2.70	7 682	0.04	0.03

Source: IBGE – Demographic Censuses 1991 e 2000. IPEA – GDP municipal districts, www.ipea.gov.br.

Note: The total area of these municipal districts (215.182 Km²) is greater than the area of the Brazilian Pantanal (137.150 Km²). From: Andrade & Iandanza, 1997, apud Iandanza, 1993.

Taking into consideration the demographic data it is possible to understand that the most significant environmental pressure on the pantanal does not occur from within the pantanal itself. Natural changes of seasons, when flooding of the plains occurs, hamper the mechanization process and thus protect the area from the threat of modernization. Nevertheless, the onward march of the occupation of the area around of the pantanal has become the principal threat to the environment. In other words, the spread of land occupation of the cerrados, specifically, of the area of the pantanal river basins endangers their sustainability.

Similarly, as was observed, the pantanal was incapable of keeping up with the energetic population growth of the Center-West. It was also observed that this region was unable to keep up with the speed of production of the region. Looking at the relative performance of the Gross Domestic Product (GDP) of the pantanal in relation to the Center-West, it is possible to note that there was a significant reduction in the period from 1985 to 1998, going from 3.5 percent to a mere 1.8 percent. These values indicate impoverishment of the economy of the pantanal, whose demographic contribution, although limited, is still double that of its economic contribution. Studies conducted by Andrade and Iandanza (1997:179-83) already suggest reduced economic vigor taking place in the

economy of the municipal districts of the pantanal, when traditional industries of meat processing no longer flourish due to an overall reduction in stock farming.

Of the two municipal districts that significantly increased their population, in this case Ladário and Rio Verde de Mato Grosso, only Rio Verde de Mato Grosso presented corresponding economic development. The municipal district of Ladário's participation in the regional GDP indicated a decline of 50 percent, suggesting growth on the outskirts of Corumbá. The municipal district of Mato Grosso, (located on the edge of BR163, which links Campo Grande to Rondonópolis) exhibited 100 percent growth in its contribution to the GDP, even though in absolute terms this amount is relatively small. Thus, if the demographic data and economic data are combined, it is possible to state that fortunately for the environment, the pantanal region did not grow at the same rate as the Center-West, consequently absorbing only marginally stimuli of the regional agricultural modernization process with a limited introduction of the standards of the Green Revolution.

On the one hand, this analysis confirms the hypothesis that the greatest environmental challenge in preserving the biome of the pantanal should be the productive appropriation of the outlying areas in the unrestrained use of chemicals and toxic products on crops, mining, and unrestrained urbanization around the river basin of the pantanal.⁹ The data indicates that planning the sustainability of the pantanal should necessarily be linked to planning outside of the area, in addition to policies that improve the life style of the inhabitants of the pantanal, regulating tourism, creating sustainable employment alternatives and monitoring its biome.

On the other hand, when the economic performance of the remaining Center-West, that is predominantly cerrados, is analyzed, it is of note that in terms of the occupation of space, agriculture is the principal regional activity. According to the WWF (2000:47), 70 percent of the land is used for agriculture. Of the entire region three productive systems were identified and each had characteristics that identified them. The main productive system being raising livestock and its importance can be gauged from the relative importance of the herd as well as the cost of maintenance. Despite productive expansion, cattle raising is characterized by economic convergence, limited use of labor, and insignificant input into the urban economy of the area. This activity is widespread in the Center-West, although it is primarily concentrated in the areas of the south of Goiás, the north of Mato Grosso and in a more homogeneous manner, in all of Mato Grosso do Sul.

The second productive system is represented by agricultural commodities production, notably soybean and corn, that are concentrated principally in the south of Goiás, north and southeast of Mato Grosso and the southeast of Mato Grosso do Sul. This system is intensely mechanized, with limited use of laborers with concomitant impact on processing and putting these products on the market. The dynamics of this system can create jobs and income for municipal districts that have urban infra structure in and around the area. It should be pointed out that, according to the agricultural census of 1996 (IBGE), the South and Southwest of Goiás as well as the Southwest of Mato Grosso do Sul are areas that use productive technology and also have the largest areas of pasture and cultivated land.

The third productive system is characterized by the areas that are used in the traditional manner, to cultivate basic foods, primarily in the northeast and north of Goiás and in which are located the municipal districts that were most affected by the dismantling of government programs that gave assistance to agriculture. Porangatu, for example, the most important municipal district of the area, that produced significant amounts of food in the seventies and eighties, products that were sold in the local market and sustained by cooperatives, is today considered a stagnant economic area as a consequence of agriculture depletion and having been turned into pasture.

Table 7 shows the economic performance of municipal districts in terms of contribution to the regional GDP.

Table 7
Percent of Center-West GDP
Selected municipal districts by decreased participation – 1985-1998

Municipal districts	1985	1990	1996	1998
Brasília	29.80	39.73	36.42	39.29
Goiânia	12.93	12.65	11.67	10.85
Campo Grande	6.34	6.67	7.77	8.48
Cuiabá	6.18	6.70	5.88	6.05
Anápolis	2.63	2.05	1.65	1.63
Dourados	1.46	1.16	1.54	1.45
Corumbá	1.24	1.05	1.22	1.25
Aparecida de Goiânia	0.43	0.88	0.95	1.05
Catalão	1.05	0.82	0.77	0.78
Rondonópolis	0.95	1.02	0.89	0.74
Rio Verde	1.01	0.78	0.69	0.70
Várzea Grande	0.95	0.84	0.71	0.69
Itumbiara	1.14	0.56	0.59	0.58
Luziânia	0.56	0.63	0.64	0.56
Tres Lagoas	0.49	0.34	0.52	0.50
Jataí	0.56	0.45	0.46	0.49
Sinop	0.64	0.35	0.37	0.44
Cáceres	0.73	0.38	0.41	0.44
Niquelândia	0.68	0.52	0.41	0.41
Caldas Novas	0.28	0.31	0.38	0.38
Ponta Porã	0.72	0.61	0.60	0.38

Source: GDP municipal districts – IPEA (www.ipea.gov.br - special subjects).

It is clear that the distribution of goods in the Center-West is heterogeneous and presents the symptoms of fragility in its development. The Federal Capital is a serious decided pressure on the region, although its administrative function has limited effect on the development of the food regional sector.¹⁰ It should be noted that Brasília constitutes an administrative enclave whose activities are preponderantly linked to public Federal administration. In view of this fact and in contrast to other cities of the Center-West, the federal capital does not have the same economic dynamics that complement the economy of the Southeast. Brasília's location is the result of a political decision and its economic and population growth are a result of the transfer of fiscal resources, as of yet not being integrated into the productive national market.

Nonetheless, large amounts of income circulate in the region as a result of a large consumer market. The Federal District attracts a large migratory population in addition to stimulating production in and around the area. In other words, as long as the Federal District becomes heavily populated and its markets are strengthened, the regional accumulation of capital is favored and is extended to additional areas making opportunities available to secure a closer relationship to the regional and national economies.

If the GDP for the most recent year available of the municipal districts selected, that are located in the pivotal cities of Brasília and Goiânia, are added together, it will come to a total of 54 percent of the GDP of the entire region. It is exactly in this area that food production participates the least. Added to the GDP of the other two state capitals, it is possible to come to a total of 70 percent of the regional GDP. Hence, from an economic point of view, regional economic productivity is more important than even demographic density. The result of this process is that there is the development of standards of consumption in these regions that is divided and has extraordinary buying power, which is incompatible with the living conditions of the population. It is also clear that in terms of the technology and diversity that currently exists, it is clearly improbable that the regional productive structure will meet the demands placed on it.

The three municipal districts located in the major agricultural production areas, Rondonópolis, Rio Verde and Dourados, have had little impact on the regional economy and indicate no trends toward an increase in participation. In effect, the demographic and economic chart of the intermediate municipal districts reveal a lack of fit between the productive activities presently in effect and the capacity of the region and the intermediate municipal districts and the ability to appropriate the income generated. Consequently, they are unable to bring about productive diversification that increase the value and create more jobs.

Ultimately, the type and size of the municipal districts indicate a delicately structured foundation, municipal districts with less than 50 thousand inhabitants, in which the largest number of municipal districts are concentrated, and it also reveals the centralizing and exclusion principles in effect. Therefore, measures taken to reduce the negative impact on the environment applicable on agriculture production will be welcomed but do not solve the social problem in unequal distribution of income, access to social benefits, and essentially do not achieve the most general objectives of sustainable development.

4. The challenges of sustainability

To complete this study it is important to reflect on the impact of the lack of planning, lack of investment policies geared toward economic and environmental sustainability as well as the lack social inclusion of the inhabitants of the Center-West. From an environmental standpoint, the effect on the ecosystem of the cerrados is significant as well as worrisome, specifically due to chemical contamination of the waterways, genetic impoverishment and soil erosion. These changes were instigated primarily by monoculture, by the use of chemicals and technology, by introducing exotic species into the regional flora, by the industrialization process of planting and by harvesting sugar cane and the harmful effects of unplanned urban development. However, it is not possible to forget that continuous investments in chemical products and mechanization geared toward increasing productivity as well as adapting the soil of the cerrados so that it would be appropriate for mechanized agriculture, made economically viable due to the original price of the land, were fundamental in fomenting the competitive advantage of modern agriculture in the region. The cost to the environment, however, has as yet not been calculated, given that the existing studies, although in agreement and unequivocal in terms of the negative impact on the environment, lack political commitment to present adequate opposition when faced by private interest and official dependence on the export balance. Any analysis of land occupation of the cerrados is biased in terms of the increase in productivity, and very little has been done in terms of understanding the cost of increase in private capital and the deteriorating effect on the environment.

At the moment, it is not cogent to add voice to that approach, although agreeing with it, it must be understood that the major challenge is not in making the public aware of the dangers of exploitative agricultural practices and economic exploitation of the cerrados. The problem is to identify activities that are capable of promoting sustainable development of the region with a more equitable distribution of wealth as opposed to the existing system, which according to the WWF (2000), is responsible in changing approximately $\frac{3}{4}$ of the area causing untold damage to the vegetation.

With this in mind, two proposals will be presented in terms of regional development. The first deals with development of urban infrastructure and also relates to demographic expansion, urban development and their impact on the environment. The second deals with urban infrastructure such as transportation and regional integration, these being understood as necessary complements in rethinking a regional model of inter regional work inclusion.

Taking into consideration consumption items of basic infrastructure such as water, sewage disposal, garbage collection and electricity, the one item that is delivered best to the population is electricity. In the majority of regional urban centers, almost all private urban homes have electricity. The same is not true in terms of the water supply, garbage collection and sewage disposal. The daily newspaper Folha de São Paulo (28/03/2002), states that in the Center-West only 17.9 percent of the municipal districts in year 2000 had sewage disposal, while the national average is 53.2 percent. In addition, of the total sewage collected

only 51.1 percent is treated, given that these figures are influenced by the indices of the Federal Capital.

In analyzing information obtained from the demographic census of 2000 (IBGE, 2000) in terms of the availability of water, garbage collection and overall sanitation, it can be seen that among these items, lack of appropriate sewage disposal is the biggest problem of the region. Data from the 2000 census show that the number of bathrooms linked to city sewage lines (with the exception of the Federal District in which 84 percent of the bathrooms are linked to sewage lines) the region faces a chaotic situation. Goiás, for example, in terms of sewage, has 32 percent of the homes are connected to sewage lines, followed by Mato Grosso, 17 percent and Mato Grosso do Sul, 12 percent. In terms of municipal districts, it is possible to mention Sinop, that has a rapidly developing urban center in the North of Mato Grosso, where there are no bathroom fixtures linked to a sewage system. It should also be mentioned that in important municipal districts of the Pantanal such as Cáceres, only 13 percent of the bathrooms are linked to the sewage system. Municipal districts located around the State capitals such as Aparecida de Goiânia (15 percent), Várzea Grande (11 percent), show a similar trend. It may be stated that the highest level of basic sanitation available in urban centers of the Center-West are located in or near large regional conglomerates. In these cities that have large populations and vigorous economic development, sanitation programs were developed with public funds. The availability of these services in urban centers decreases in relation to the importance of its regional hierarchy, becoming less available in frontier areas that show the greatest population expansion.

In terms of garbage collection, the availability of this service on the average is satisfactory. However, the census of the state of Mato Grosso indicates that only 72 percent of the population receives this service. However, garbage collection is not the only problem. Problems reside in the quantity, appropriate disposal and the possibility of recycling. In terms of the quantity of garbage, the biggest problem is in the pivotal cities of Goiânia and Brasília, where the regional population density is the greatest. There are not only problems in relation to the excess garbage, but also a shortage of water that results from unplanned urban growth.

Ultimately, one of the major challenges of demographic sustainability of the Center-West is in the precarious nature of the urban infra structure designed to deal with the collection and treatment of solid and liquid waste. Investments in these areas would not only improve the quality of life of the population that live in the region and protect the environment, but it would also create jobs, income and diversified production.

Another fundamental issue to be thought about in regional development refers to the necessary investment that should be made in the transportation network, regional integration, that along with planned programs will be an incentive to alternative production thus strengthening links between intermediate urban network.

The basic outline of transportation infrastructure of the Center-West was inherited from past decades. The principal objective of the transportation system of the time was to allow access to the frontier, without any concern for the environment or the internal structure of a regional urban network. On the one

hand, highways are in disrepair suppressing economic activity due to reduced flow of merchandise. On the other hand, this model of development was appropriate at that time of land expansion. However, the strategic restructuring of the productive base requires a redesigned plan and strategic integration of the highways.

Throughout the nineties the government announced plans for infrastructure renewal, known as the "national axis of integration", that had it been carried out, would have had further impact on the regional social and economic structure. However, as is well known, the objectives of that plan were not intended to foster internal integration nor develop the regional potential, in addition to presenting a group of questionable environmental proposals.

Once the need to reorganize the regional infrastructure is recognized in order to modify the existing model and to foster sustainable development that alters the model that excludes and centralizes, it is fundamental to be concerned with two basic requirements: the need to strengthen productive commercial integration of the small and intermediate urban network and to develop a new system of integration, keeping in mind regional ecology and economic zoning.

5. Final considerations

Given the social and environmental challenges pointed out, the question remains if it is possible to envision in the future the current model of agricultural occupation of the Center-West and its ensuing results on production and productivity.

The conclusion reached does not imply a pessimistic view of the existing structure of the cities of the Center-West. It does, however, mean that the existing system needs to be restructured, not merely a superficial reform giving the changes an environmentally friendly appearance. It is necessary to adopt an approach that seeks to incorporate technological innovations and provide financial benefits as well as maintaining the continuity of the vigorous socio-economic development, without however, affecting regional sustainability.

It becomes clear that restructuring regional space does not preclude measures that are complementary and at the same time regulate private use of the environment, such as the tacit incorporation of techniques and practices that preserve the urban and rural ecosystem; adopting as well as adapting new technology; establishing, maintaining and recovering areas of environmental preservation; developing research and programs that assist in understanding the biological diversity and using them continuously.

These considerations indicate weaknesses in what could become a regional development project characterized by concentration of income and reduction of social mobility. Economy, as well as centralizing the population around a few urban centers, contributes to marginalizing and a precarious way of life in large urban centers. This also leads to insufficient job opportunities and lack of goods and services in other municipal districts. The situation provides a warning signal in that pivotal areas of development are abandoned in favor of a "structural axis" as conceived of in the official program of infrastructure of the nineties, thus perpetuating regional inequalities. In other words, government programs would be subject to the dictates of private investments, essentially geared to exporting raw materials,

as can be seen from official reports of the period. Policies of this nature essentially provide advantages for established areas as well as condemning areas that were not established were destined to remain without adequate political representation. Thus, it is relevant to present a plan of development for medium sized cities, a plan that incorporates adequate infra structure, that envisions appropriate environmental preservation and is capable of functioning as a regional urban link. These municipal districts should receive strategic investment in key areas of production and services, giving them the ability to develop a new division of labor geared toward economic development as well as socio-environmental sustainability. Areas of importance, among others, are health concerns, education, research, tourism and biotechnology. Investments in these areas would be linked to a new plan of transportation infrastructure geared toward integrating the regional urban structure.

Essentially, the Center-West needs to be accepted as a strategic economic, environmental center, due to its bio diversity, natural resources and due to the fact of being relevant to national integration and to the place it occupies internationally and in Latin America. Emphasizing these aspects warrants rethinking the productive potential of the region and the need to secure international commitment to finance programs geared toward improving the urban and rural infrastructure of the region. The financial contribution of international organizations is vital. This can be achieved through direct financing of projects sponsored by World Bank, non-governmental organizations and others, with a commitment that the cost be at the 0.7 percent level of the GDP of developed countries,¹¹ in other words, reducing the Brazilian international debt linked to internal institutional commitment of developing programs of sustainable development. Essentially, the sustainability of these two biomes should be committed to improving the life styles of the populations that live in these areas, avoiding in effect the current logic of expanding agriculture production at any cost or financing only projects of immediate financial gains. These general guidelines merely suggest what multidisciplinary groups can do to develop positive projects and programs.

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Notes

¹ Brazil is divided in 5 political and administrative regions, also known as traditional regions, one of those regions being the Center-West (or Midwest) - the states of Goiás, Mato Grosso and Mato Grosso do Sul as well as the Federal District.

² From: Instituto Brasileiro de Geografia e Estatísticas (IBGE), 2000 Demographic Census.

³ From: IBGE, Diretoria de Pesquisas, Departamento de Contas Nacionais, Contas Regionais do Brasil 1996-99.

⁴ The cerrado, with an almost entirely tropical climate, is a complex of different forms of vegetation that have variable physiognomies and floristic compositions, forming an ecological mosaic. Ecologists define it as a mixture of low trees and a well developed herbaceous strata. The core of the cerrado, considered the most characteristic and continuous portions, occupies 1,500,000 km² in the Central Brazilian Plateau, in the states of Goiás, Tocantins, Federal District, part of Minas Gerais, Bahia, Mato Grosso, Mato Grosso do Sul and part of Maranhão, Piauí, and Rondônia. Unconnected portions, forming islands of cerrado, are found in Amazonas, Amapá, Roraima, Alagoas, Bahia, Ceará, Paraíba, Pernambuco, São Paulo and Paraná. This fact, in addition to biological and political differences in defining cerrado, has led to a range of estimations of total area.

⁵ Goedert et al (1980) suggest that this biome extends to other Brazilian states, totaling 2 million Km², concentrated in the Brazilian Center-West.

⁶ According to the WWF (1995) the Brazilian cerrados may be characterized by the availability of water and low soil nutrients.

⁷ The Green Revolution is a name given to the process responsible for the transformation of productive practices in agriculture, its primary elements being: introduction of new varieties of plants and extensive use of chemical, biological, and mechanical input.

⁸ The north of the state of Mato Grosso is considered transitional from the cerrados to the Amazon forest. Although the economy of some municipal districts is supported by forestry, it is prudent not to include a discussion of this biome given that it would mean a broader discussion of the Amazon complex, a discussion that would require separate treatment that is beyond the scope of this paper.

⁹ The sources of the principal rivers that drain the pantanal are not located in this area.

¹⁰ Further details available in Guimarães and Leme (2001).

¹¹ Based on Agenda 21, from ONU, Rio de Janeiro, 1992.