Biofuels:
energy won´t feed the hungry

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Summary

Introduction

The beginning of the Twenty-First Century was marked by great expectations towards expansion of agricultural fuel production and consumption in several countries. High oil prices stimulated fossil fuel substitution programs, mainly in developed countries.

In Brazil, which is the world's biggest sugarcane producer, the federal government realized this scenario offered a great opportunity for transforming the country into the world's biggest ethanol producer and exporter. In 2011, Brazil had signed agreements with 78 countries for the production and commercialization of agricultural fuels.

However, it was precisely in the end of this period that several facts relating to global and national aspects reversed the tendency towards increase of domestic consumption and ethanol exports. In Brazil's case, the priority given to pre-salt exploration, along with other factors that will be described further on, radically changed the optimistic scenario. The 2008/09 harvests production level was not reached in subsequent years. The aspiration of becoming the world's biggest ethanol exporter was replaced by the need to import the product to supply domestic demand.

Among the goals set by The Biodiesel National Program was income generation for family agriculture, which is a privileged supplier of raw materials for biodiesel production. Until nowadays, however, soy oil, which is mainly produced in great properties, is the principal source of these raw materials, followed by the cattle fat supplied by the biggest slaughterhouses in the country.

Thus, Brazilian production of agricultural fuels is based on two main monocultures, i.e., soy and sugarcane, in vast pasture lands. People do not raise cattle to produce animal fat, by the same token they do not cultivate soy to obtain oil. Widely used in the feeding of animals raised in confinement, soy flour is the reason for cultivating the grain. However, it can be said that the use of these two raw materials for biodiesel production increases soy and cattle raising profitability, which is an additional stimulus for producing them.

The same cannot be said about sugarcane, from which sugar or ethanol is produced. Therefore, the increase of ethanol production and the maintenance of sugar production levels require the expansion of the area occupied by sugar cane.

Among other known problems, monoculture production makes use of vast land extensions, which causes deforestation or displacement of other activities. The aforementioned cultures make intense use of agrochemicals, which threatens water and soil quality. It can also affect agricultural production and often the health of neighbouring populations.

We conducted field studies in the municipality of Mirassol d'Oeste in Mato Grosso, where people in land reform settlements and other family producers of diversified food seek to develop their activities in areas near extensive cattle raising and sugar cane and soy monocultures. This study makes an analysis of the impacts of these two monocultures and vast pasture areas on family food production and on these families lifestyles and, as such, it investigates whether know such coexistence is possible.

1. Agricultural fuels and monocultures

Sugarcane

Sugar cane plantation in Mirassol d'Oeste, Mato Grosso state

Sugar cane, which is mainly cultivated in tropical zones located in the South Hemisphere, accounts for around three quarters of the world's sugar production. In temperate climate regions, beet accounts for almost half of all raw material for sugar production. Brazil, India, China, Thailand and Pakistan are, in this order, the world's biggest sugar producers, according to data produced by the Food and Agriculture Organization of the United Nations (FAO).

Biggest sugarcane producers in the world

	Millions of tons	% of the world total
Brazil	670,7	37,8%
India	347,9	19,6%
China	123,4	6,9%
Thailand	96,5	5,4%
Pakistan	58	3,2%

Source: FAOStat

Sugarcane occupies the third largest cultivated area in Brazil, after soy and corn. For the 2014/15 harvest, the official prediction is that this culture will occupy 9,1 million hectares. Three States will concentrate 80% of the cultivated area: São Paulo, with 51,7%, Goiás, with 9,3%, and Minas Gerais, with 8,9%[1]. It is in these States, as occurs in Paraná and Rio Grande do Sul, that the biggest number of new plants is concentrated.

Brazilian States with the largest sugarcane cultivated areas

	Area (thousands of hectares)		**Variation in percentage terms**
State	**2013/14 Harvest**	**2014/15 (*) Harvest**	
São Paulo	4.552	4.696	3,2
Goiás	818	878	7,3
Minas Gerais	780	789	1,2
Mato Grosso do Sul	654	712	8,9
Paraná	586	645	10,1
Alagoas	417	390	-6,5
Pernambuco	285	278	-2,5
Mato Grosso	238	245	2,9
Others	481	497	3,3
Total	**8.811**	**9.130**	**3,6**

Source: CONAB (*) Prediction

Sugar

Brazil is also the world's biggest sugarcane producer and exporter. According to the United States Department of Agriculture (USDA), in the 2013/14 harvest, 37,8 million tons were produced in Brazil, which represents 21,5% of all sugar produced in the world. Moreover,

[1] CONAB data, 2014.

Brazilian sugar exports within the period reached 26, 2 million tons, corresponding to 48% of the world's total exports.

The world's biggest sugar producers and exporters

Harvest	2010/11	2011/12	2012/13	2013/14
Production				
Brazil	38,4	36,2	38,6	37,8
India	26,6	28,6	27,3	27,0
EU	15,9	18,3	16,7	16,1
China	11,2	12,3	14,0	14,3
Thailand	9,7	10,2	10,0	11,4
US	7,1	7,7	8,1	7,7
Mexico	5,5	5,4	7,4	6,7
Others	39,0	34,7	31,2	32,3
Total	**153,4**	**153,4**	**153,3**	**153,3**
Exports				
Brazil	25,8	24,7	27,7	26,2
Thailand	6,6	7,9	6,7	7,5
Australia	2,8	2,8	3,1	3,2
Mexico	1,6	1,0	2,1	2,5
Guatemala	1,5	1,6	1,9	2,0
EU	1,1	2,3	1,7	1,5
India	3,9	3,8	0,2	1,8
Others	48,3	53,9	55,0	54,5
Total	**91,6**	**98,0**	**98,4**	**99,2**

Source: USDA

Ethanol

Between 2000 and 2009, Brazilian ethanol production increased steadily, from 10,5 to 27,7 million cubic metres. A combination of factors boosted ethanol consumption in the domestic Market, such as the mandatory blending policies, establishing ethanol as an additive to be blended with pure gasoline, as well as the launching of flex fuel vehicles, which can be fuelled with any mix of ethanol or gasoline. Also worth of mention are the increase of the population's purchasing power, tax reduction and long-term car financing.

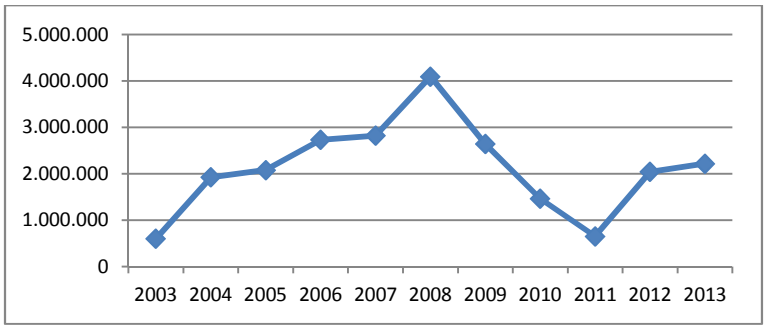
Since the end of 2005, when the then American President George W. Bush announced goals for increasing the use of agricultural fuels, great expectations were created and billions of dollars were invested. Only in Brazil, US$ 30 billion were invested in the building of over a hundred plants, without taking into account investments made for establishing sugarcane plantations[2].

Ethanol exports also increased exponentially, an upward trend that was interrupted by the global financial crisis, and the recession that came with it, as from 2008, which reduced

[2] http://www.novacana.com/n/etanol/mercado/exportacao/embarques-globais-etanol-cair-030614/

significantly global fuel consumption and oil prices. In the same period, food price upheaval in the global market raised the world's awareness towards the negative consequences of agricultural fuels on food production. Development of shale gas production in the US has meant a new alternative to oil consumption in that country, which has contributed to the sharp decrease in world ethanol production and trade. Between 2008 and 2011, Brazilian ethanol exports fell sharply, as shown in the graph below.

Brazilian ethanol net exports (exports minus imports, in tons)



Source: MAPA

The crisis that affected the sugar-ethanol sector as from 2009 was the cause for growing indebtedness of the companies. Between 2009 and 2013, 44 plants were closed.[3] After huge investments were made in the expansion of production, the sector's predictions of strong increase in ethanol sales did not come true, which affected both the domestic and the external markets. Among the main factors contributing to this new scenario, the following stand out: government subsidies through oil national company Petrobrás to keep gas prices low and prevent rise of inflation, which ended up making ethanol consumption less economical for consumers than gas; the destination of a higher volume of sugarcane to sugar production, due to a global price increase.

Stagnation or reduction of production and consumption in this period was not restricted to Brazil. In the US, ethanol consumption, previously estimated to reach 3,75 billion gallons in 2014, will be of approximately 2,2 billion gallons. The European Union postponed the incorporation of renewable fuels into the transport matrix and kept tariff and non-tariff barriers to ethanol imports unchanged. In 2004, predictions signal that global exports are likely to fall for the third consecutive year, reverting to 2006 levels.

In this scenario, the International Ethanol Association (Ietha), created in 2006 as a stimulus to building an ethanol global market will be extinct in 2014. With 45 members, who are representatives of all ethanol chain in the country, from the productive sector (national and international plants) and important logistics companies, the São Paulo-based organization for many years struggled to establish global regulations and standards for ethanol trade.

So many unconfirmed predictions for the future of ethanol make it unwise to come up with new estimates. See below projections developed by the Ministry of Agriculture in 2009

[3] http://www.em.com.br/app/noticia/economia/2014/03/30/internas_economia,513332/crise-deixa-produtores-de-alcool-apreensivos.shtml

involving ethanol figures in 2013. Exports, for instance, did not even reach one-third of the projected volume[4].

Ethanol production, consumption and exports: projections in 2009* and the reality in 2013 (in billion of litres)**

	Predicted	Occurred
Production	41,9	28,0
Consumption	35,8	21,0
Exports	7,3	2,3

Sources: * MAPA ** Secex & Única

Soy

Soy cultivation occupies the largest agricultural area in Brazil. The official prediction for the 2013/14 harvest takes into account that the cultivated area in the country will be over 30 million hectares[5]. Brazil is the world's second biggest producer. The US comes second with a cultivated area of 34 million hectares, according to the USDA data.

Eighty-five per cent of the world's soy production is concentrated in just four countries: the US, Brazil, China and Argentina. The US, Brazil, Argentina and Paraguay are the three biggest soy grain exporters, and have a share of over ninety percent of the world markets, as shown in the table below. China imports over 60% of all soy traded globally.

World soy grain production and exports (in millions of tons)

Production	**2011/12**	**2012/13**	**2013/14**	**Exports**	**2011/12**	**2012/13**	**2013/14**
US	84,2	82,6	89,5	US	36,3	41,9	44,0
Brazil	66,5	82,0	89,0	Brazil	37,2	35,9	40,7
Argentina	40,1	49,3	54,5	Argentina	7,7	7,7	9,7
China	14,5	13,0	12,2	Paraguay	3,6	5,5	5,5
Others	33,9	41,4	41,6	Others	7,5	8,8	9,4
Total	**239,2**	**268,3**	**286,8**	**Total**	**92,3**	**99,8**	**109,3**

Source: USDA

Note: The data involving Brazil's production and exports differ from those supplied by Brazilian official sources due to the distinct methodologies adopted.

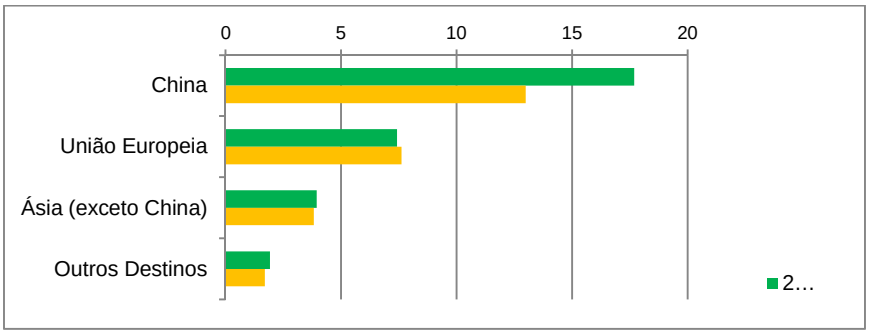
[4] MAPA, 2009

[5] CONAB 2014.

The soy complex is the most important agribusiness sector in Brazil. In 2003, it accounted for 31% of external sales (US$ 30,96 billion). Soy grain exports reached an estimated record of US$ 22,81 billion, with an increase of US$ 5,36 billion in relation to 2012. The amount exported went from 32,9 to 42,8 million tons of soy grain, which represented 52% of the 2012/13 Brazilian soy harvest.

Besides, soy occupies a growing share of Brazil's total exports, which reached approximately US$ 242 billion in 2013. Such share, which was 7,6% in 2000, already reached 12,8% in 2013. The main destinations for Brazilian soy complex exports are China, the European Union and Asia, as shown in the graph below.

Destination of Brazilian soy complex exports (US$ billion)



Source: Abiove

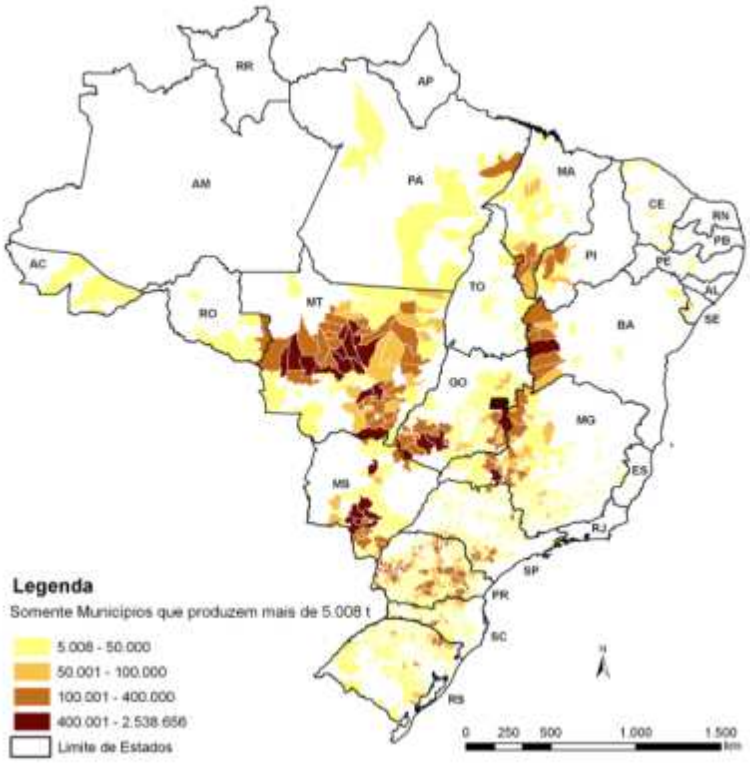
In the 2012/13 harvest, soy occupied over 52% of the total grain cultivated area. The official prediction is that it will take over 53% in 2013/14.

Brazil main grains cultivated area (in thousands of hectares)

Grain	2012/13 harvest	2013/14 harvest	Variation %
Soy	27.736	30.110	8,6
Corn	15.829	15.746	-0,5
Beans	3.075	3.328	8,2
Rice	2.400	2.396	1,7
Wheat	2.210	2.628	18,9
Cotton	894	1.103	25,1
Others	1.419	1.507	6,2
Total	53.563	56.818	6,1

Source: CONAB, 2014

Soy production: 2013/14 harvest



Source: CONAB-IBGE

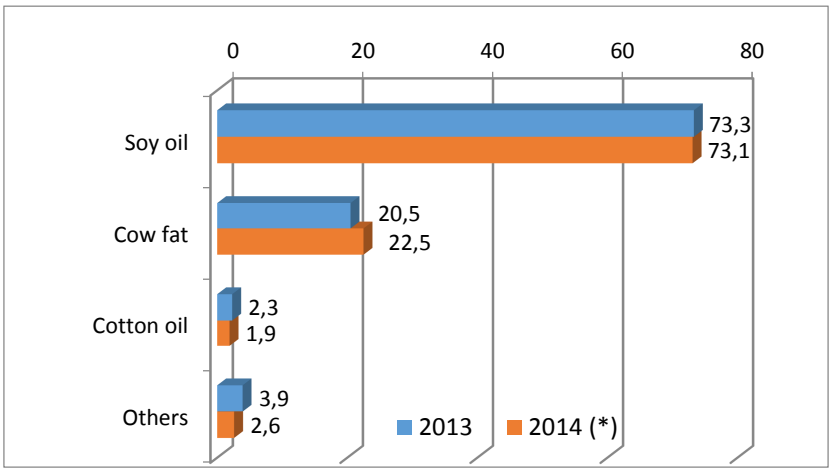
Soy and biodiesel

Launched in 2005, the National Program of Biodiesel Production and Use had among its goals the reduction of diesel oil consumption and income generation for family agriculture, which was to have a privileged position as a supplier of raw materials for the production of a new fuel. The program has succeeded with respect to the reduction of fossil fuel consumption. Until the end of 2014, the diesel oil produced in Brazil will have a 7% mix of biodiesel in its composition.

Soy plantation in Mirassol d'Oeste

The Midwest and South regions, which are Brazil's biggest soy producers, also concentrate the majority of the biodiesel installed capacity and production. Soy is the predominant raw material used in production. The National Oil Agency (ANP) Bulletin for June 2014 reports that soy (73,1%) and cattle fat (22,5%) account on average for 95% of the total volume of raw materials used for biodiesel production in the country[6].

Brazil: raw materials used in biodiesel production - percentages



Source: ANP, 2014. (*) Until april

[6] ANP, 2014.

As for family agriculture, the Ministry of Agrarian Development and Petrobrás Biofuels have been making efforts to increase the market share of the raw materials produced by these farmers, such as castor bean, dendê palm and jathropa, with a view to reaching the job creation and income generation goals foreseen in the Program. However, the participation of these oilseeds did not go beyond 3,9% of the total in 2013.

According to the National Trade Federation for Fuels and Lubricants (Fecombustíveis in Portuguese), the government's main concern is that the strong dependence on soy will end up contaminating the market with the instabilities of international negotiations involving soy. From around 70% to 80% of biodiesel consumer's price depends on the cost of the vegetal oil used in production. Moreover, the government understands that biggest percentages of mandatory use of biodiesel in Brazil may also affect soy oil world offer, especially if high standards are adopted, such as 20% or 30%, as demanded by the productive sector led by the Brazilian Vegetable Oil Industries Association (Abiove). "*For these reasons, some government sectors have been placing their bets on the use of other raw materials, such as jathropa, sunflower, canola, dendê palm, algae and palm*."[7]

Notwithstanding this concern, the federal government issued a Provisory Measure (MP 647/2014), which was sent to the National Congress in May 2014, and established step increases for the mandatory blending percentages for biodiesel and diesel oil mix, which went from 5% to 6% in July 2014, and for 7% as from November in the same year.

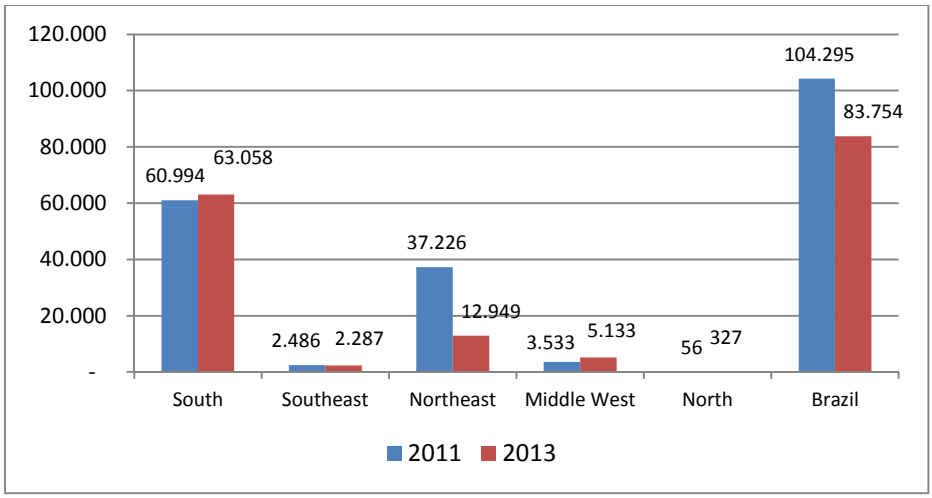
According to the federal government, the provisory measure aimed at giving continuity to the policy of increased use of renewable sources, with a view to facilitating the attainment of the goals foreseen in the National Policy on Climate Change (PNMC) and a better positioning of the country with regard to the United Nations Convention on Climate Change. The convention, which was ratified by Brazil in 1994, sets the priority of stabilizing the greenhouse gases concentrations in the atmosphere. The Provisory Measure also reaffirms that biodiesel should be preferably obtained from the raw materials produced by family farms.

According to data produced by the Ministry of the Agrarian Development and published by the ANP (Petroleum National Agency), in the 2010-2013 period the total number of family farmers supplying raw materials to biodiesel producers was reduced from 100 to 84 thousand families. The regional analysis reveals an increase in the South, Midwest and North regions and a corresponding decrease in the Northeast and Southeast regions[8].

[7] Fecombustíveis, 2012.

[8] ANP, 2014.

Number of families supplying biodiesel raw materials



Source: ANP

2. Monoculture impacts on food production in Mato Grosso state

Mato Grosso, the biggest grain producer in Brazil, occupies around one-fourth of the total cultivated area in the country and is a leading producer in the three largest cultivated areas: soy, corn and cotton. Within the State, for the 2013-2014 harvest, cotton accounted for 57,4% of the total cultivated area, with 28% for soy and 20,8% for corn.

Main crops cultivated areas – Brazil and Mato Grosso state – in thousands of hectares 2013/2014 harvest

	Brazil	MT	% MT
Soy	30.110	8.616	28,6
Corn	15.746	3.273	20,8
Sugarcane	9.130	245	2,7
Beans	3.328	322	9,7
Wheat	2.628	-	-
Rice	2.396	176	7,3
Cotton	1.119	642	57,4

Source: Conab, 2014

Sugarcane in Mato Grosso

Mato Grosso is the eighth biggest sugarcane producer in Brazil. According to Canasat-Inpe[9] data, in the State, for the 2013/2014 harvest, around 80% of all sugarcane (301,7 thousand hectares) are grown in municipalities located in the High Paraguay River Basin (238,7 thousand hectares).

[9] http://www.dsr.inpe.br/laf/canasat/cultivo.html

Cane cultivation in sensitive biomes: High Paraguay River Basin (BAP)

The Presidential Decree No. 6.961/2009 established an Agroecological Zoning (ZAE) for sugarcane. The decree was subsequently sent to the National Congress for approval as a Law Project (PL 6.077/2009).

The Cane Zoning prohibits cane plantation expansion and the building of new ethanol or sugar plants in Amazon, in the Pantanal wet lands or in High Paraguay River Basin. It also establishes that primary vegetation areas cannot be deforested for cane cultivation, which cannot be expanded into areas with declivity equal or higher than 12% (in which mechanization is not viable). Finally, it makes it necessary for new entrepreneurships in the sector to obtain a certificate issued by the Ministry of Agriculture, Livestock and Supply attesting that it will not pose risks to food security in the country.

The Zoning law project that is currently being submitted to the National Congress is considered by the rural congressional representatives to be an open-ended topic. In March of 2013, the Chamber of Deputies set up a special committee to discuss the zoning implementation as an initiative of the Agricultural and Feedstock Parliamentary Group (FPA). The current deputy and former mayor of the municipality of Sinop, Mr. Nilson Leitão (PSDB), a FPA member, states that

"We want to grow cane in consolidated second-yield areas: if the farmer doesn't want to raise cattle anymore and wants instead to grow cane, so he can grow cane in that area that is already cleared." [10]

Sugarcane in Mato Grosso High Paraguay River Basin municipalities with over three thousand hectares – 2013/2014

Mato Grosso municipality	Cultivated Area (in hectares)
Barra do Bugres	54.202
Denise	46.053
Alto Taquari	34.908
Nova Olímpia	21.180
Jaciara	20.277
Tangará da Serra	13.337
Lambari d'Oeste	11.651
Itiquira	5.907
Mirassol d'Oeste	5.691
Alto Araguaia	5.228
Diamantino	3.682
Juscimeira	3.441
Total BAP-MT	**238.712**
Total MT	**301.700**

Source: Canasat, Inpe

[10] http://www.noticiasagricolas.com.br/noticias/sucroenergetico/119205-criada-comissao-especial-para-discutir-zoneamento-da-cana-de-acucar.html#.UVNPkRxlk0c, acesso em 02/03/13.

Sugarcane plants in operation in Mato Grosso state

Plant	Municipality
Barrálcool	Barra do Bugres
Cooperb 1	Lambari d'Oeste
Cooperb 2	Mirassol d'Oeste
Coprodia	Campo Novo do Parecis
Itamarati	Nova Olímpia
Libra	São José do Rio Claro
Pantanal	Jaciara
Usimat	Campos de Júlio
Brenco	Alto Taquari

Source: Sindalcool-MT

Corn Ethanol in Mato Grosso state

Like in the US, two Mato Grosso sugarcane plants have recently initiated production of corn ethanol. The initiative originally came as a response to the sudden increase of corn production in Brazil, which resulted from the 2012/2013 crop failure in the US. This led to a spike the international market prices. After North-American production came back to normal, corn prices slumped because of the excessive supply caused by Brazilian rise in production.

The idea to use corn in ethanol production came up as a measure to prevent the product was traded at very low prices. Since then, two Mato Grosso plants, Usimat and Libra, have been using corn as a raw material for ethanol production during sugarcane intercrop periods. There are also projects being implemented in Goiás and Mato Grosso do Sul.

In addition to ethanol, for each ton of corn used, 240 kilos of DDG (Distilled Dry Grains) are produced. DDG is a concentrated compound made up of corn solid particles with a high protein and nutrients level. There is a great deal of demand for the compound in the livestock feed market. Besides, depending on the industrial process used, it can also be used to produce corn oil[11].

Soy in Mato Grosso

The Midwest is Brazil's largest producing region. 13,9 million hectares will be cultivated by the 2014/2015 harvest. Mato Grosso alone accounts for 27,0 of the 86,3 million tons of soybean produced in the entire country in the 2013/2014 harvest, and 8,62 of the 30,11 million hectares cultivated in the country in the same period. The main producing region in the State is the Midnorth. There, along Cuibá-Santarém motorway (BR-163) are located some of the Brazilian largest producing municipalites, such as Sorriso, Nova Mutum, Nova Ubiratã and Lucas do Rio Verde.

[11] Canal da Bioenergia, 2014.

Brazilian States with the largest soy cultivated areas

State	Area (million of hectares)		Variation %
	Harvest 2012/13	Harvest 2013/14	
Mato Grosso	7,82	8,62	10,2
Paraná	4,75	5,02	5,7
Rio Grande do Sul	4,62	4,94	6,9
Goiás	2,89	3,08	6,6
Mato Grosso do Sul	2,02	2,12	5,0
Bahia	1,28	1,31	2,3
Others	4,36	5,02	15,1
Total	**27,74**	**30,11**	8,5

Source: CONAB

Soy cultivation in sensitive biomes: the High Paraguay Basin (HPB)

Several municipalities make up the High Paraguay river Basin in the Centre-South and Southeast regions of the State and are also important soy producing regions, such as Diamantino, Primavera do Leste and Campo Verde.

According to IBGE[12] (The Brazilian Institute of Geography and Statistics), in Brazil the total soy cultivated area in 2012 stood at 25 million hectares. In Mato Grosso, it amounts to approximately seven million hectares. In Mato Grosso do Sul, this figure reaches 1,8 million hectares.

The table below shows the expansion of soybean cultivated area in the High Paraguay Basin municipalities in the States of Mato Grosso (MT) and Mato Grosso do Sul (MS) across roughly one decade. In the end of the period in 2012, soycrops in the High Paraguay Basin region (MT) represented 22% of the total soy cultivated area in the State. In 2012, the soy grown in the High Paraguay Basin region (MS) accounted for approximately 48% of the total soybean cultivated area in the State. Altogether, these monocultures cultivated areas in both States represent almost 10% of the total soy cultivated area in Brazil.

Soy expansion in the High Paraguay Basin (HPB), 2003-2012

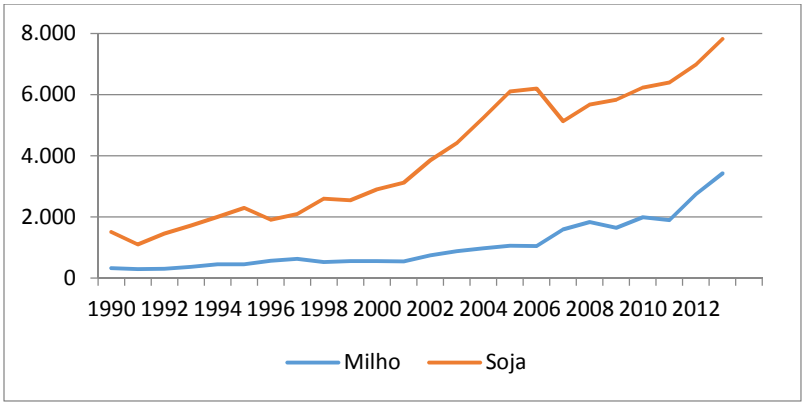
	2003	2012	2003-2012
Total HPB MS	689.070	879.150	28%
Total HPB MT	1.341.486	1.568.067	17%
Total HPB	2.030.556	2.447.217	20%

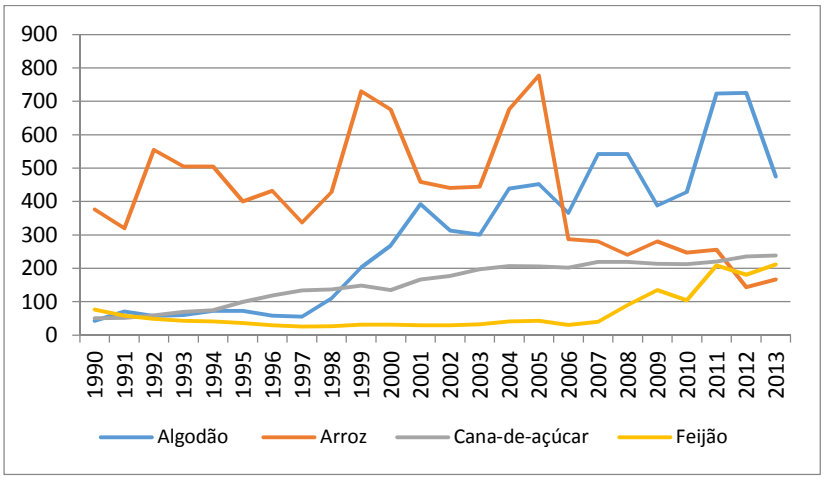
Source: IBGE

Soy, corn, cotton and sugarcane expansion took place with detriment to important food crops, such as rice, which, according to CONAB (National Food Supply Company) in 1998/1999 occupied a 730 thousand hectare cultivated area, of which only 166 thousand remain, as far as the 2012/2013 harvest is concerned.

[12] The CONAB data on soy cultivation are more updated than those presented by the IBGE. However, only the IBGE provides information on production per municipality by means of its data bank. Therefore, the information presented here on soy cultivation in the High Paraguay Basin region was provided by the IBGE.

Mato Grosso main agricultural crops cultivated areas – in thousands of hectares





Source: CONAB

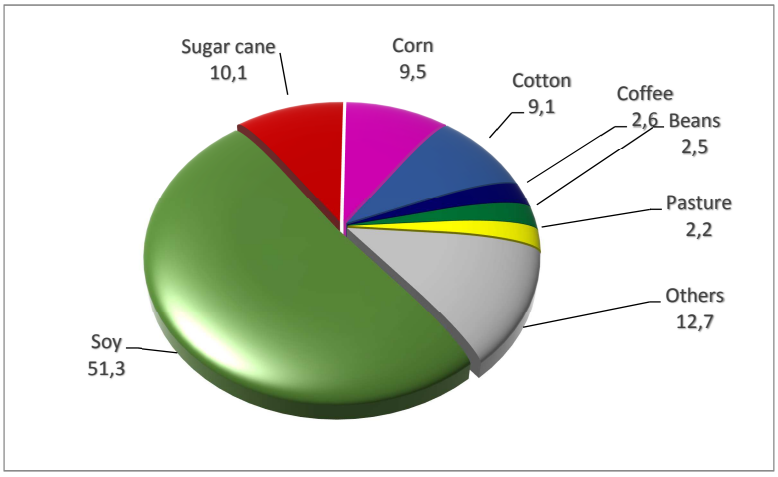
Moreover, diversified production of other food crops, such as fruit, legumes and green vegetables, has been extremely reduced in relation to the State population's consumption needs. For instance, according to data obtained from the municipality of Lucas do Rio Verde's administration, 90% of the inhabitants' food consumption come from distant supply centres, such as São Paulo, in the Southeast region, and Curitiba, in the South region.

Family farmers in the State face a series of difficulties to produce these food crops. To begin with, the municipalities and the State governments do not give them the necessary support. As shown by the study, the government authorities' attention is focused on agribusiness large-scale production.

Large-scale use of agrochemicals in crops such as soy, corn, sugarcane and cotton is another serious problem affecting not only food production, but also the health of the rural population living near large monocultures. Altogether, these four crops account for 80% of agrochemicals sales in Brazil in 2013. Of the US$ 11,454 billion sales of agrochemicals in the period, the State of Mato Grosso accounted for US$ 2,508 billion, which represent 22% of the total sales volume in the country.[13]

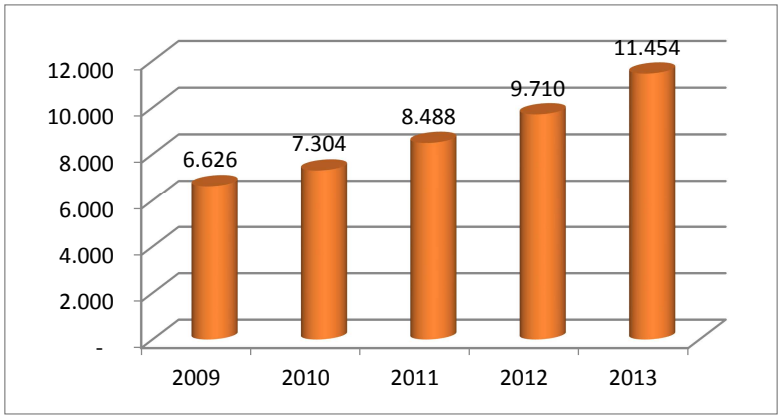
[13] http://www.sindiveg.org.br/noticia.php?ed=05&cod=2416

Percentage distribution of agrochemical consumption in Brazil in 2013



Source: Sindiveg

Agrochemical sales performance in Brazil – US$ 1.000



Source: Sindiveg

Water volume reduction caused by the deforestation brought about by these expanding large monocultures has also affected local populations. The problem is aggravated by water contamination by pesticides. Worse still, the populations are not the only ones affected. In the Cerrado (Brazilian savannah) are located the water springs flow into three important aquifers and six large hydrographic basins: Amazon's, Tocantins', Atlântico Norte-Nordeste's, São Francisco's, Atlântico Leste's, Paraguaçu-Pardo-Salinas-Jequitinhonha-Vaza Barris-Rio de Contas' and Paraná-Paraguay's. The conservation of the Pantanal, the largest wet land plains in the planet[14], depends on the latter.

[14] Bourscheit, 2012.

Intensive cultivation of sugarcane, combined with the rapid expansion of soy farming in the High Paraguay Basin region located in the State of Mato Grosso, has led us to choose the Mirassol d'Oeste municipality to carry out the field studies that provided us with the data for this text[15]. There, we could make direct detailed observation of the pressure put by both monocultures on family production of food crops.

The Pantanal wetlands and the High Paraguay River Basin (box)

Mirassol d'Oeste is among the 87 Brazilian municipalities located in Paraguay River Basin. Around eighty percent of its total area lies on a high plateau, with the remaining twenty percent located in a plain, which becomes a wetland in the flood period of the Pantanal.

The 1988 Brazilian Constitution declared the Pantanal a National Heritage site. It holds sites internationally regarded to be of crucial importance for the Wetlands Convention – Ramsar. It also secures areas declared in 2000 by the UNESCO as a Biosphere Reserve, which classifies the biome as a Humanity's Natural Heritage.

In the plains, which usually remains flooded between October and April every year, agriculture is not a well-developed activity. In addition to the floods, the soil low fertility also restricts agricultural activities. Therefore, cattle raising is a dominant activity in the region.

However, one cannot conceive of the Pantanal conservation without taking into account the importance of the High Paraguay Basin (HPB) as a whole. It is precisely in this region of the high plateau that one finds the greatest threats to the biome's integrity. Paraguay river source is located in the State of Mato Grosso. The river and its tributaries are responsible for the recharge of the water that originate Pantanal floods. On the other hand, as they are located in region among several biomes, Pantanal fauna and flora were made up of, and still depend on, these biomes' elements. The high areas are also provides a shelter for several animal species in the flooding period. It is in these areas of the high plateau that the main impacts of human activities on the HPB are felt. Consequently, they generate the most serious threats to the Pantanal conservation.

Like Mirassol d'Oeste, in the high plateau regions, cattle raising, soy and sugarcane monocultures are considered the biggest threats to the Pantanal conservation in the whole Basin area.

High Paraguay River Basin

Source: WWF

[15] In 2009, this same region, ActionAid carried out studies that resulted in the publication of the Cortina de Fumaça (Smoke Curtain) report, which is available for download at http://www.actionaid.org.br/sites/files/actionaid/cortinafumaca_resumo.pdf. In Roseli Nunes settlement, located in the municipality, FASE Mato Grosso, a partner organization in the present study, gives systematic support to farmers members of the Agroecological Producers' Regional Association (Arpa).

3. Mirassol d'Oeste

Located in the southeast of Mato Grosso State, the Mirassol d'Oeste municipality occupies 1,073 km2. According to the IBGE 2013 statistics, it has a population of approximately 25 thousand inhabitants, of whom around 80% live in urban areas. According to the IBGE classification, the Amazon and the Pantanal biomes are found in the municipality's territory. Mirassol d'Oeste is located in the High Paraguay Basin, and is among the 12 municipalities that make up the Jauru micro region, whose main rivers are Jauru and Cabaçal, both tributaries of Paraguay River.

Brief Historical Background

Until the beginning of 1977, the current Mirassol d'Oeste was part of the Cáceres municipality, whose main village was founded in 1778. The main factors contributing to the settlement of the region by immigrants coming from other parts of Brazil in that period were the soil fertility, the water abundance, the need to guard international borders and the easy access by land to Cuibá and São Paulo along Paraguay River. At that time, the region's economy was based on livestock activities and animal and plant extractivism.

Deforestation and pesticides´ pollution threatens the rivers of Mirassol d'Oeste

The Bororos indigenous people originally inhabited the region where the municipality stands today. They occupied this vast area of the country during an estimated period of seven thousand years[16]. The few descendants of this population in the Mirassol d'Oeste region are currently settled in the indigenous reservation of Umutina, located in the municipality of Barra do Bugres, which also hosts what remains of six other indigenous ethnicities.

In the 1950s and 1960s, an intense government campaign was set up in Mato Grosso to occupy and "colonize" the unclaimed lands in the State by supposedly occupying unsettled lands, precisely where these indigenous peoples previously lived, as well as other small farmers and traditional populations. Such occupation process was accelerated by Federal and State government projects, which, among other benefits, granted fiscal incentives to the so-called colonization in the Midwest and North regions with a view to occupying the Cerrado and Amazon.

It was through this process that the current territory of Mirassol d'Oeste was subdivided, sold and, to a large extent, illegally possessed by investors who did not even know the land, according to Mr. Nerio Gomes de Souza, a family farmer at the Rosely Nunes settlement. The new landowners of this vast portion of land were mostly driven towards raising beef and milk cattle.

For this reason, the Mirassol d'Oeste settlement, founded in 1964, is named after the São Paulo municipality of Mirassol, from where the majority of the first settlers came at the time, together with inhabitants from other São Paulo municipalities, such as Fernandópolis, Jales, Santa Fé do Sul, São José do Rio Preto and Votuporanga.[17] By the end of 1976, Mirassol d'Oeste was separated from Cáceres[18] and gained political and administrative autonomy as an independent municipality.

Throughout the years, farmers coming from other States, like Minas Gerais, continued acquiring portions of the municipality's land. On the other hand, groups of landless family farmers came from other regions in search of land to settle and farm. For them, however, the propagated unclaimed land in the region was not available. It was only after a hard struggle that they could finally settled. They received support from the Landless Rural Workers Movement (MST). The history of these farmers in Mirassol d'Oeste will be described in more detail further below.

Mirassol d'Oeste Economy

Until the 1980s, in addition to livestock, Mirassol d'Oeste boasted a growing and diversified food production, especially rice, beans, coffee and corn, as well as fruit, vegetables and poultry. However, beef and milk cattle raising kept on being the most important economic activity in the municipality.

In the 1990s, cattle raising expansion, followed by the recent inauguration of the sugarcane plant of the current New Millennium Distilleries aggravated land grabbing, speculation and conflicts[19] .

Between 1990 and 2012, the cattle herd nearly doubled from 61 thousand to 141 thousand. According to the IBGE[20], in the same period, milk production increased from 2,4 to 17,8 million

[16] http://pib.socioambiental.org/pt/povo/bororo/239
[17] http://www.expressaonoticias.com.br/?pg=noticia&idn=8443
[18] http://www.citybrazil.com.br/mt/mirassoldoeste/historia-da-cidade
[19] Abrasco, 2012

litres. Notwithstanding sugarcane and, more recently, soy expansion, the municipality cattle herd keeps on growing. Milk production, which currently stands around 60 thousand litres per day, is an important source of income for family farmers in the municipality.

Brazil Foods (BRF) built a large slaughterhouse in Mirassol d'Oeste. The company is currently being taken over by the Minerva slaughterhouse and awaiting the Economic Defence Administrative Council (CADE)'s approval. In 2014, the city mayor set up a campaign to transform the municipality into the "capital city" of cattle raising in the west of Mato Grosso. Poultry production has also increased strongly in the last years as shown in the table below:

Performance of livestock production in Mirassol d'Oeste

	1990	2000	2007	2012
Cattle raising	67.480	99.496	139.907	141.533
Pig farming	12.799	4.591	4.959	3.640
Poultry	45.018	540.107	330.987	590.086

Source: IBGE

Agriculture

As can be seen in the following table, sugarcane and soy cultivated area in 2000 was nil. In 2012, sugarcane cultivated areas stood at 4,4 thousand hectares, followed by soy, with two thousand hectares. Altogether, these were already the agricultural activities occupying the largest portions of land in Mirassol d'Oeste. On the other hand, the cultivated areas with crops like corn, beans, rice and banana have been drastically reduced in recent years, as shown in the same table. Others, such as coffee, cotton and orange, simply disappeared.

Agricultural Production in Mirassol d'Oeste – cultivated area (in hectares)

	1990	2000	2007	2012
Sugarcane	2.181	-	3.500	4.435
Soy	-	-	1.350	1.965
Corn	2.500	1.950	260	920
Sorghum	-	-	-	220
Manioc	455	30	60	130
Rubber	52	88	-	110
Beans	2.200	1.100	120	60
Rice	1.500	1.110	150	50
Banana	913	60	20	20
Tomato	4	8	8	8
Cotton	5.500	200	-	-
Coffee	1.600	18	-	-
Orange	8	-	-	-

Source: IBGE

Food *versus* sugarcane and soy in the municipality

The reduction of diversified food production can be initially explained by the inauguration, in the 1980s, of the first agro-industry in the municipality: the Mirassol d'Oeste Agricultural Cooperative of Cane Producers (Cooprocami). The company, founded in 1983, went into

[20] Municipal Livestock Research

production in 1986. With the Alcohol National Programme (ProÁlcool), the Federal Government granted fiscal incentives to the company.

With the ProÁlcool decline in the 1990s, the plant was closed[21]. In 2002, the company was taken over by the Agricultural Cooperative of Rio Branco Cane Producers (Cooperb), currently called New Millennium Distilleries, whose headquarters are located in Lambari d'Oeste. The Mirassol d'Oeste plant came back into operation in 2006 and is currently called Cooperb II[22]. According to Gessimar Charles de Barros, a technician at the Mirassol d'Oeste Agriculture Office, between 1.500 and 1.600 people are hired by the plant every year during sugarcane crop periods.

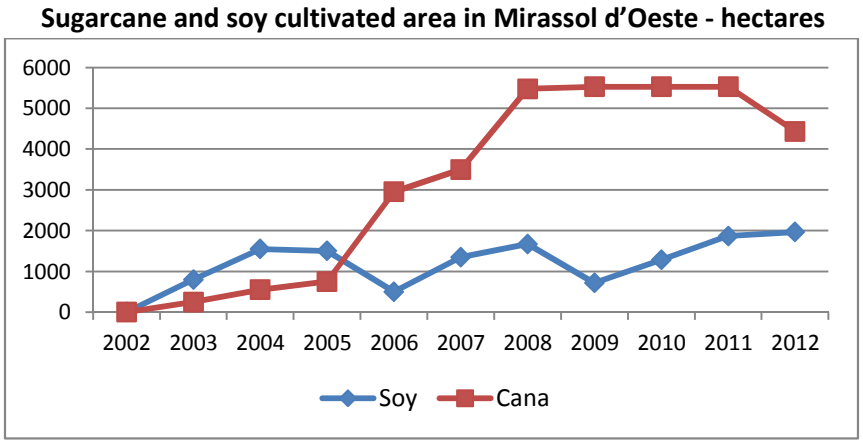
Novo Milênio Sugar cane plant marked in the red balloon. The municipality is located on the upper right side.

As from 2003, as indicated by the IBGE dada in the graph below, sugarcane monoculture began to expand again, occupying 5.527 hectares in 2009. In the same year, the Federal Government decree that established the aforementioned Agroecological Zoning for Sugarcane (ZAE Cana) came into force. The Zoning Decree prohibited the building of new plants, as well as the expansion of the ones already in operation in the Amazon and the Pantanal biomes, or in the High Paraguay Basin, where Mirassol d'Oeste is situated. Hence, the cane-cultivated area in the municipality remained unchanged until 2011, and shrank in 2012.

[21] Mazario and Casarin, 2009.
[22] Pinto, 2010.

Soya plantation in Mirassol d'Oeste

The chart below shows that, as from 2010, just after the prohibition of sugarcane expansion in the region, the soy cultivated area began to expand continuously, more than doubling between 2009 and 2012: from 718 to 1.965 hectares.

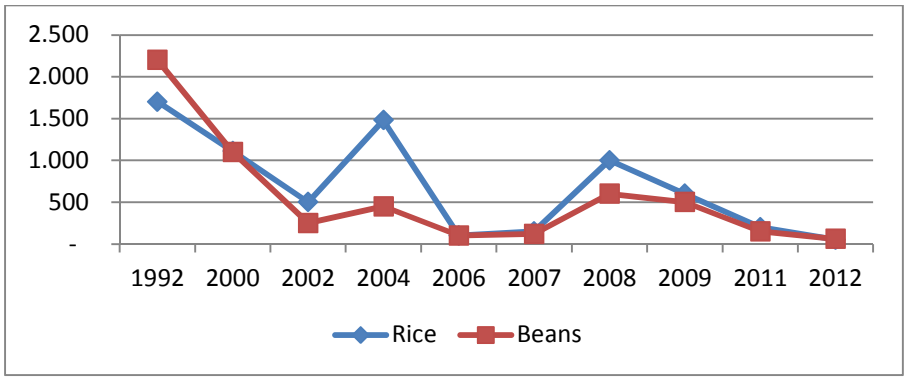


Source: IBGE

There is broad evidence of the combined impact of cane and soy monocultures on basic food crop production, such as rice and beans. The cultivated area with these food crops had a strong decrease in the period the plant was being built. After that, it has a partial recovery in the instalment period in the beginning of 2000 and it starts decreasing again in subsequent

years. Food crops production has another recovery in 2008 when there was a decrease of the soy-cultivated area. Hence, with the keeping of cane production at high levels, combined with a continuous soy expansion in the municipality, rice and beans crops have virtually disappeared.

Mirassol d'Oeste cultivated area performance – rice and beans (hectares)



Source: IBGE

4. Roseli Nunes Settlement

According to the municipality's administration, there are three agrarian reform settlements in Mirassol d'Oeste: Santa Helena, Roseli Nunes and Margarida Alves. Moreover, there are three other Land Funding Programmes, according to the Municipality's Chief Agricultural Officer, in addition to the Silvio Rodrigues[23] camp. As shown in the table below, Roseli Nunes is the one with the biggest number of settled families, according to the National Institute for Colonization and Agrarian Reform (INCRA).

Mirassol d'Oeste´s Settlements

Settlement	Family capacity	Number of families settled
Margarida Alves	145	144
Santa Helena II	53	53
Roseli Nunes	331	307
Total	**529**	**504**

Source: adapted from the Ministry of Agrarian Development 2010 b

In the second half of the 1990s, with the MST in the Grande Cáceres region, the struggle for land began, resulting in the creation in the beginning of 2000 of the settlements currently in existence. Mr. Nerio Gomes de Souza, a family farmer at the Roseli Nunes Settlement, recalls the history of the settlement formation:

"Seen from the outside, Mato Grosso looked a really nice place, there was land available. Then, what happened was farmers, mostly from Minas, bought the land here and spread the word there. So, they began attracting us. The same boss we used to have back in Minas Gerais continued being our boss here. There, we grew and harvested rice in marshes in a fifty-fifty share-cropping scheme, half to us and half to the landowner. So, we came here and in the very first year, it's the same scheme".

Mr. Nerio Gomes de Souza

[23] http://www.popularonline.com.br/atualidades/343-projeto-porteira-adentro-vai-incentivar-pequenos-produtores-rurais-de-mirassol-d-oeste

"There were some locals who'd been here longer, who were not farmers, and they told us: we can give you land to farm, as much as you want. So, that was when we left our boss and started growing rice, corn, grass for cattle feed… in the following year, we grew further. It was a large tract of land that was little by little subdivided and sold in large and small portions. So, we decided to work with one of these smaller landowners and remained there for three years."

"After that, with the plant inauguration, we worked as cane cutters for quite a long time. Later, we opened up our eyes and stood up to fight. The first struggle was against the union, which was for rural workers but defended the landowners' interests instead. Later, we succeeded in winning the elections at the union, in 1996, and went to fight for land. The INCRA and the Intermat kept on saying there was no land here, said it all amounted to sesmarias. They said that if we wanted land we had to move further up north. But we wanted to stay here".

After that, the group sought support from the MST and set up the first camp with 1.503 families. Soon, others followed. Eventually, they managed to force the INCRA to expropriate unproductive farms.

With an area of approximately 10,5 thousand hectares, the Roseli Nunes Settlement encompasses three municipalities: Mirassol d'Oeste, Curvelândia and São José dos Quatro Marcos. This area, whose expropriation the MST had been demanding since 1996, currently lies where the former Fazenda Prata used to be. According to Mr. Nerio,

"This farm used to be a business, the Agropastoril Prata, where they used to raise cattle. When we were doing our job, I received many death threats. The law court prohibited us to occupy the farm. So, we moved on to occupy another area, but we wanted this one".

The families settled there came from three camps: Roseli Nunes, Margarida Alves and Paulo Freire from the municipalities of Curvelândia, Cáceres, Rio Branco, Lambari d'Oeste, Salto do Céu and Mirassol d'Oeste. The families came from several States, like Minas Gerais, São Paulo, Goías, Paraná, Mato Grosso, Mato Grosso do Sul and others. The INCRA issued the title in March 2001 and the settlement, which had 331 patches of land[24] , was created in June 2012.

Currently, 331 families live in the settlement. The majority of the people earn their income from milk cattle raising. At Roseli Nunes settlement 13 thousand litres of milk are produced every day. This production has to be sold at very low prices to slaughterhouses in the region, because the settled farmers have not yet obtained the required sanitary certification to directly sell their produce to the general public.

The setting up of Arpa Agroecological Association

Under the name Cáceres Agriculture and Livestock Organized Producers' Association (Asproac), the Regional Association of Agroecological Producers (Arpa) was founded in 1997 in Cáceres municipality's headquarters. The Association was present in a permanent fair in the Cáceres Rural Workers' Union premises, where they traded food items produced in the municipality's settlement.

[24] Godoi and Batista, 2012.

As mentioned by Mr. Ronaldo Freitas[25], the adoption of agroecological principles by Arpa's associates is a pioneering initiative in Grande Cáceres region. They took a training course in agroecology taught by technicians from the Sustainable Agriculture Interchange Group (Gias) and Arpa associated families received systematic technical support from the FASE organization. Agroecological food production was an alternative to the predominant production model in the region, almost exclusively based on milk production, sold to dairy companies at indecently low prices.

This integrated milk production model, where family farming is restricted to supplying prime materials to great industries prevails until nowadays, as Mr. Nerio ironically points out:

"Our milk is bad for health. After the dairy company buys it, it becomes healthy. The milk producer receives R$ 0,79 per litre, and the normal market price reaches R$ 2,80".

In 2014, Arpa is present in four municipalities in the region and counts on 104 associated families: Mirassol d'Oeste, São José dos Quatro Marcos, Curvelândia and Cáceres. At Roseli Nunes, 40 of these families collectively cultivate 23 varieties of food crops, of which ten are produced the whole year. This production is enough to feed 750 low-income families in the city and at schools by means of the Food Acquisition Programme (PAA)[26] and the National School Feeding Program (PNAE)[27]. The food supplied by the Arpa to these programmes receives a thirty-percent overprice in relation to products cultivated in a traditional way, as they are produced according to agroecological principles. The Arpa holds the respective certification granted by the Ministry of Agriculture.

Mr. Ronaldo also stresses that the relevance of these federal government food acquisition programmes goes far beyond guaranteeing income for family food production. They make it possible to flexibilize and decentralize public supply of agricultural crops. Moreover, they enable the participation of family farmers who had been traditionally excluded from these markets. The stimulus given to associations also helps integrate family producers. There is also stimulus given to planning production for other markets. Finally yet importantly, there is a strengthening of the debate on the quality of the food produced in the country.

According to Mr. Gessimar Charles de Barros, a technician at the Agriculture Office, the current municipality administration has made a great deal of progress in drawing partnerships with the State and Federal governments, and has been giving special attention to family farming in the municipality. Nowadays, 122 producers supply food by means of the Food Acquisition Program. The PNAE operation, however, is still incipient, and counts on only seven suppliers. The main problem is the lack of a food transport and distribution system to schools, which hinders the participation of producers who live far from the municipality's headquarters.

However, Mr. Gessimar, as well as the municipality's chief agricultural officer, demonstrated solid understanding of the dimension of the problems faced by Mirassol d'Oeste family farmers, which Roseli Nunes Settlement dwellers detail below.

[25] Freitas, 2006.
[26] Editor's note: details at http://www.mds.gov.br/segurancaalimentar/decom/paa
[27] Editor's note: more information on the law at: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l11947.htm

Life in Roseli Nunes settlement

Barriers to family food production

The presence of these extensive cultivations near the settlement poses a serious threat not only food production, but to health preservation and their livelihoods as well. In addition to the strong presence of sugarcane, in the last years soy and teak[28] have been occupying areas near the settlement, which aggravates the problems faced by Roseli Nunes dwellers.

"*There's cane all around us. In the beginning, when we settled here, there was cane just over there, and beyond. Now, there are cane plantations on this side too. Where there used to be pasture land, all there's now is cane plantation. There's also this Soroteca that uses a lot of poison. That's quite strong",* says Rosenilda.

Water scarcity

Water supply problems have been around since the setting up of the settlement. As a matter of fact, it is due to the rainfall regime in the region, which is characterized by droughts between June and September. In the southern part of Roseli Nunes Settlement, where 126 families live, there are no rivers or streams of water. Besides, ground water is usually inadequate for human consumption due to its high salinity levels[29]. Deforestation and the silting-up of rivers, caused by expanding monoculture and pasturelands, have been reducing even further the water volume available in rivers, streams and wells.

That is what happens to Mr. Ailton Basilio da Costa and most of his neighbours. Settled in a patch of land 14 kilometres away from the nearest water source, he and his family currently live on milk production. Mr. Ailton tells us that he would like to join the Arpa, but he believes he would not have enough water available for production. The same applies to other families, like Mrs. Eliane and Mrs. Rosenilda, who live in the same region and have been noting that the water from the well, which has a high salinity level, has become scarcer in the last three years, which coincides with the expansion of sugarcane in an area nearby. Besides, drinking water has to be fetched from distant places, around three kilometres away.

Spraying of agrochemicals

In addition to water scarcity, the settlers also have to face agrochemical spraying:

"*This year, maybe because of the poison, all crops failed: okra, pumpkin, orange, all of them failed. The wind carries the poison they spray from airplanes on the cane plantation to make them mature quickly. I would like to grow something but it's hard this way. We can't grow beans because the poison cripples the crops*", says Mr. Ailton.

"*The plane flies really close to the houses spraying poison. It really interferes in production. Once, we grew beans, it came out pretty, really green, about to blossom and then, suddenly, the airplane flies over here. Then, less than three days later, the leaves grew yellow and the crop failed. In the last three years they've been using the tractor, but the poison still hit us here".*

[28] Editor's note: tree originated from Asia. In Brazil, a pioneering experience took place in Rio Claro, São Paulo and in Rio de Janeiro, in the beginning of the twentieth century. The first commercial plantation was promoted by Cáceres Floresta S.A., in Cáceres, Mato Grosso. http://pt.wikipedia.org/wiki/Tectona_grandis

[29] Godoi e Batista, 2012

Pesticides being spread by plane over both sugar cane plantation and neighbor community in Mirassol d'Oeste

"Once, the banana harvest looked good, but then the leaves grew yellow. After that, it got some sort of disease really, then almost all the crop failed. There were just some small trees left. Down there, near the cane plantation, everything failed. They didn't even come out", says Mrs. Eliane.

The agrochemical that both Mrs. Eliane and Mr.Ailton refer to is a desiccant, a type of herbicide used in soy and sugarcane plantations at the end of the harvest cycle to speed up the natural plant drydown process, allowing crops to be harvested. In addition to this, these cultivations use other herbicides, as well as insecticides and synthetic fertilizers. All these toxic products cause water contamination, diseases and often cripple food crop production in neighbouring areas. That is what happened to Mr. Ailton, whose production is currently restricted to milk cattle.

"*Nobody grows beans anymore. If they could, that would become cheaper for those who buy it. I had to give up growing rice too. Nowadays, even manioc fails. When we were given the land, it was for everybody to cultivate it, at least for survival. Everything came from our gardens. I earned my living from my own crops. After I got this patch of land here, I farmed it for about three years. After that, I gave up because we lose it all in the end. I lost motivation. It's better to buy food than grow it the way I do it*", says him.

According to Mr. Nerio, the spraying of the desiccant has become a generalized practice at Roseli Nunes Settlement:

"*The bean season is precisely when they spray the poison to speed up cane maturity, from April to June. That's when both cane and beans ripen. The problem is that the bean grains are not quite the right size yet. That ends up crippling the grains. So, round here people gave up growing rice. It grows yellow. It has already killed all the crops. Folks around here have also given up growing papaya too because it dies. They don't grow papaya in the region anymore*".

Besides the desiccants, other herbicides and insecticides are used in the sugarcane and soy plantations that cripple the agricultural production of many settlers at the Roseli Nunes settlement. The spraying of insecticides on monoculture areas drives the surviving insects away, which then attack family farmers' food crop production and livestock area.

"*Caterpillars, cicadas, all sorts of bugs are driven here. They've finished the corn and end up attacking the livestock as well. I planted a garden once. I grew scarlet eggplant and aubergine. Some big beetles came and attacked the plants and the crop failed. There came flies, aphids.. I poured some spray mix, I put some ashes in the baby plants to save them to no avail*", says Mrs. Eliane.

"*People around here have shifted to pasture monoculture and there are many plagues, a lot of cicadas which finish the rice. As few people grow it, and the area is small, birds eat it all. I grew corn here. If I hadn't picked them unripe, the birds would've finished them all, because they have nowhere else to go*", says Mr. Nerio about agrochemicals being also used in the pasture areas.

Contamination of family cultivations also explains the non-use of yielding potential and food supply capacity that the Food Acquisition Programme and the PNAE could promote. Eligibility for these programs includes regular productivity rates that can meet contract demands for commercialization. Frequent crop fails caused by agrochemicals have led many farmers to give up food cropping for good and dedicate instead to livestock production only.

"When we grow food crops, we make plans. We make plans to grow, we spend money with tractors and harrowing. In the end of the day, you plant and don't pick, the crop fails. We end up giving it up. We have expenses and take no profit. So, it certainly makes us think: it will all happen again. It becomes complicated to grow again those crops that failed", says Mrs. Eliane.

Mrs. Eliane's case is also commonplace to a great number of settlers, as they state in Rosely Nunes Settlement Letter[30].

"*We are part of an Association that grow food crops without the use of agrochemicals. We struggle for Agroecology and get organized, but that's hard because we can't get the organic production certificate, on account of all that poison that's sprayed by the plant on the cane plantation and is carried by the wind to our settlement. Since 2004, we've been working on a agroecological project for producing food crops without toxic substances and we are currently getting access to public commercialization policies with the Food Acquisition Program and the PNAE. We're struggling to produce healthy food generating life, right? Schoolchildren, families from poor neighbourhoods receive our products. However, we have to face too many difficulties. In fact, as we sit here trying to figure out a natural way to produce food, there are people who don't care and cause harm to us".*

According to Mr. José Vanderlei Batista, the municipality's Chief Agricultural Officer, Tordon, or 2,4-D, is the most widely used herbicide in the region. It is an agrochemical classified by the

[30] Abrasco, 2012.

National Agency for Sanitary Surveillance (ANVISA) as Extremely Toxic (Class I). There are 29 2,4-D based commercial products registered at the Ministry of Agriculture, Tordon by Dow Agrosciences being the most widely known. 2,4-D is notorious for being used during Vietnam War as one of the components for "agent orange". In addition to thousands of deaths, over 500 thousand children were born with serious birth defects because of the dioxins released by the product during the conflicts. Recently, the Federal Prosecutor's Office (MPF) filed two public civil actions demanding the suspension of evaluation and commercialization of nine agrochemical active ingredients, among which the 2,4-D.

The spraying of the agrochemical by planes tends to become an intensive practice as soy cultivation expands in the municipality:

"The cane area is on the other side. Near the plantation up ahead there's a farm that used to belong to a Portuguese man. Now it belongs to Arcanjo. They grow soy and spray the area from planes too. Now, the one down there will start growing soy too and will use planes to spray agrochemicals. They already use planes to spray the pastures", says Mr. José Vanderlei.

5. Monocultures' impacts on the municipality

Agrochemicals and other residues used in soy and cane monocultures contaminate water, soil and air, and cause problems that go far beyond cultivated areas. Moreover, they cause harm to the people living in the municipality's headquarters. Cane cutters working conditions and other issues will also be dealt with here.

Threats to health

The spraying of agrochemicals on monocultivation and pastureland cause health problems at the Roseli Nunes settlement and everywhere else in the region. There have been several reports on intoxication, skin disease and other health problems supposedly caused by contact with chemical products, by either water or air. According to Mr. Nerio, the increase in the cancer rate is evident:

"*It's cancer that kills the most. Many people died here in the settlement. Settlers also use herbicides in the pastureland. It causes harms to us too. There's poison all around us and we know that kills*".

"*Here, lately, we've had a lot of cases of kidney problems, skin problems and allergies. We lost a twenty-one-year-old youngster to cancer. We think his death is related to the poison. The air's full of it. Such a bad smell*".

Another problem caused by these residues is the outbreak of the so-called stable fly, which lies its eggs in the stillage or in cane decomposed wet straw. After the larval stage, the fly needs blood to initiate a new cycle and then attacks not only the herds, but human beings as well.

Used as a fertilizer in cane cultivated area, the stillage causes pollution of both surface (water streams and springs) and ground water (aquifers) and gradually increases soil salinity.

Stillage has a high concentration of ammonia, magnesium, aluminum, iron, manganese, chloride and organic matter. From ten to fifteen liters of stillage are produced for each liter of ethanol. Frequent stillage leaks caused breaks in the pipelines installed for cane fertirrigation

and were determinant factors for the prohibition of sugarcane expansion in the High Paraguay Basin.

One of these cases with strong repercussion was the leaking of stillage from Itamaraty Plant in 2007, whose headquarters are located in the Nova Olímpia municipality. The leak contaminated the Bracinho stream and rivers Bugres and Quebra Cadeira and killed large quantities of fish and other animal species. According to reports collected in Barra do Brugres in 2003, in addition to the bad smell and the death of fish and other animals, like birds, turtles and alligators, the tribe residents could not to drink the water from these rivers for several days. The incident seriously affected the lives of the people living in the Umutina Indigenous Reserve. They reported the stillage spill to the Public Prosecutor's Office. A proceeding was initiated but, as of yet, without any result.

In August 2006, a stillage leak in a Cooperb cultivated area in Mirassol d'Oeste caused the deaths of thousands of fish in the Guarani water stream located in the municipality rural area. The stillage contaminated the stream and killed minnows, piavas and piraputangas. The incident was confirmed at the time by representatives from the Public Prosecutor's Office and the State Environmental Office's (Sema) inspectors.

In addition to agrochemicals and stillage, cane straw combustion also causes problems to several families living at Roseli Nunes, in the city's outskirts and in other places where sugarcane is cultivated:

"*When they set fire to the cane, it's even hard to breath. The air gets really heavy, with smoke getting in the house*", says Mrs. Eliane.

Cane straw combustion poses serious risks to human health, including respiratory problems caused by organic compounds generated by the combustion, such as highly cancerigenous hydrocarbon. Ozone concentrations generated from cane combustion are also worrying.

Active nitrogen is responsible for local and regional environmental problems, such as acid rain and water contamination, with great potential to affect natural forests biodiversity. Nitrogen absorbing plants and microorganisms can proliferate and invade others' niches, which destroys the ecosystem and biodiversity balance.

Studies carried out by the Environmental Sanitation Technology Company (Cetesb), from São Paulo, revealed that several municipalities located in Ribeirão Preto and Araçatuba, in São Paulo, presented high ozone concentration. In the region, during the sugarcane-burning period, hospitalization due to problems affecting the respiratory tract had an increase rate between 75% and 100%. These data were obtained from the Hospital Information System hosted at the National Health Service (SUS). In such cases, there can also be an increase of cardiac diseases, as well as a premature ageing of the lungs (even in children) and risk of cancer.

According to Mrs. Vlaukenia Kippel, a biologist and sanitation inspector at Mirassol d'Oeste municipality's administration, in one of the places where airplane spraying occurs, there is a school and a community where 25 families live near one of the water reservoirs that account for the city's water supply.

"*These are the people we are most concerned with. People say they have respiratory problems because of the burning, the agrochemicals… They say there is a strong smell. They're face a serious risk as they're really surrounded by cane plantation. They've complained that all their*

crops turn yellow. What's worse, they have to eat these crops. In the end, they get twice as intoxicated."

As demonstrated by Mr. Valdir José Ribeiro, Chairman of the Mirassol d'Oeste Rural Workers' Union, in the locality there are currently 25 families surrounded by sugarcane in an area managed by the Mato Grosso Land Institute (Intermat). Airplanes spraying agrochemicals can be seen both in the cane-cultivated areas and in the area where the families live. One can also see that the reservoir located in the area, which accounts for the city's water supply, receives a significant amount of agrochemicals sprayed by airplanes on the cane plantations nearby.

Collecting water in Mirassol d'Oeste. The reservoir, and the cane plantation in the background.

End of fishing

Massive use of agrochemicals can also cause the extinction of several plant and animal species in the region's rivers and streams of water. Even if they survive the direct effects of the substances, the herbivorous fish species cannot find food, as herbicides destroy the aquatic vegetation, which affects all life-sustaining ecosystem in the rivers.

Before reaching the Roseli Nunes Settlement, the River Bugres also crosses some municipalities where vast cane plantations can be found too, like Nova Olímpia and Barra do Bugres. Though the contamination cannot be proved for lack of regular analyses, one can take for granted that the water from River Bugres and other courses of water already present high levels of contamination by agrochemicals and stillage, which harms several animal and plant species. Mr. Nerio reports on the collapse of fishing in Mirassol d'Oeste:

"*It wasn't hard for us to catch fish for eating. Nowadays, one can't catch any. We walk to the river, spend the whole day there and don't catch any fish. I don't agree it was the fishermen who finished the fish because, before the plant was built, in the 80s, I used to come fishing here in this river. If you spent one hour fishing here, you'd need extra hands to carry all the fish back home. I used to come all the way from Curvelândia to fish here. One night, we caught three pintados in one hour. Nowadays, you don't catch them anymore*."

The city water

There has been water scarcity in the municipality's headquarters during the drought period. Agricultural chief-officer Mr. José Vanderlei Batista quotes two neighbourhoods in the city whose water supply is deeply affected in the period: Jardim São Paulo and part of the city Centre. The municipality authorities have been making additional efforts to keep the city water supply, as agrochemicals are also present in the water that supplies the municipality's headquarters, where 80% population live. They demand the municipality to make additional efforts to keep water supply to the city. According to Mr. José Vanderlei:

"*A reservoir which supplied water for the municipality is no longer used because of the contamination by insecticides. Now, we're using the water from another reservoir, because we've already given up fetching water from the main one. The water was tested and it came out it's contaminated. This testing was done by the Saemi (Mirassol d'Oeste Autonomous Water and Sewage System). That's because the cane plantation reached up to the edge of the reservoir. When it rained, everything (the agrochemicals) was washed down the reservoir*".

However, Mrs. Vlaukenia says the problem related to water contamination in impounding areas in the city is still unsolved:

"*One of the reservoirs where the water's impounded lies in a lower ground surrounded by the sugarcane plantation. Every now and then, they spray agrochemicals from airplanes. So, the risk of contamination is very high. We've requested tests but so far we've received no answe*r".

Mrs. Vlaukenia says the municipality is equipped to just making the analysis of water turbidity, which is complemented by checking contamination by faecal coliforms in Cáceres regional reservoir. She also reports that both the people and the municipality's authorities are concerned with the situation. She says she has tried to make water analysis to check the presence of agrochemicals, without success:

"*I tried to make a consultation with our Regional authorities. They informed me this type of analysis is made outside the town and costs a lot of money. In the State, the test is not made, except when an urgent request is made by the Public Prosecutor's Office. They can't afford this type of analysis for all municipalities*".

As concerns the cultivation areas, she tells us that the Agriculture Office's employees have been making efforts to request the population to reduce the use of agrochemicals.

"*Some people have come to us asking us how we can provide help. As we can't make the tests, the only thing we can do is give farmers some guidance on how to change the way in which they use these agrochemicals with a view to using them in a natural way as far as possible*."

Labour precarization: cane cutting

The impossibility of carrying on with agricultural production forces many Mirassol d'Oeste inhabitants to earn a living as cane-cutting workers. As mentioned, in harvest time, between March and October, sugar mills generates between 1.500 and 1.600 jobs, according to Gesimar de Barros. In Mrs. Roseli Nunes Settlement's case, according to Mr. Nerio, there are around 40 people working in this activity:

"*They leave at three in the morning and come back late at night and don't get a full day's work salary (R$ 40,00). They receive R$ 28,00, R$ 30,00 per day*".

Cane cutters work under particularly unhealthy conditions. It is hard work, because of the amount of physical effort and posture required, the exposition to the sun, agrochemicals and other residues, such as ashes from the cane straw and stillage. The cane cutter can hardly keep on doing this job for over 12 years. In Mirassol d'Oeste's case, sugarcane cutters have to face even harder conditions, as described by Mr. Valdir:

"*We've asked them not to use planes to spray agrochemicals. There were times when we got to the plantation area and there were workers cutting cane there with the airplane flying over. We had to intervene and demand the sugar plant to stop this: either you stop this or workers will leave the plantation*."

Despite the cane-cutting activity, often renders these workers unfit for work in other tasks, they are hardly retired for permanent handicapping. The situation is aggravated by their having their working contract going as long as six months per year, which corresponds to the harvest period. AS fifteen years of contracted work are necessary for them to be entitled for rural worker's retirement, and it is impossible to go on working on the job for thirty years, retirement becomes an unattainable benefit. On the other hand, there are no statistics or medical certificates that prove the hazardous working and health conditions these workers are subjected to.

"*One can go on working as a cane-cutter for some 10, 12 year tops. People I know who took it longer than that are all receiving a social-security invalidity pension benefit. Medical doctors don't tell anybody what causes the disease. They just say you have lung problems. Even workers themselves avoid getting notified for fear of being fired*".

6. Municipal Authorities' Plans

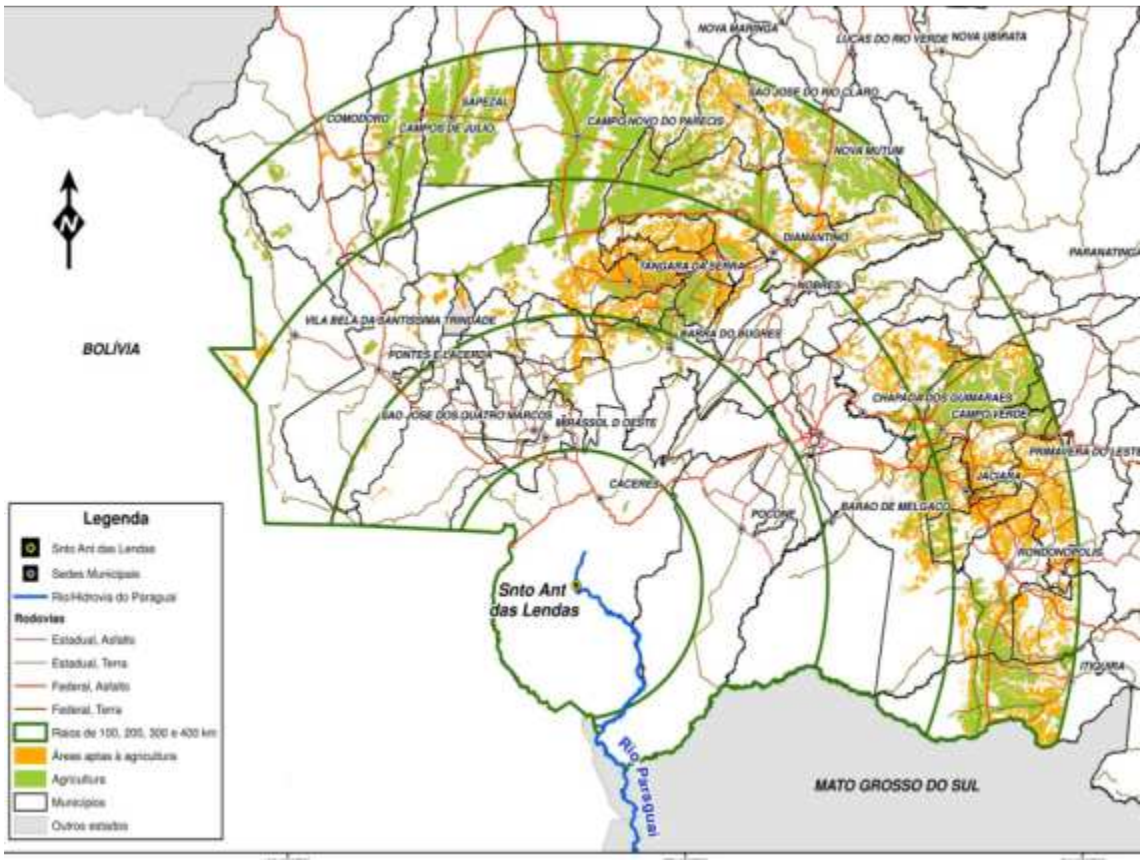
Mirassol d'Oeste municipality has announced, through several official information bodies, a plan to promote economic growth in the municipality by acting on several areas, with the underlying belief that "agribusiness is by all means the main area in any State's economic sector". Moreover, they are also committed to increasing support to family food production through the municipality's government.

Agribusiness

According to Mr. José Vanderlei Batista, the municipality's Agricultural Chief Officer, soy expansion in Mirassol d'Oeste, which has been going on for some time, must accelerate in the next years and will mostly occupy areas previously intended for pasture. Apart from these, still according to Batista, there is little availability of appropriate land for mechanized soy production.

When they announced the building of the Cáceres-Corumbá section of the Paraguay-Paraná highway and of the Morrinhos Port the nearby municipalities were converted into preferential targets for soy cultivation expansion in Mato Grosso. The public infrastructure works are part of the Federal Government's Growth Acceleration Programme (PAC-2). In addition to the possibility of counting on low freight costs to transport production, the region is also attractive

in terms of farmland property prices, much lower than in other municipalities in the Middle-North region of Mato Grosso.



Paraguai-Paraná Waterway coverage. Source: Movimento Pró-Logística, 2013

Mato Grosso State Soybean and Corn Producers' Association (Aprosoja) highlights, in a news bulletin published in July 2013, that, in the High Paraguay Basin region there are especially favourable opportunities to expand soy production in Jauru Valley, which encompasses the municipalities of Figueirópolis d'Oeste, Rio Branco, Cáceres, Lambari d'Oeste, Jauru, Mirassol d'Oeste, São José dos Quatro Marcos and Cabaçal Reservation.

Mirassol d'Oeste current mayor declares his wishes to make the municipality "*an economic reference for agribusiness".* He expresses his belief that the building of Morrinhos port is a great opportunity to turn his plants into reality. He argues that Mirassol has an estimated area of over 1.200 km2 of good quality soil, with 80% of the land available, and encourages producers to start cultivating over a thousand hectares in 2014: *"we expect to attract more investors, as we have fertile and cheap land*".

Mr. José Eusébio's twenty-thousand-hectare Urutau Farm is currently the biggest soy investment being made in Mirassol d'Oeste. According to Eusébio, "*the farm a production capacity of 5 thousand hectares of soy, 2.500 hectares of corn, in addition to raising 15 thousand cows and cattle-fattening facilities for 20 thousand cattle raised in confinement*". Urutau Farm is making investments worth over R$ 10 million in infrastructure for receiving its own soy production in addition that of other producers in the municipality.

According to mayor Mr. Elias Mendes Leal, the initiative must be considered "*a gateway to investments in grain production. For this reason, we shall invoke the Mirassol d'Oeste Rural* Union, the Banco do Brasil, Associations and Service Clubs to improve agribusiness in our city".

During the events to celebrate the 49th anniversary of the municipality's foundation, the mayor announced his intention to attract agribusiness entrepreneurs from the livestock and large monoculture sectors. According to the Jornal Popular[31], "*in the mayor's opinion, agribusiness is by all means the chief sector in the economy of any state or municipality, as high productivity levels improve the State's participation in the country's GDP, and attracts big investors in search of even bigger profits*".

"*Our main goal is to show investors our city's potential and attract big entrepreneurs from this State to come to know and invest in Mirassol d'Oeste, which came to be known as the Cattle Capital City of Mato Grosso. Apart from that, we also have potential to integrate agriculture and livestock production, and thus attract investors to produce soy, corn, sorghum and other types of crops in areas already exploited by livestock production*".

In order to achieve this goal, he announced, on the occasion, the creation of a data bank with information on local producers who plan to sell or lease their rural properties to agribusiness entrepreneurs who want to invest in the municipality.

New threats to food production: mining activities

In September of 2010, they announced the discovery of giant phosphate and iron ore deposits in Mirassol d'Oeste. All told, 427 million tons of phosphate and 11,5 billion tons of iron with a 41 percent concentration were identified. The iron ore volume is four times bigger than the one existing n the Carajás hills in Pará, whose concentration is, however, bigger (67%) .

The phosphate and the iron ores were identified in a mountain with an average of 52 metres high and 19 kilometres long. The work being carried out is still in its research and prospection stage. The phosphate ore is widely used as a fertilizer in Mato Grosso in grain cultivating areas. Currently, part of the phosphate for consumption in the State comes from São Paulo and Paraná and the remaining is imported from Israel. Brasil Exploração Mineral (Bemisa), whose main shareholder is bank-owner Daniel Dantas, who also owns the Opportunity Group Inc., is carrying out the prospection of the reserves.

According to the municipality's Agricultural Office employee, Gesimar, there are currently feasibility studies being carried out for phosphate and iron segregation, in addition to the nickel's exploiting potential.

From the municipality government's side, there is a high expectation that mining activities will generate jobs to the population and royalties to the municipality's coffers. These royalties, the so-called Financial Compensation for the Exploitation of Mineral Resources (CFEM), whose value is around 2% of net sales of mineral products, as far as iron and phosphate are concerned. These 2% are split between the municipality (65%), the State (23%) and the Federal Government (12%).

In September of 2013, Mirassol d'Oeste municipal authorities managed to obtain support from Mato Grosso represesentatives at the National Congress for the necessary permit for Bemisa

[31] http://popularonline.com.br/cidades/mirassol/39-mirassol-d-oeste-ganha-referencia-como-a-capital-do-boi-no-oeste-e-entra-na-rota-da-soja-no-estado

to carry on with exploitation activities in the mine, until then paralyzed for lack of authorization by the National Department of Mineral Production (DNPM). On the occasion, the mayor declared: "*as far as our administration is concerned, there will be no more barriers so that the company Bemisa Brasil Exploração Mineral, which is part of the GM4 Group, can, as soon as possible, really initiate the exploitation activities in the reserves*". The mayor also seeks support from the State's Legislative and Executive bodies for implementing the necessary infrastructure works to transport the future production. .

The mineral deposits are also located in the Roseli Nunes and Santa Helena Settlements' lands. The settlers are highly concerned. According to them, in the Roseli Nunes settlement alone, there are 110 patches of land where the minerals can be found. The exploitation of these resources can jeopardize all current activities. They are even more concerned about the INCRA's employees informing that the land in which they live belong to the State. Therefore, they are not even entitled to receiving a compensation for assigning the tenancy of the land to the mining companies.

There have been accounts that, in addition to the INCRA, there are other sources of pressure, such as the DNPM and the municipality government themselves. With Mr. Nerio's help, who is a city council representative, the settlers tried to pass a law establishing that the settlements and traditional communities should be exempt from being expropriated. The law proposal was turned down and the mayor sent to the city Chamber a new environmental law code for the municipality that foresees new opportunities for mining companies. The municipal government project establishes that the assignment of settlers' patches of land to the mining companies for mineral exploitation can be dealt with directly by both parties concerned.

Basic food production

The municipality's authorities claimed their concern over decrease of basic food items production. Nowadays, most of these food items are acquired in localities distant from the municipality.

"*Some twenty years from now there will be no family farming. If you go down to one of the settlements there who do you think grows food crops? Only the elderly. Children do not have this vocation for agriculture anymore*", said Chief Officer Mr. José Vanderlei Batista

In the beginning of 2014, mayor Elias Mendes Leal announced the Project "Porteira Adentro" (The "Through the Farm Gate" Project), which is clearly aimed at encouraging Mirassol d'Oeste small rural producers. The project, which was announced at the municipality settlements, will offer small producers land for covering corrals ground, capacity-building training for producing food of animal origin and embryo transfer. On the occasion, the mayor declared:

"*If we don't encourage the rural sector, small producers or future farmers, who are our children today, won't be get the profile to work as a small producers and who will produce food for us in the town?*"

Monocultures, family farming and mining activities: can they coexist?

Echoing the discourse that also predominates at the State and Federal levels, the municipality's government have embraced the commitment to simultaneously stimulate agribusiness production growth and family farming, in addition to the new possibilities for increasing municipal tax collection through mining activities.

However, reality shows a scenario in which there is a clear need to make choices by stimulating some activities on the one hand and inhibiting or regulating some on the other. What we can observe is that, in parallel with the growth of monocultures, diversified food production by family farming has decreased continuously.

The intensive use of agrochemicals harms not only family food production but the whole population as well. As a matter of fact, in addition to contaminating the water in Mirassol d'Oeste, the agrochemicals are carried by rivers and spread the contamination in areas far outside the municipality's limits. For this reason too, the planning of economic activities must take into account that the municipality is an integral part of the High Paraguay Basin, whose rivers are responsible for recharging the Guarani aquifer. Moreover, water contamination, combined with the deforestation that has been affecting the region, also jeopardizes the future of the wet lands of Pantanal in the Middlewest region.

7. Conclusions & Recommendations

Here, we present conclusions and recommendations given to face the problems dealt with throughout the present study, which reflect the opinions issued by interviewees and social organizations in the High Paraguay Basin region[32].

- Establish a moratorium on soybean cultivation as well as other monocultures throughout the High Paraguay Basin, based on the same criteria adopted in the decree that prohibits sugarcane expansion in the Basin.
- Eradicate embankment of wetlands and basins in cultivation and pasture lands.
- Prohibit the spraying of agrochemicals by planes to protect the population, their agricultural production and hydric resources near monoculture and pasture land. Also prohibit the use of agrochemicals that have been banned in other countries for causing proven damage to health or environment.
- Revoke Decree number 1.651 from March 11th 2013 from the State of Mato Grosso Government, with a view to keeping in force the State Decree – MT Number 2.283/2009, in order to restore the minimal distances for spraying agrochemicals in relation to settlements, cities, villages, neighbourhoods, water sources, isolated households, groups of animals and springs.
- Promote regulation and rigorous supervision of the sales and use of agrochemicals and GMO seeds, as a measure to protect family farming territories that adopt the transition cycle for agroecological production of food.
- Demand the making of systematic studies of river and well water quality in areas where agrochemicals and stillage are used.
- Conduct studies on the occurrence of diseases related to exposition to agrochemicals by comparing the obtained results in these areas with those from areas where monoculture is not present.
- Establish a compensation for family farmers for loss of production caused by the use of agrochemicals in nearby areas, payable by those responsible for the spraying.
- Punish intimidating practices related to communication and reporting of disease caused by agrochemicals in workers living in the region, as well as other health conditions deriving from exposition to risks in the work place, mostly in monocultivation and slaughterhouse areas. Demand compensation to the victims.

[32] The studies, supported by Aliança dos Ecossistemas involved the minucipalities of Diamantino, Alto Paraguai, Cáceres and Poconé.

- Conduct studies to determine the minimal distances allowed for the spraying of stillage as a fertilizer in sugarcane cultivation areas by protecting specially riverheads and basins.
- Implement the programmes foreseen for collection and adequate treatment of sanitary sewage, by preventing untreated sewage dumping in river and stream waters.
- Systematically overseeing by public authorities of mining activities, whether licensed or not.
- Guarantee that the threatened and affected populations have a right to direct consultation, consent and veto power on mining projects.
- Guarantee the right to delimiting the areas liberated for mining activities in family farming territories, as those in traditional communities and settlements that prove to have diversified food production. Prevent the possibility of individual negotiation for assignment of land tenancy between settlers and mining companies that is carried out without the knowledge of their community organizations.
- Value agroecological products by means of preferential acquisitions by official food acquisition programmes.
- Adopt state regulatory measures that guarantee the implementation of official food acquisition programmes. Promote the effective functioning in the region of current official programs that stimulate production and preferential acquisition of family farming food, as the National Agroecology and Organic Production Plan (Planapo), the Food Acquisition Program (PAA) and the National School Feeding Program (PNAE).
- Provide support to the setting up of public fairs with a view to effecting direct commercialization between producers and consumers.
- Provide technical and financial support to self-processing of milk production, fruit pulp as well as other food items, whose processing aggregates value to family production.
- Set up integrated zoning of all agricultural and livestock activities that prevent the implementation of monocultures in areas that are crucial for the protection of ecosystem and in strategically important regions for diversified food production.
- Monitor law projects following procedural steps that can result in impacts on the region, such as the new Mining Code, the State Zoning and the Pantanal Law.
- Guarantee the concerted participation of local civil society organizations in state and national committees and councils, whose resolutions can secure rights and positively influence on these populations' and the environment living conditions.

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