



Agriculturable lands and  
biofuel in Brazil.  
The sugarcane in the Paraná Basin.

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**AGRICULTURABLE LANDS AND BIOFUEL  
IN BRAZIL.  
THE SUGARCANE IN PARANÁ BASIN**

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## PRESENTATION

We must think carefully about ecological, economic and social impacts from biofuel expansion production - positive and negative - including food security and prices of agricultural commodities. It means that we must be prepared to adapt to significant changes in land use, production and energy consumption – the Brazilian agricultural economy is undergoing a strong process of change. In the future, this process will be more intertwined with politics and economics reaching beyond to all areas of the economy.

The following text deals with biofuel in Brazil, with greater focus given to ethanol produced from sugarcane. Sugarcane farming occupies around 6.96 million hectares (2007/08 harvest) or 0.8% of the country's territory – and it is the type of farming with the greatest perspective of expansion in the next years, especially in regions with better infra structure, better lands and more appropriate climate – one rainy period and another period for the concentration of the sugar.

Developing studies, analyses and building scenarios are fundamental for the debate on economic – when the “country” is the focus – social and environmental sustainability in the production of biofuels and the resolutions of its main problems.

The use of pesticides; contamination by vinasse (to produce one liter of ethanol 12 to 15 from vinasse are generated); degrading working conditions; fires; human occupation of ecologically sensitive areas; the transference of activities such as cattle-raising to regions like the Amazon and the pressure on humid areas such as the Pantanal; the search for lands that are currently destined or appropriated for the production of grain and the degeneration of democracy with a concentration of political power promoted by mega conglomerates.

In this text the main focus is on the use of land and the expansion of sugarcane plantations. Its origins are in the work developed by Ecoa to analyze the process of expansion and the consequences in the sub-basin of the river Ivinhema, one of the most important regions that produce grain and meat in the country.

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## 1. INTRODUCTION

Understanding in depth the quantity, quality, the current use and the location of tillable lands in Brazil is essential work for a productive and careful debate on the expansion of the production of biofuels, particularly ethanol. This would allow, for example, the construction of scenarios surrounding the competition for better arable lands between sugarcane, grain production, and cattle-raising, as well as the social and economic consequences.

What becomes a necessity are complex studies, which should aggregate data and information related to environmental quality such as ground, water, climate, biodiversity and areas of great ecological relevance. Another area is economic quality, especially transportation and electric infra structure – a production unit will be less lucrative if it's distant from the great consumer centers and from electrical lines: the farther the distance, the lower ethanol profit will be lower and the electricity that can be produced with the burning of the bagasse and straw (left over from the sugarcane) will be more easily placed in the market if generated close the transmission lines.

The government policies until now have as basis for its propaganda the quantity and quality “arable” land available in Brazil, an action that aims to facilitate national and international approval of the expansion, which also attracts private internal and external investment and the financing from public banks in the country such as BNDES (Brazilian Development Bank) and multilaterals such as IDB (Inter American Bank of Development).

## **2. THE BASIS FOR EXPANSION OF BIOFUELS IN BRAZIL: THE PNA (AGRO-ENERGY NATIONAL PLAN)**

The PNA<sup>1</sup> 2006-2011 was elaborated by the Mapa (Ministry of Agriculture, Cattle and Supplying) and by the Embrapa (Brazilian Agricultural Research Corporation's), with the objective of expanding the presence of biofuels in the energy matrix in a “planned and sustainable way.” This guarantees that the country possesses an immense stock of available lands and that the expansion can be based on four comparative advantages for production:

- The possibility of large-scale irrigation planting, since the country possesses one fourth of the superficial and underground fresh water reserves on the planet;
- The possibility of multiple plantings in the year according to “productive windows”, such as the crop and mini crop systems already adopted for grain or the summer and winter crop;
- The extension and geographic location of Brazil, whose major part is found in the tropical and subtropical strips, with intense solar radiation (source of bioenergy) besides having great diversity of climate, possessing “exuberant biodiversity,” which allows for “various options associated with the planting of energy;”
- The possibility of Brazil “incorporating new areas to energy agriculture without competing with food agriculture and with limited environmental impact to what is socially acceptable. Thus, the Cerrados expansion area, the cattle-raising – farming integration, the degraded pastures, areas of reforestation and the currently marginalized areas – such as the Northeast Semi arid region – add up to 200 million hectares.”

Strictly speaking, PNA utilizes for its construction the current ideas regarding the biofuels possibilities in the country, which are based in their majority, in favorable environmental conditions – biodiversity, water, surface relief, ground and climate and taking into account a great availability of lands for the expansion of agriculture and, therefore, of agro-energy in a harmonious way with the agricultural production.

With the increased debate generated by the expansion of sugarcane production over areas formerly developed for grains and the threats over ecologically sensitive areas, the federal government presented the elaboration of a zoning system as a tool for the execution of PNA to define where the new sugarcane cultivation could occur and restricted areas.

## **3. THE AGRICULTURAL ECONOMY, THE PRODUCTION OF SUGARCANE AND THE ECONOMICAL AND ENVIRONMENTAL RESULTS**

Brazil has a total area of 851 million hectares, of which 15.9 are under a layer of water. Of the remaining 835.1 approximately 6.96 million or 0.8% were planted with sugarcane for

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<sup>1</sup> MAPA; EMBRAPA INFORMAÇÃO TECNOLÓGICA. **Plano Nacional de Agroenergia (PNA) 2006-2011**. 2. ed. Brasília: Embrapa Technological Information 2006. Available in: [http://www.agricultura.gov.br/portal/page?\\_pageid=33,2864458&\\_dad=portal&\\_schema=portal](http://www.agricultura.gov.br/portal/page?_pageid=33,2864458&_dad=portal&_schema=portal). Accessed on Nov. 30th, 2007.

the 2007-2008 harvest<sup>2</sup>. In the 2006-2007 harvest the industrialization of the 475 million tons collected for the industrialization produced 17.5 billion liters of alcohol and 30.2 million tons of sugar<sup>3</sup>. The producing units also generated 1,400 MW (Megawatts)<sup>4</sup> of electrical energy. It can be estimated that the 3.19 million of hectares were destined to ethanol (45.78% of the sugarcane area) and 2.83 million of hectares (40.6 % of the sugarcane area) for sugar.

In the 07-08 grain yield the production surpassed 143.27 million tons, result obtained from the cultivation of different species in an area of approximately 47.09 million hectares<sup>5</sup> 21.23 million hectares were destined for soya (45.08%); 14.71 million for corn (31.23%) and the remaining 11.15 .

Cattle-raising occupies around 20% of the territory or 172.3 million hectares, supporting 169.9 million heads of cattle, with a production of 21.43 billion liters of milk<sup>6</sup>; 8.6 million tons of meat and 42.4 million leather units<sup>7</sup>.

The average of 0.98 heads of cattle per hectare is considered low for the country and is an extensively debated topic and is always presented as an indicator of inefficiency in the sector: taking up an enormous territory for a very low economic performance.

Armind Kichel, from Emprapa Cattle for Slaughter<sup>8</sup>, informs us that 80% of the pastures in the country have some level of degradation and that 60% are totally degraded. The same researcher states that the average production of meat per animal/year is around 40 to 45 kilos, which could reach 90 with the adoption of proper management.

The Brazilian GNP (Gross National Product) (that is a monetary measure of the performance of the three economic sectors: cattle-raising, industry and services) in 2006 was US\$ 1.11 trillion<sup>9</sup>, of which US\$ 69.66 billion (6.24%) were generated by cattle-raising. Of this total agriculture generated US\$ 39.52 billion (57%) and cattle raising US\$ 30.14 (43%)<sup>10</sup>.(Chart 1).

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<sup>2</sup> CONAB (National Supply Company). **Acompanhamento da safra brasileira cana-de-açúcar Safra 2007/2008**. Third reading. Nov. Brasília: CONAB, 2007. Available at: <<http://www.conab.gov.br/conabweb/download/safra/3lev-cana.pdf>>. Accessed on Dec. 12th, 2007.

<sup>3</sup> CONAB, 2007, p.11.

<sup>4</sup> JANK, M. **A relação do setor sucroalcooleiro como meio ambiente**. Sertãozinho, 2007.

<sup>5</sup> CONAB. **Acompanhamento da safra brasileira de grãos Safra 2007/2008** – Ninth reading. Jun. 2008. Conab. Available at: <[http://www.conab.gov.br/conabweb/download/safra/estudo\\_safra.pdf](http://www.conab.gov.br/conabweb/download/safra/estudo_safra.pdf)>. Accessed on Jun. 17th, 2008.

<sup>6</sup> IBGE. **Censo agropecuário: resultados preliminares**. 2006. Rio de Janeiro: IBGE, 2007. Available at: <<http://www.ibge.gov.br/home/estatistica/economia/agropecuaria/censoagro/2006/default.shtm>>. Accessed on Jan. 15th, 2007.

<sup>7</sup> INSTITUTO FNP. **Anuário da Pecuária Brasileira 2007**. São Paulo: FNP. 2007.

<sup>8</sup> YONEYA. F. Manejo de pastagem evita degradação. **O Estado de São Paulo**. Aug. 16th, 2007. Available at: <<http://www.seagri.ba.gov.br/noticias.asp?qact=view&notid=11229>>. Accessed on Nov. 27th, 2007.

<sup>9</sup> The dollar value used as a reference by this paper was US\$ 1.00 = R\$ 2.15. This was the average rate for December of 2006.

<sup>10</sup> CEPEA/USP; CNA. **O agronegócio fecha 2006 com pequeno crescimento**. São Paulo: CEPEA/USP, CNA, 2006. Available at: <[www.cepea.esalq.usp.br/comunicacao/Cepea\\_PIBAgro\\_2006.do](http://www.cepea.esalq.usp.br/comunicacao/Cepea_PIBAgro_2006.do)>. Accessed on: Dec. 2nd, 2007.



**Chart 1. Agricultural GNP and its participation on the country's wealth (2006).**

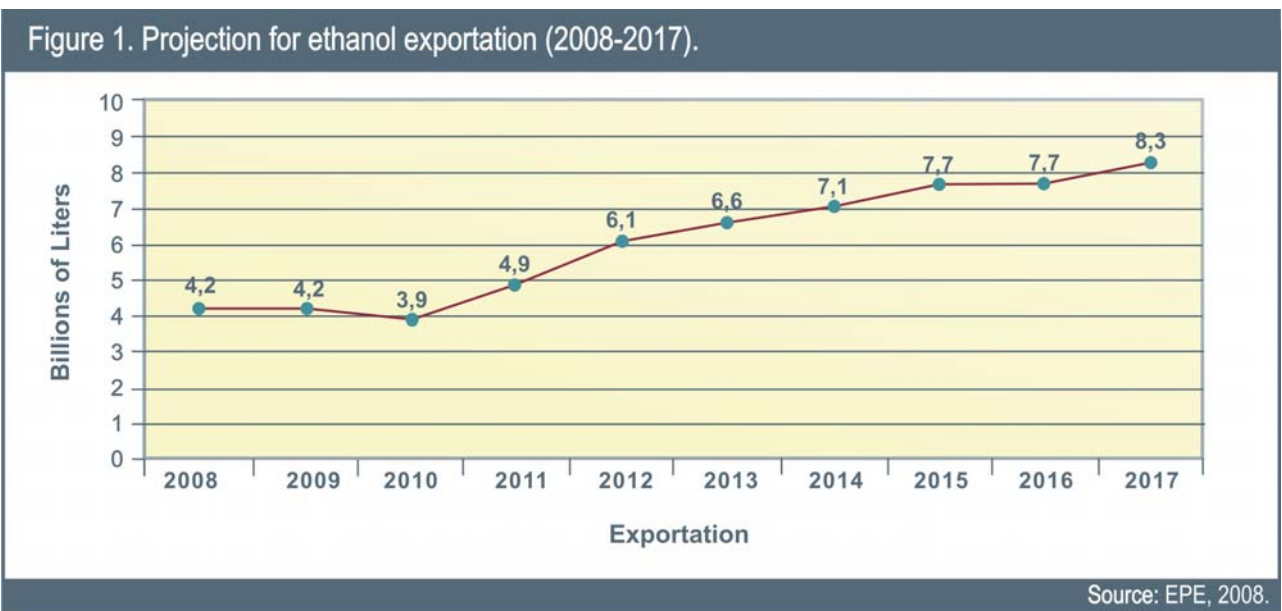
GNP	GNP (billions of dollars)	Occupied area (millions of hectares)	Participation on GNP BR (%)
Brazil	1.110,00	851,00	100,00
Agricultural	69,66	235,30	6,11
- Agriculture	39,52	62,00	3,47
- Livestock	30,14	172,30	2,64

Source livestock area: IBGE, 2007.  
 Source agricultural area: MAPA, 2007.  
 Source GNP: IBGE, 2007.  
 Source Agricultural GNP: CEPEA/CNA (Cattle-Raising and Agriculture Confederacy of Brazil), 2006.

#### 4. ETHANOL PRODUCTION PROJECTION AND EXPORT

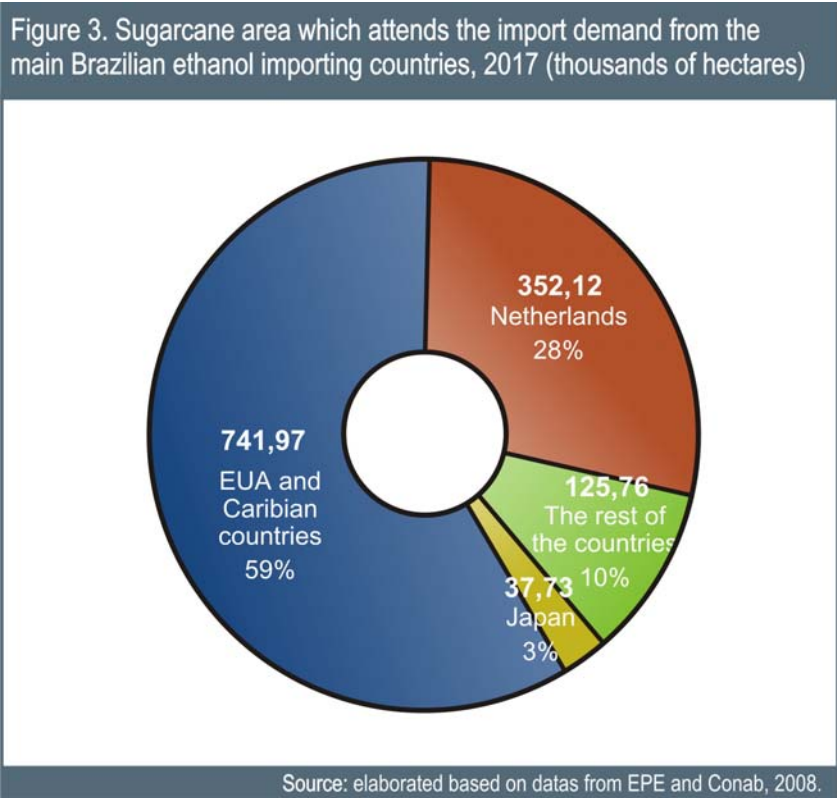
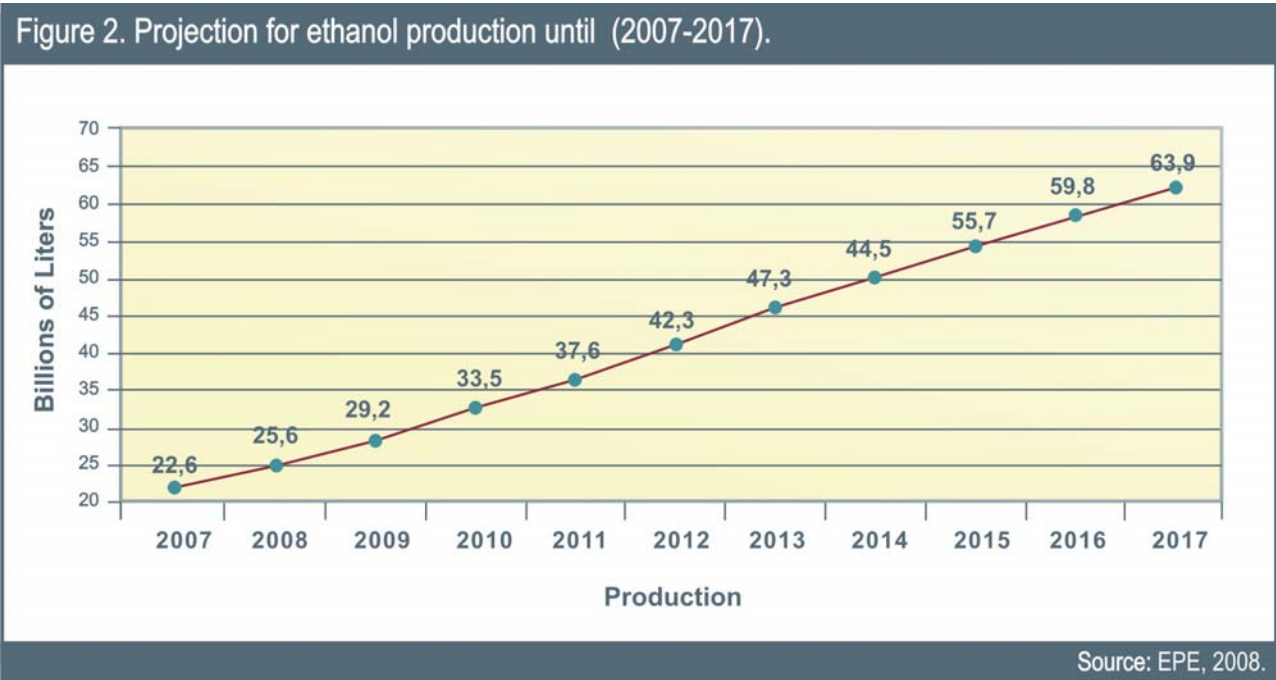
The projection made by a study from SP State Commerce Federation, published in August 2008, points that until 2015 Brazil should export 13.1 billion liters of ethanol annually, which will satisfy the US import demand of 12.1 billion liters if the decision is made to change from 5% to 10% the quantity of bio-fuel in gasoline<sup>11</sup>.

The EPE (Energy Research Company) published another study in September of 2008, forecasting that until 2017 Brazil would reserve a smaller annually quantity for export: 8.3 billions liters. (Figure 1)



<sup>11</sup> FOLHA ONLINE. Estudo aponta liderança de EUA e Brasil na produção de álcool até 2015. **Folha Online. São Paulo**, 19 ago. 2008. Available at: <<http://www1.folha.uol.com.br/folha/dinheiro/ult91u435398.shtml>>. Accessed on Ago. 20<sup>th</sup>, 2008.

In the 2007-08 yield the percentage of sugarcane collected destined for the production of ethanol was 54%, allowing for the conclusion that it demanded an area of 3.19 million hectares from a total of 6.96 of the culture. It is possible to estimate that in 2017 the required area will be of 9.68 million hectares for the total production of 63.9 billion liters, if the current average production is maintained 6.6 thousand liters of ethanol per hectare. (Figure 2).



## 5. INVESTMENTS IN SUGARCANE AND ETHANOL

The investments in the last years in the expansion of the production of ethanol, sugar and electricity were around US\$ 10 billion. The forecast of how much capital will be collected in the sector until 2015 is varies, but Unica (Sugarcane Industry Association), estimates at around US\$ 33 billion and is likely to reach 23 billion until 2012<sup>12</sup>.

The BNDES announced that it will loan around US\$ 9.16 billion between 2007 and 2010, with US\$ 7.15 for the production of sugar and alcohol; US\$ 1.08 for the co-generation of energy (1.4 mill megawatts); US\$ 87 million for the cultivation of sugarcane and 66.51 million for research and development<sup>13</sup>. The Estado de São Paulo newspaper<sup>14</sup> informs that only four groups – Brenco, Ceron, Odebretch and Cosan – will invest around US\$ 3.25 billion. In the story “From the finance market to the industries,” the same paper states that the investors are “accustomed to the speculative world of the finance market and are willing to run great risks to collect great profits. In the last two years, they have dished out billions of dollars in the country, bought dozens of industries and kick started a series of projects involving ethanol production<sup>15</sup>.”

“This group includes heavy weights like the Hungarian George Soros, the Indian Vinod Khosla, the American management group Wellington Management, the investment funds Kidd & Company, Stark and Och Ziff Management and Merrill Lynch, among others.”<sup>16</sup> Logically this scenario could drastically change with the current market crises, begging the situation to be followed closely in the next months.

## 6. SUMMARY OF SOME STRATEGIC INFORMATION

- The PNA considers that there are 200 million hectares of available land for the expansion of agriculture. Other institutions offer distinct numbers;
- Cattle-raising is an inefficient area of the agriculture economy. It is the principal agent of environmental degradation through deforestation in the Amazon. It occupies around 25% of the national territory and almost 60% of the lands considered apt for agriculture, generating only 2.64% of the GNP – US\$ 30 billions in 2006. The meat production average is too low: 40 kilos per hectare, per year;
- Agriculture takes up 7.5% of the territory and 18.5% of the arable lands, generating 3.47% of the agricultural GNP in 2006;
- More than 90% of the Atlantic Forest has been removed;

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<sup>12</sup> VIALLI, A.; DE CHIARA, M. Exportação de etanol vai triplicar. **O Estado de São Paulo**. São Paulo, Aug. 20th, 2008. Economy. B11.

<sup>13</sup> BNDES. **Carteira do BNDES para setor de açúcar e álcool já soma R\$ 19,7 bilhões**. Available at: <[http://www.bndes.gov.br/noticias/2007/not271\\_07.asp](http://www.bndes.gov.br/noticias/2007/not271_07.asp)>. Accessed on Dec. 5th, 2007.

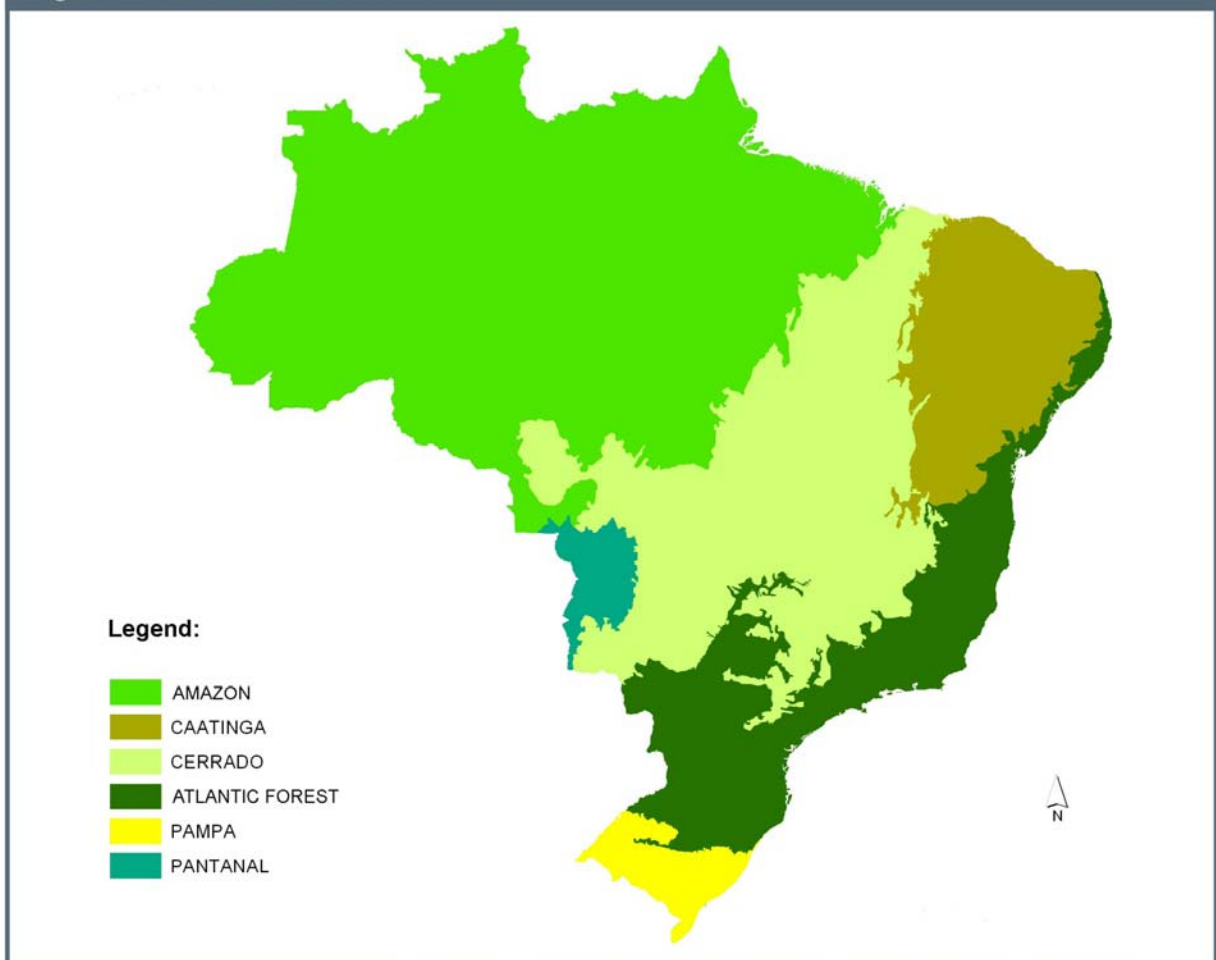
<sup>14</sup> TOMAZELA, J. M. Grandes grupos lideram expansão nos canaviais. **O Estado de São Paulo**. São Paulo, Sep. 21st, 2007. Available at: <[http://www.estadao.com.br/suplementos/not\\_sup83228,0.htm](http://www.estadao.com.br/suplementos/not_sup83228,0.htm)>. Accessed on Sep. 23rd, 2007.

<sup>15</sup> PEREIRA, R. From the finance market to the mills. **O Estado de São Paulo**. São Paulo, Dec. 22nd, 2007. Available at: <[http://www.estadao.com.br/estadaodehoje/20071223/not\\_imp100069,0.php](http://www.estadao.com.br/estadaodehoje/20071223/not_imp100069,0.php)>. Accessed on Dec. 23rd, 2007.

<sup>16</sup> AGÊNCIA ESTADO. Novos reis do etanol vem do mercado financeiro. **O Estado de São Paulo**. São Paulo, Dec. 23rd, 2007

- Of Cerrado, according to engineer and researcher Mauricio Galinkin, there remains 20% of the native vegetation, with the risk of completely disappearing until 2030. Of the original 204 million hectares, 57% have already been deforested and half of the remaining areas have been altered;
- Deforesting in Cerrado today has reached three million hectares per year.
- In the Amazon 70 million hectares have been deforested of the existing 420 in the Brazilian territory – the region spreads through 9 countries, with a total area of 660 million hectares;
- The biome that suffers the most direct impact in agriculture and the most threatened is Cerrado. Indirectly, through the transference of activities such as cattle-raising and soya plantations, is the Amazon. The ecoregion of Pantanal – the largest humid area in the world – also suffers direct and indirect impacts. (Figure 4).

Figure 4. Brazilian biomes.



Source: IBGE (Brazilian Institute of Geography and Statistics), 2004.

## 7. BIODIESEL

As part of the National Policy on Agro-energy, the Brazilian Government launched the National Biodiesel Program (PNPB)<sup>17</sup>, with increasing addition goals from the product to the diesel utilized in the country reaching 5% in 2013. In January, 2008 the initiative entered the mandatory phase with the 2% mixture reaching 3% in July, equivalent to 1.3 billion liters.

The program also includes “social” goals, such as involving 200 thousand families of small farmers, which means around 4.8% of the total 4.13 million existing in the country. Some rules assure biodiesel producing companies the use of a seal name Social Fuel Seal, in case the raw material is obtained from family based agriculture. This seal allows for tax benefits.

The biggest company in the sector is Ecodiesel Brazil, which currently has 38 thousand families affiliated. It was responsible for 21.1% of all the biodiesel produced in the country from January to June, 2008: 435 million liters, according to data from the MDA (Ministry of Agrarian Development). The same department informs that US\$ 139 million have been passed through family agriculture in 2007 from the sale of resources for the production of biodiesel. The money should increase this year, mostly due to the high prices of raw material like castor oil and soya.

### 7.1. The Current Scenario

Due to various factors the government has made a revision of the program goals, among them the reduction from 200 thousand to 100 thousand families to be integrated. Also under evaluation are the goals for the implantation of the mixture in the diesel due to the increase of the price of agriculture products like the castor oil plant and even Soya, this last responsible for 85% of oil destined to biodiesel.

## 8. LAND PRICE

Folha de São Paulo newspaper, on its February 10<sup>th</sup>, 2008 issue, published information regarding research from the FNP institute, a private consultancy, that land value in Brazil during 2007 reached 17.83% above inflation – 9.6% in the year<sup>18</sup>. The price of hectare increased from an average of US\$ 1.52 thousands to US\$ 1.79. Several reason were pointed for this, among which are the increase of grain price and the production of biofuels for “Flex” cars (that work with ethanol, gasoline or any mixture of the two). In the same story it’s said that in some São Paulo regions in the last three years, occurred bigger absolute increases of hectare value: “the regions of Araraquara, Bauru, Piracicaba, Ribeirão Preto and Pirassununga had, in some cases, the value of hectare double in grain, sugarcane, coffee and pasture areas.” These are areas of intense sugarcane production.

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<sup>17</sup> BRASIL. **National Biodiesel Program (PNPB)**. Available at: <<http://www.biodiesel.gov.br/>>. Accessed on Aug. 10th, 2008.

<sup>18</sup> FOLHA ONLINE. Os preços das terras batem recordes no país. **Folha Online**. São Paulo, Feb. 10th, 2008. Available at: <<http://www1.folha.uol.com.br/folha/dinheiro/ult91u371052.shtml>>. Accessed on Feb. 15th 2008.

“This scenario redirected investment funds, including international sources, to the land market. The preferred regions are the ones in the border, in Mato Grosso, west of Bahia and in the one called “Mapito” – Maranhão, Piauí e Tocantins. The preference reflect in the numbers. One hectare of land that was valued at US\$ 2.08 thousands in Luis Eduardo Magalhães, in the Bahia Cerrado, at the start of 2007, went to US\$ 3.25 thousands after one year. In the Balsas Cerrado (MA), the price went from US\$ 225-US\$ 413 to US\$ 604- US\$ 665 in the same period. In Alta Floresta (MT), the soya areas evolved from US\$ 632 to US\$ 930<sup>19</sup>.”

Corroborating with this information, the Soya Producers Association of the State of Mato Grosso (Agrosoja/MT), the state that produces the most grain in the country, informed that according to the *Diário de Cuiabá*<sup>20</sup> newspaper, from January 7<sup>th</sup>, 2008, the increase in the average hectare prices in the most valued regions, reached 34% in 2007, where the most expensive regions are located where there federal highways BR-163 and BR-364 are. The price is measured in sacks of Soya, being able to reach up to 200 per hectare. The lands allocated for sugarcane culture as in Poconé went up in price. In Poconé a hectare, that was priced at US\$ 706 went up to US\$ 986 – 39.66% in one year.

This extraordinary increase in value of land in the inhabited regions with good infrastructure is one of the elements that pushes the expansion of the agriculture border and, as such, the deforestation of the Amazon, Cerrado and Pantanal.

In Roraima, near the equator line, in the northern hemisphere, a sugarcane plantation is under development. The reasons given by the authorities for using the region are the relative low land price (US\$ 697), the ground relief and the availability of water in the soil (Estado de São Paulo newspaper, September 7<sup>th</sup>, 2008)<sup>21</sup>.

## 9. GRAIN VERSUS SUGARCANE – CONFLICTS ARISE

The dispute for territories between sugarcane and grains triggeres new economic and political processes in some regions of the Paraná Basin. In the Sub-Basin of Ivinhema River (Figure 5), Maurício Peralta, Cooagri development manager<sup>22</sup>, one of the biggest Agriculture Cooperatives in the country, interviewed in 2007, informed that the leasing of areas belonging to cattle raisers by ethanol mills, which were destined in the past for grain producers, or at least, were said to be “land reserve” and thus served for containing the prices. In the Legislative Assembly of Mato Grosso do Sul and the Representatives Chamber of two municipalities of the same State were presented new legislation projects

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<sup>19</sup> FOLHA ONLINE, 2008.

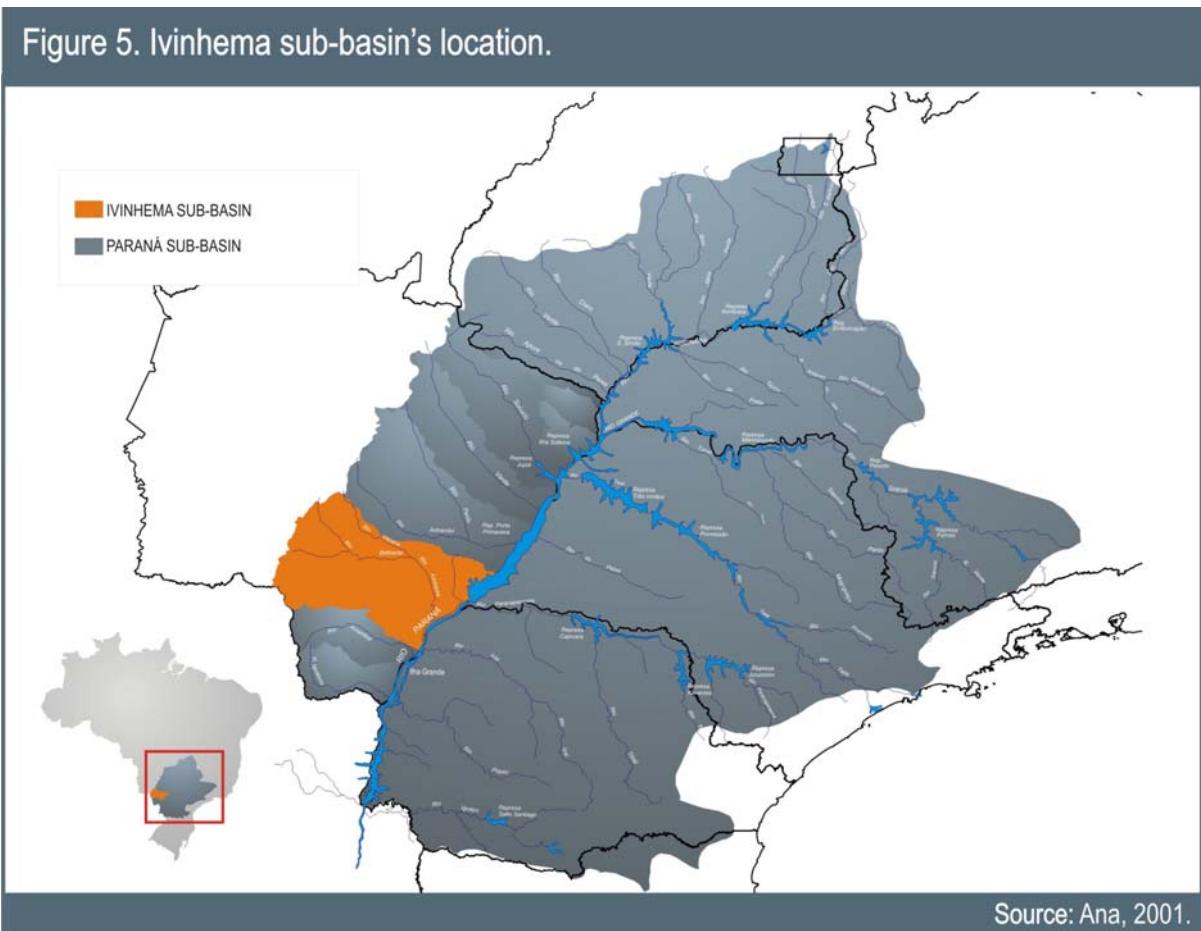
<sup>20</sup> MACIEL, M. Terras I: Alta chega em 117% em MT. *Diário de Cuiabá*. Cuiabá, Economy. Jan. 06th 2008. Available at: <<http://www.diariodecuiaba.com.br/detalhe.php?cod=306572&edicao=12007&anterior=1>>. Accessed on Jan. 20th 2008.

<sup>21</sup> ARRUDA, R. Roraima, a nova fronteira do álcool. *O Estado de São Paulo*. São Paulo, Sep. 7th 2008. Economy, p. B9.

<sup>22</sup> According to the Anuário do Agronegócio 2007 – Globo Rural, in 2007 Cooagri occupied fourth place among the fifty biggest companies of the agriculture sector of the Mid West of the country, receiving for the second year in a row the award for The Best In AgroBusiness – Soya Production. It was spotted among the 1000 greatest companies featured in Valor Econômico Magazine 1000, and elected as the biggest and best company for the Mid West Region in the sector of Agriculture. More information may be obtained in the company’s website site. Available at: <<http://www.cooagri.coop.br/>>.

with the objective of limiting the expansion. In the Assembly a law was passed defining the minimum distance between producing units, but was later revoked. In the Chambers the objective was to establish a maximum percentage of territory occupation, an initiative that was not successful but that had great repercussion.

In the second week of September, 2008 the ex-Secretary of State and current Mato Grosso do Sul representative, Paulo Duarte, denounced that some of the economic groups that installed sugar and ethanol producing units in the State are not meeting the requirements set for obtaining operation facilities, as well as tax evasion. He alerted that the current scenario is grave particularly in some grain producing municipalities, where there is a risk of break down in the local economic structures. The accusation has as major focus the group Louis Dreyfus Agroindustrial Commodities Ltda., with 3 mills in the high basin of Ivinhema.



### 9.1. Goiás Rio Verde – A Problematic Case

The Municipality of Rio Verde, in the high basin of the Paraná River (Figure 6), approved a law in September, 2006 to maintain the planting limit at 10% for sugarcane in its territory. The Alcohol Industry Union of Goiás, where the municipality belongs to, took legal action to question the law. The mayor, Paulo Roberto Cunha, said to the Estado de São Paulo newspaper that if “the Constitution gives us the right to organize the use of the urban and rural soil, we have the prerogative to dictate the rules for the development of our

municipality. And we don't think that it's going to develop through sugarcane expansion. On the contrary, it takes us back to the feudal age, because it concentrates the means of production in a small group." He further argues that while a Company and a Cooperative – Perdigão and the Southeast Goiás Rural Agroindustrial Produces Cooperative (Comigo) – employ 65 thousand people year-round, in the Mogiana Region, region that produces the most alcohol in São Paulo, 100 thousand people work half a year. "I can't accept that happening here. The reason being, when these people become unemployed, who will have to take care of them is City Hall and not the alcohol industry."

## 9.2. São Paulo

The government of the State of São Paulo, the richest in the country, responsible for 33% of the GNP, announced that it will deter the expansion of sugarcane in some of its basins, after a concession of licenses for the producing units in the analysis. The reason for such measure is that the sugarcane monoculture already occupies 70% of the agriculture areas of the territory 4.9 million hectares currently used, and by 2010 will reach around the 6 million mark.<sup>23</sup> According to governmental calculations, São Paulo has 19 million hectares of lands that could be used for agriculture (arable), of which 9 million (47.4%) are pastures.

## 10. CONCENTRATION OF LAND AND FAMILY BASED AGRICULTURE

The substitute manager for the Agriculture Cattle-Raising Census of IBGE, Luiz Fernando Pereira Rodrigues, affirms that "even with major groups investing on lands, it's still early to say that the funding concentration advanced in the country. In some regions, the settlings multiplied the number of properties. In others, of large-scale production, this (concentration) could be occurring."<sup>24</sup>

One of the most sensitive processes for the production of biofuels is the effect over the agricultural family. This sector of the economy has 4.1 million properties in Brazil and produces 70% of the food consumed internally (56% milk, 67% bean, 89% manioc, 70% chicken and 75% onion)<sup>25</sup>, a situation that could be placed in risk in some regions with the substitution of its traditional cultures for products destined for biodiesel or for the planting of sugarcane for ethanol. In the other hand, 2007 saw part of the families reach better gains with the increase of prices of some of its products, partially due to the demand of biodiesel production.

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<sup>23</sup> FREGONESI, L. Governo do Estado apresenta Zoneamento Agroambiental para o cultivo da cana de açúcar. São Paulo, Sep. 18th, 2008. Available at: <http://www.ambiente.sp.gov.br/verNoticia.php?id=173>. Accessed on Sep. 20<sup>th</sup>, 2008.

<sup>24</sup> FORTES, G. Preços da terra quebram recorde no país. *Folha de São Paulo*. São Paulo, Feb. 10th. 2008.

<sup>25</sup> CASSEL, G. Um Plano para o Brasil. *Folha de São Paulo*. São Paulo, July 20th, 2008. Tendências e Debates. Available at : <http://www1.folha.uol.com.br/fsp/opiniao/fz2007200808.htm>. Accessed on Aug. 30<sup>th</sup>, 2008.



### 11. QUESTIONS ABOUT LAND IN BRAZIL FOR BIOFUEL EXPANSION

Question 1: There is a lot of land in Brazil for biofuel expansion. Is this true? Are there any doubts?

Question 2: If it's a 'true story', how is it developing in the country?

More detailed information about Brazilian land distribution, may be viewed in chart 2, drawn according to Alexandre Strapasson, director of Sugarcane and Agroenergy Department, of the Mapa (Ministry of Agriculture, Livestock and Supply). (Chart 2).

**Chart 2. Brazilian land distribution and expansion possibilities, according to Strapasson.**

Type of occupation	Area (2006) (millions of hectares)	Sugarcane
Amazon Forest	360	<ul style="list-style-type: none"> <li>• Actual area in Brazil: 6,9 millions of ha (&lt;1% of territory)</li> <li>• Expansion forecast until 2017: + 3 millions of ha</li> </ul>
Pastures	220	
Protected Areas	55	
Annual Cultures	47	
Perennial Cultures	15	
Cities, Lakes and Highways	20	
Cultivated Areas	5	
Subtotal	722	
Other types of use	38	
Areas not explored, available for agriculture	91	
Total	851	

Source: IBGE e Conab/Mapa, 2006, Strapasson, 2007.

In the commercial sector, Unica<sup>26</sup> considers that 340 million hectares are fertile land, and from these, 77 million are available for expansion<sup>27</sup>

According to Jank, president of Unica, the expansion of the sugarcane and grain production should occur over the pastures. Observe that the chart deals with the area designated for ethanol. The total area for sugarcane today is 6.96 million hectares. The expansion also has, as support, sugar and electricity. (Chart 3).

<sup>26</sup> UNICA. Available at: <<http://www.unica.com.br/>>. Accessed on Mar. 15th, 2008.

<sup>27</sup> JANK. Marcos. Perspectivas do açúcar, etanol e bioeletricidade. In: **Simpósio Internacional e Mostra de Tecnologia da Agroindústria Sucroalcooleira**. Piracicaba. 2007.

Chart 3. Brazil: potencial for expansion (millions of hectares, 2006), according to Unica.

Brazil	850		
Total of arable lands	340 (40%)	% of total Brazil	% of arable lands
1. Cultivated lands: total	63	7.4	18.5
Soya	22	2.6	6.5
Corn	13	1.5	3.8
Sugarcane	7	0.8	2.1
Sugarcane for ethanol	3	0.4	1.0
Orange	1	0.1	0.3
2. Fields	200	23.5	59.0
3. Available fields (ag. cattle)	77	9.1	23.0

Source: Jank, M., Mapa e Unica, 2007.

In the Mapa site, for example, it is informed that “Brazil has 388 million hectares of fertile land and high productivity, of which 90 million have not yet been explored<sup>28</sup>.”

Generally speaking, the reading of the numbers presented by companies, researchers and members of government that work in the areas connected to the agriculture sector for tillable lands, it can be noticed that they are calculated by the sum of the areas with pastures (200-220 million hectares), with the ones destined for agriculture (60-70 million) and the Cerrado and other areas still not explored. In this way, the figures reach 300 and 388 million hectares. An important note is that, at least until now, the numbers used for pastures (200-220 million hectares) have not been confirmed by the cattle-raising Census of IBGE realized in 2006, when 172 million hectares were found. (Chart 4)

Chart 4. Agriculturable and available fields in millions of hectares, according to different sources.

Sources	Agriculturable	Available for expansion
Embrapa	370	91,0
Mapa	388	90,0
Unica	340	77,0
Dante Scolari - Parlament Consultant	-	103,3
University of Campinas - Rogério Cerqueira Leite	300	-
Datagro (consultancy company in sugar and biofuel's sectors)	-	101,0

<sup>28</sup> MAPA. **Agronegócio brasileiro: uma oportunidade de investimento**. Mapa. 2004. Available at: <[http://www.agricultura.gov.br/porta1/page?\\_pageid=33,968707&\\_dad=porta1&\\_schema=PORTAL](http://www.agricultura.gov.br/porta1/page?_pageid=33,968707&_dad=porta1&_schema=PORTAL)>. Accessed on Nov. 5th, 2007.

However, as already mentioned in this work, it is not enough to have an accurate reading of the quantity of available lands or fertile lands to know if the biofuels and, specially, the expansion of sugarcane will bring problems or advantages for the country and the population. More complex studies and analyses are required to discover what the support elements are related to the environmental quality such as soil, water, climate biodiversity and zones of great ecological relevance like humid areas, together with the situation of the transport and electricity infrastructures.

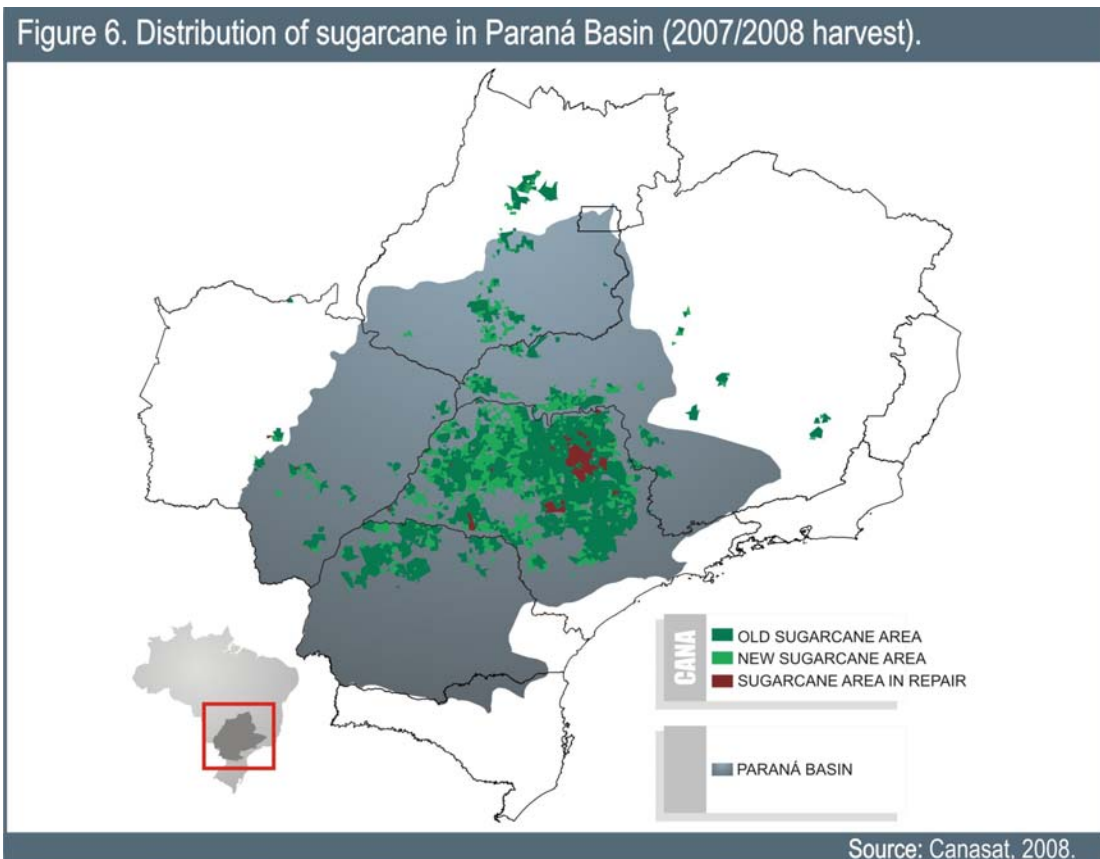
A producing unit of ethanol from sugarcane will be less lucrative if it is distant from the great consumer centers and from the electrical lines, since the exceeding electricity produced that could be sold from the burning of the bagasse and straw will not be placed in the market at competitive prices.

Thus the preference is for lands in regions that offer easier access to the ethanol and sugar market and the delivery of energy – with consolidated means of transportation.

The road until now has been to maximize the numbers related to land, without debating over the factors presented above.

## 12. MAIN EXPANSION – THE PARANÁ RIVER BASIN IN BRAZIL

The production of sugarcane in Brazil has been concentrated on the 88 million hectares of the hydrographic region of the Paraná River (Figure 6), notwithstanding the great territory of the country – 851 million hectares. It is responsible for over 80% of the current production and also – important to note – the main expansion areas, in progress and projected until the 2014-2015 harvest.



The real situation is that the sugarcane will not come from the 388 million hectares informed by Mapa, but from the best lands of the Paraná Basin. This process is in development despite the low productivity of cattle-raising – a factor that facilitates the occupation of sugarcane and grain and the deforested areas, but unexplored in various regions and tax incentives of all kinds. Obviously there are other important new areas of sugarcane expansion – including the states of Maranhão, Tocantins and Mato Grosso – but none like the Paraná Basin.

According to ANA (National Water Agency)<sup>29</sup> the hydrographic region of the Paraná River has an area of 879.86 km<sup>2</sup> or almost 88 million hectares. Being one of the national territory sedimentary beds that, in hydro-geological terms, possesses “high favorability for the storage of subterranean water and constitute the most important reservoirs, due to the great density of sediments and the high porosity of great part of its lithologies, which allows for the exploration of significant rate of flow<sup>30</sup>.” As for surfaces, oxisol prevails, which is categorized as a success for agriculture in Brazil. The ground relief has a predominance of Plateaus which facilitates the mechanization.

Among the determining economic factors for the installation of the sugar mills is the fact that the region possesses the best transport infrastructure – which facilitates the access to great consumer centers and the maritime ports for export. Another important factor are the electrical networks connected to the national system, since the generation of exceeding electrical energy for commercialization is a proposal from the projects that are either in operation or being planned. Standing out among political reasons are the pro ethanol federal government campaigns and long term loans with favorable interest rates offered by state agencies such as the BNDES, Bank of Brazil and multilaterals such as the IDB.

The environmental factors have an obvious impact over the price of land. An example of the importance of the “relief” factor is the information shown in a regional newspaper (Jornal da Manhã) by José Humberto Guimarães, Agriculture and Cattle-Raising Municipal Secretary of Uberaba city (Minas Gerais), in the high basin of the Paraná River. According to the secretary the hectare in a “flat” region, and therefore allowing for the use of agricultural machines, costs between US\$ 3 and 5 thousand and in urban areas around Uberaba (not mechanized); the value is a lot less. There are regions in which declivity is superior to 12% and makes it difficult to plant. In these lands, the hectare costs only US\$ 2 thousand<sup>31</sup>, about 2 or 3 times less.

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<sup>29</sup> ANA . **Dados Hidrológicos: Hidroweb Sistema de Informações**. Ana. 2001. Available at: <<http://hidroweb.ana.gov.br/>>. Accessed on Nov. 18th, 2007.

<sup>30</sup> SERVIÇO GEOLÓGICO DO BRASIL. **Mapa de domínios e sub-domínios hidrogeológicos do Brasil**. 2001. Available at: <<http://www.cprm.gov.br/publique/media/RecHidSub.pdf>>. Accessed on Sep. 19th, 2007.

<sup>31</sup> NATÁLIO, F. Soja e cana triplicam valores das terras. **Jornal da Manhã**. Uberaba, Set. 19th, 2008. Available at: <<http://www.jmonline.com.br/?canais,9,08,334>>. Accessed on Set. 15th, 2008.

## 12.1. A case study: Ivinhema sub-basin

### 12.1.1. The main Agriculture and Cattle-raising activities: grain, cattle-raising and sugarcane

The Ivinhema sub-basin is known for its relevance in the agriculture production (high part) and cattle-raising (low part) of the country. In the summer harvest of 2006-2007, around 923 thousand hectares were destined for the planting of grains in all the sub-basin. This area is equivalent to 0.23% of the one considered by the Agriculture Department as arable in the country (388 million hectares), but produced 3.1% of grains (132 million tons). This information is detailed on charts 5 and 6.

**Chart 5. Area occupied by agricultural activities in the sub-basin of Ivinhema (2006/2007 harvest).**

Territory	Total Area (thousand hectares)	%	Sugarcane (thousand hectares)	%	Grains* (thousand hectares)	%	Cattle Raising (thousand hectares)	%
High	2.573	55	125,22	71	835	90	920	37
Low	2.075	45	50,58	29	88	10	1.577	63
Total sub-basin	4.648	100	175,80	100	923	100	2.497	100

\* Summer harvest.

Source: Systematic Survey of Agricultural Production, IBGE, 2007 and Agricultural Census, IBGE, 2007.

**Chart 6. Production of sugarcane, grains (2006/2007 harvest) and cattle raising (2006) in Ivinhema's sub-basin.**

Territory	Sugarcane (millions of t)	%	Grains (millions of t)	%	Cattle Raising (millions of heads)	%
High	6,05	79	3,68	89	1,24	42
Low	2,75	21	0,45	11	1,73	58
Total Sub-Basin	8,80	100	4,13	100	2,97	100

Source: Seprotur, 2007, Systematic Survey of Agricultural Production, IBGE, 2007, Agricultural Census, IBGE, 2007.

### 12.1.2. The high basin and the production of grains

The principal production of grain is in the high part of the sub-basin. It produced 3.68 million tons or 2.77% of the national production. For these results the favorable soil, relief and climate conditions add to infrastructure and other factors such as low soya production cost in some of its municipalities. In the 07-08 harvest a research done by West Agriculture and Cattle-Raising Embrapa<sup>32</sup> showed that the estimated average cost of 9.1% in the region was inferior to the one in Campo Novo do Parecis municipality, one of the major producers in the north of the country.

<sup>32</sup> RICHETTI, A. *Estimativa do custo de produção de soja, safra 2007/2008, para Mato Grosso do Sul and Mato Grosso*. Technical Report. Dourados: Embrapa Agropecuária Oeste, n. 137, Oct. 2007. Available at: <http://www.cpao.embrapa.br/publicacoes/ficha.php?tipo=COT&num=134&ano=2007>. Accessed on Nov. 10th, 2007.

### 12.1.3. Scenario for sugarcane expansion in the region for 2015

In case all of the 60 working and planned ethanol, sugar and electricity producing units, are installed in the sub-basin until 2014-2015, the occupied sugarcane area will be 2.2 million hectares. In the high part 31 units will occupy 1.27 million hectares and in the low part 27 for 929 thousand hectares. The territory percentage taken by sugarcane would go from the current 4.9% to almost 47%.

In chart 7 are detailed all data on the endeavors that are underway or in development.

**Chart 7. The sugarcane and the production of sugar, alcohol and electric energy in Ivinhema sub-basin.**

Harvest	Industries	Nº of industries	Plantation (thousand hectares)	Grinding (millions of t/year)	Sugar (thousand t/year)	Ethanol (millions of L/year)	Participation Ethanol BR** (%)	Energy Production (MW)	Invest (millions of dollars)	Employes (thousand)
2006/2007	In operation	6	175,80	8,80	463,00	396,70	2,27	50,70	-	12,40
Prevision* 2014/2015	In development	-	70,15	6,78	42,25	593,68	1,61	198,00	-	1,90
	In instalation	37	1.377,45	114,78	5.198,58	6.805,80	18,48	2.954,00	5.332,88	62,58
	Planned	17	585,39	50,26	2.799,28	2.642,81	7,17	313,70	2.525,15	33,50
	Total	60	2.208,79	180,61	8.503,11	10.438,99	28,34	3.516,40	8.462,07	110,38

\*For the prevision of the 2014/2015 harvest it was considered informations about the industries in operation (2006/2007 harvest) and the maximum capacity of production previewed for the industrie's projects in development, in instalation and planned.

\*\*In the 2006/2007 harvest, Brazil produced 17,47 billions of liters of ethanol (Conab, 2007). The production projection for the 2014/2015 harvest is for about 36,83 billions of liters (Mapa, 2007).

Source: Ecoa, 2008.

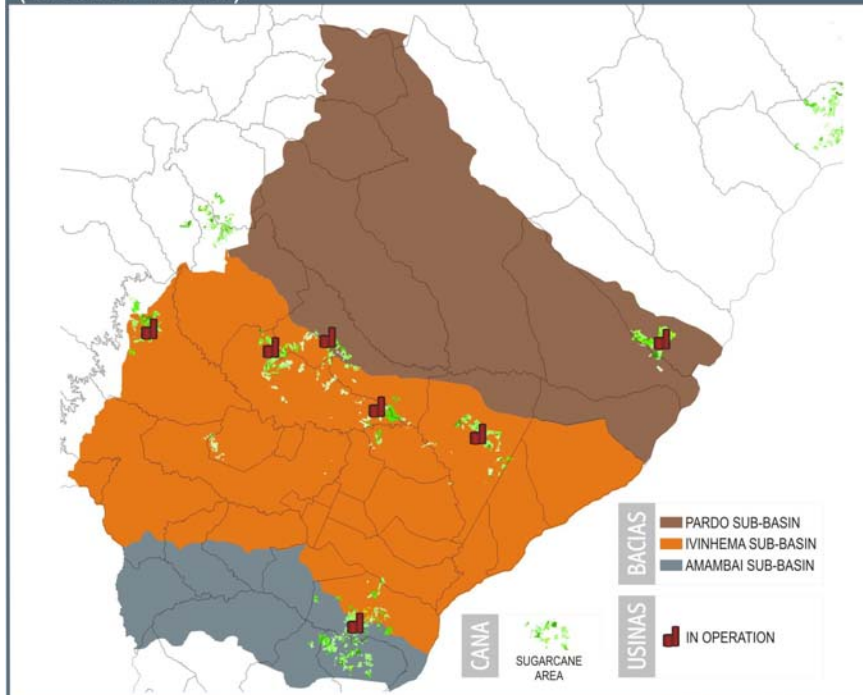
While a grain producing region in under pressure from sugarcane, with the possibility of having 47% of its territory occupied with 60 units, one neighboring sub-basin, Pardo River (Figure 6 and 7), is projecting the installation of “only” nine until 2014-2015. What would be the reasons? In the Pardo sub-basin the rural economic activity that prevails is extensive cattle-raising with low occupation per hectare, due to the prevalence of Quartzipsamments, in the upper part, which are presented as “(...) completely dominated by sand (...) and quartz being the mineral fraction of the soil (...) lacking in nutrients (...) the few existing nutrients are concentrated in the organic matter,” by the Lavras Federal University.<sup>33</sup> In the Ivinhema basin the oxisol class prevails, characterized by the agricultural potentiality, considering the natural fertility that reacts well to correction and the possibility of mechanization. It should also be taken into account the good irrigation conditions for this type of soil and the availability of water in the sub-basin.

A reference that should help the answer to the previous question is the study done by Cargin and Marchão<sup>34</sup> from Embrapa Cerrados, about pasture soil and the sugarcane occupation. It concludes that the soil presents “general aptitude characteristics favorable for sugarcane culture” but that generally have “extremely low levels of fertility,” being the recovering of the productive systems possible with the great economic limitation of the high cost of fundamental resources generated for the correction and fertilization.”

<sup>33</sup> MARQUES, J. et al. **Solos do Cerrado**. Departamento de Solos/Universidade Federal de Lavras. Lavras. Available at: <<http://www.dcs.ufra.br/Cerrados/Portugues/CNeosolo.htm>>. Accessed on May 5<sup>th</sup>, 2008.

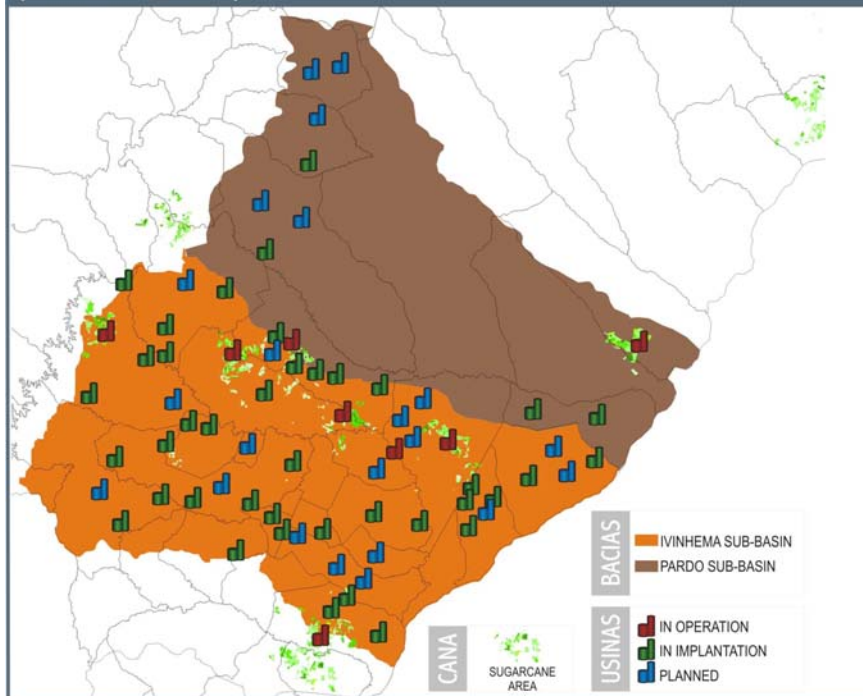
<sup>34</sup> CARGIN, A.; MARCHÃO, R. L. **A expansão da cana-de-açúcar no Cerrado brasileiro: perspectivas e limitações**. 2007. Available at: <[http://www.paginarural.com.br/artigos\\_detalhes.php?id=1558](http://www.paginarural.com.br/artigos_detalhes.php?id=1558)>. Accessed on Nov. 10th 2007.

Figure 7. Industries in operation in Pardo and Ivinhema sub-basin. (2006/2007 harvest).



Source: Ecoa, 2008.

Figure 8. Industries planned to be installed in Pardo and Ivinhema sub-basin. (2014/2015 harvest).



Source: Ecoa, 2008.

### 13. CONCLUSIONS AND REGISTERED

On September 18<sup>th</sup>, 2008 the Brazil Agency informed about the research done by the GESEL (Electrical Sector Study Group), from the Federal University of Rio de Janeiro (UFRJ), according to which the generation of electricity through burning of the sugarcane bagasse could reach 10 000 MW or even 15 000 MW. This is equivalent to almost one and half times the production capacity of the biggest Brazilian hydroelectric plant, Itaipu.<sup>35</sup> Around 20% of the Brazilian consumption. The use of biomass for energy generation could be one of the positive aspects of cane production in the country, including environmental factors, since it could prevent new hydroelectric plants from being built in the Amazon – big agents in the deforestation – and even the application of the expansion plan of nuclear centers (50) informed recently by the Federal Government.

Another advantage that could result from the sugarcane expansion would be the occupation of areas with high indexes of degradation, and in particular, the ones occupied by low productivity pastures. The country would have economic gains with the recovery of regions affected by cattle-raising – an activity that generates low number of jobs: one for every 500 hectares against 41 in sugarcane<sup>36</sup>. It could even obtain environmental improvements related to water, ground and biodiversity, since pastures, in general, promote erosion, loss of nutrients and do not respect even the permanent preservation areas.

In relation to the central question of this work, the main warning is for the necessity of disciplining the expansion through the specific credit policies, of infra-structure and tax benefits. The exclusive occupation of the lands with better aptitude for agriculture will most likely promote damage to local economies and in the mid-term for the country.

A fundamental question not analyzed in this study is about the work, being in this area, the hand cutting of sugarcane, an activity that absorbs around 500 thousand workers per year in the country<sup>37</sup>, usually young people that cut as much as 12 tons a day. With the advance of mechanization, and army of unemployed will surely arise that demand specific policies, specially with the creation of a support fund with the objective of developing a process of mid-term transition to other activities.

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<sup>35</sup> GANDRA, A. Biomassa terá participação crescente na matriz energética brasileira, prevê estudo. **Agência Brasil**, Sep. 19th, 2008. Available at: <<http://www.udop.com.br/index.php?item=noticias&cod=99528>>. Accessed on Sep. 20th, 2008.

<sup>36</sup> MORAES, M. A. F. D. de, O mercado de trabalho da agroindústria canavieira: desafios e oportunidades. **Economia Aplicada**. v. 11 n. 4. Oct./Dec. 2007. Available at: <<http://www.scielo.br/pdf/ecoa/v11n4/08.pdf>>. Accessed on Sep. 20th 2008.

<sup>37</sup> MORAES, M. A. F. D. de. 2007.



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