

*International Capital and New Frontiers of  
Biofuel Production in Brazilian Midwest*

*Capital Internacional e as novas fronteiras de produção  
de biocombustíveis no Centro-Oeste brasileiro*

*Capital International y las nuevas fronteras de producción  
de biocombustibles en el Medio-Oeste brasileño*

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**Abstract**

The paper analyzes the advance of international capital in the management of industrial complexes engaged in the production of ethanol, sugar and electricity in Brazil and, in the state of Goiás in particular. In order to analyze the socio-environmental impacts of the development of the sugarcane industry, the study investigated the establishment of sugarcane industries in the state of Goiás, especially in the municipality of Edéia. This region experienced the expansion and internationalization of the sugarcane industry, as part of the ‘Third March to the West’, during which the industrial estate established therein was acquired by the English group British Petroleum (BP). The data presented in this article highlight the increase in the flow of international capital investment in the sugarcane industry in the state of Goiás, which is in consonance with the rate of national increase.

**Key words:** International Capital; New Production Frontiers; Sugarcane Industry.

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**Resumo**

O artigo analisa o avanço do capital internacional na gestão dos complexos industriais produtores de etanol, açúcar e eletricidade no Brasil e, no estado de Goiás em particular. Para analisar os impactos socioambientais do desenvolvimento da indústria da cana-de-açúcar, o artigo investiga o estabelecimento do complexo sucroalcooleiro no estado de Goiás, especialmente no município de Edéia. Essa região

experimentou a expansão e a internacionalização do complexo sucroalcooleiro, como parte da “terceira marcha para o oeste”, sendo o complexo industrial ali estabelecido adquirido pela companhia britânica British Petroleum (BP). Os dados apresentados nesse artigo destacam o aumento do fluxo de capital internacional investido no setor sucroalcooleiro em Goiás, o que está em consonância com o aumento das taxas nacionais desse tipo de investimento.

**Palavras-Chave:** Capital Internacional; Novas Fronteiras Agrícolas; Indústria Sucroalcooleira

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### Resumen

El artículo analiza la expansión del capital internacional en la gestión de complejos industriales que producen etanol, azúcar y electricidad en Brasil y en el estado de Goiás, en particular. Para analizar los impactos ambientales del desarrollo de la industria de la caña de azúcar, el artículo investiga la creación del complejo de azúcar y alcohol en el estado de Goiás, en especial en el municipio de Edéia. Esta región experimentó la expansión e internacionalización del complejo de azúcar y alcohol como parte de la “tercera marcha hacia el oeste”, siendo el complejo industrial establecido adquirido por la empresa británica British Petroleum (BP). Los datos presentados en este artículo ponen de manifiesto el aumento de los flujos de capital internacional invertidos en la industria del azúcar y etanol en Goiás, que está en consonancia con el aumento en las tasas nacionales de este tipo de inversión.

**Palabras Clave:** Capital Internacional; Nuevas Fronteras Agrícolas; Industria de Azúcar y alcohol.

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## Introduction

This article reflects on the advance of international capital in the management of industrial complexes engaged in the production of ethanol, sugar and electricity in Brazil and, in the state of Goiás in particular. It sets out to examine the possible social impacts of sugarcane production in regions of “new production frontiers in former agricultural frontiers” in the Cerrado biome (PIETRAFESA, SAUER, and SANTOS, 2011). In order to analyze the socio-environmental impacts of the development of the sugarcane industry, the study investigated the establishment of sugarcane industries in the state of Goiás, especially in the municipality of Edéia, located in its southern region. This region experienced the expansion and internationalization of the sugarcane industry, as part of the Third March to the West during which the industrial estate established therein was acquired by the English group British Petroleum (BP).

The information obtained came from secondary sources from a literature review perspective which included data from scientific articles, the press, company sites, statistics from the Mauro Borges Institute (*IMB*) affiliated to the Department of Management and Planning of the State of Goiás (*SEGPLAN*), among other sources. Information was also obtained by means of visits to the municipality of Edéia, which involved collaboration from sectors of organized society (President of the Rural Workers’ Union and Environment Secretary, plus some local businessmen). In this regard, it must be emphasized that the views presented are limited to these social actors and to the information gleaned from the literature review undertaken for this study. As economic

relations are of a dynamic nature, and volatility is one of the characteristics of capital, the data herein presented cannot be considered definitive.

This study was based on a report of research conducted by the authors at the request of ActionAid Brazil, a non-governmental organization. This NGO analyzes the relationship between food production, poverty and agribusiness complexes in various parts of the world. In the case of Brazil, ActionAid Brazil requested information about the impact of biofuel production in regions of sugarcane plantation and sugarcane-based industry expansion, as well as the social conditions generated as a result of this economic process. In the context of ActionAid, the above-mentioned report was part of the project “*Confronting unsustainable biofuel production in the Americas: ActionAid’s research, networking and advocacy agenda in Brazil, Guatemala and the United States*”, which ended in 2012 and was funded by the Ford Foundation.

The content of this article is structured into three distinct periods. The first deals with the expansion of the sugarcane industry and the greater involvement of foreign groups in controlling the production of ethanol, sugar and electricity from sugarcane in South Central Brazil. The second identifies certain social indicators in the municipality of Edéia (Goiás). And finally, the third presents considerations on the data from the study site and their relation to the establishment of international industrial complexes.

### **The new configuration of international capital in the context of sugarcane industry expansion in the Southern Goiás mesoregion**

The process of constant expansion of sugarcane industry, however, was not immune to environmental conflicts in the same proportions. In this respect, we see two distinct visions. The first, represented by technician from EMBRAPA-Cerrado. These researchers have developed technology standards that increased environmental alternative techniques and increased economic gains for the units of biofuels production. Since 2009, they conduct research and experiments with sugarcane varieties adapted from the Cerrado and has achieved high productivity. According to the technicians, this could increase the volume of production in smaller areas, and reduce your costs (AGROENERGIA, 2015).

The second vision concerning the environmental impacts of sugarcane industry is composed of researchers participating in the Geomorphology, Pedology and Physical Geography Laboratory (LABOGEF-IESA-UFG). Silva and Castro (2015, p. 114) in a study on “Changes in land use and soil structure in the Cerrado in areas of expansion of sugarcane” identified that the recent process of sugarcane expansion in Southwest Goiás region has occurred

[...] primarily in clayey Red Latosols dystroferic, replacing areas of annual crop, for at a later stage, fatigued the supply of these areas, replacing pasture areas in dystrophic Red Latosol of medium texture.

According to the authors, these types of soils present “high risk to very high compression.” They also observed the existence of degradation of the soils physical

quality in this expansive process, once it has been identified [...] “index of increased resistance to penetration of the clay dispersion and soil density, accompanied by the reduction of macroporosity and changes in morforoposity [...]” The compaction process may be linked to management practices with heavy equipment. They found that it could be reduced through “fertiligation with vinasse”.

Trindade (2015), in an analysis of agricultural potential in the areas of fragile soils, confirmed the risks presented by Silva and Castro (2015). On the Southwest region of Goiás sugarcane has been installed on land that was once occupied by soybeans (maize and sorghum in rotation) until the year 2005. From this period, it has occupied areas of soil “moderately weak” and “very fragile”. These soils have the ability for natural pasture and conservation of fauna and flora.

Sauer and Leite (2012), with data from World Bank Reports on the use of land for agricultural production, identified a set of speculative international capital investments which have altered such aspects as land prices and the volume of production in the Brazilian farming system. In the case of Brazil, they emphasized interference [...] “in the expansion of eight commodities: corn, soybeans, sugarcane, palm oil, rice, rape seed, sunflower and planted forest. In Brazil this capital is mainly involved in the first three products” (WORLD BANK REPORT, 2010).

On considering that Brazilian companies have been incorporated into the sugarcane industry through international capital, as confirmed by the studies presented by Sauer and Leite (2012), it was noticed that from the year 2000 onwards there was a steady flow of funding, exceeding state policy grants through government incentives and loans. The milestone for this change in the financing and control of capital in the industry was the entrance of the Cosan Group to the Bovespa Stock Market in 2003 and the internationalization of its capital (MENDONÇA, PITTA, and XAVIER, 2011). Mendonça et al. (2011) presented an outline of mergers and foreign acquisitions in the biofuel and petroleum sector, which gave the signal for successive acquisitions:

The Royal Dutch Shell oil company appears on the scene with the establishment of a joint venture with the Cosan group. This association resulted in the setting up of the Raizen company, one of the five largest economic groups in the country, with an estimated market value of US\$20 billion. The corporation is responsible for an annual production of 2.2 billion liters of ethanol and 4 million tons of sugar. Since it started, its target has been to increase its ethanol production to 5 billion liters per annum by 2014. To do so, it has spread its control over “new” sugarcane-producing regions such as the northwest of São Paulo and the states of Goiás and Mato Grosso do Sul (MENDONÇA, PITTA, and XAVIER, 2011 p. 8).

The authors also found that it was not only foreign oil companies which were consolidating their position in the biofuel sector. The Brazilian state company *PETROBRAS*, through Petrobras Biofuel (*PBio*) also set up the *Nova Fronteira Bioenergia*, a merger with the *São Martinho* Group in upstate São Paulo and invested approximately R\$520 million in expanding the *Boa Vista* plant, in the municipality of Quirinópolis (Goiás). With that they sought to create the largest sugarcane ethanol plant

in the world, with a processing capacity rising from three million (in 2012) to eight million tons of ground sugarcane in the 2014/2015 harvest.

Besides these biofuel production giants of a petroleum origin, other large companies in the food sector have set up in Goiás since 2006. With the drawing up of the National Agroenergy Plan (2006-2011) there was increased authorization for mergers and the building of sugarcane industries in the states of São Paulo, Minas Gerais, Goiás and Mato Grosso do Sul (MAPA, 2005).

With the institutional approval of the Brazilian government, international capital “accepted” the challenge of working in the Brazilian biofuel sector. Among the agribusiness tradings traditionally focused on marketing grain, which went over to the sugarcane industry, was Cargill (of American origin), which in 2006 acquired 64% of the *Companhia Energetica Vale do Sapucaí (CEVASA)*. In mid-2011, the company announced the formation of a joint venture<sup>1</sup> with the *Usina São João*, which had built two plants in Goiás, one already in operation (municipality of Quirinópolis) and the other ready for operation. The American Archer Daniels Midland (ADM) company, also of the food sector, acquired part of the plants established in southern Goiás and the Triângulo Mineiro. The same strategy was adopted by the Sojitz Corporation<sup>2</sup>, which in 2007 acquired 33% of the *ETH* (municipality of Jataí, Goiás), along with the Brazilian Odebrecht group. Bunge took over companies already constructed and running. In 2007, it bought the *Santa Juliana* plant, in the Triângulo Mineiro. In 2008, it started selling sugar with the Tate and Lile group (American companies), and became one of the largest exporters of the commodity in the country. Recently, in 2011, it acquired control of eight plants in operation and one still under construction. These industries can together grind 20 million tons of sugarcane per harvest (MENDONÇA, PITTA, and XAVIER, 2011).

In a report published by *Exame* magazine, the reporter Fabiane Stefano (2007) presented yet another picture of the internationalization of the sugarcane industry in Brazil. She mentioned activity of international investment funds in the sector which came about through complete takeovers, association of capital or even mergers. It was a complete takeover with the Infinity Bio-energy Group, comprised of US Kidd and Company, Stark and Och Zitt Management funds, as well as the Merrill Lynch Bank. In 2006 and 2007 this group purchased eight plants, in addition to announcing the construction of five others. The cost of such takeovers was around R\$1 billion. Such enterprises were connected to the acquisition of US \$1.5 billion in grants from a London-based foundation (*AIM*).

In the context of the association between groups, Stefano’s report (2007) quoted the example of Clean Energy Brazil (CEB), which in 2006 acquired R\$400 million on the London Stock Exchange and in 2007 acquired 49% of *Usaciga Açúcar, Álcool e Energia Elétrica*, located in the state of Paraná. Two years later, it formed a joint venture

1. A Joint Venture is the signing of a contract between two or more companies, which can establish a new company in order to carry out economic and productive activities or profit-making services. BULGARELLI, Waldírio. *Trading contracts*. Sao Paulo: Atlas, 1997.

2. Sojitz Corporation is a Japanese conglomerate that operates in various industries. It was set up in 2004 through the merger of Nichimen and Nissho Iwai Corporations. Available at: [<http://www.sojitz.com/en/corporate/history/index.html>].

with *Unialco S/A*, and acquired a 33% stake in two industrial plants in Mato Grosso do Sul.

After decades of incentives and investment of public funds in the national private sector (mostly family groups), international capital has expanded its share in the sector and, according to the *Agência Estado* (07/03/2010), 58 plants changed hands in Brazil between 2007 and 2009. These operations involved more than 100 companies in the last three years. For the President of the *São Martinho* group, Fabio Venturelli, “the merger between *Cosan*, the country’s largest sugar and ethanol company, and SHELL, one of the world’s largest oil companies, is a sign of what is to come” [...] For him, “the deal, valued at US\$12 billion, was the first in which [...] one and one is five, and explained that “[...] the strategic gains are clear and point to a future where ethanol will enjoy global recognition as a renewable fuel” (*O ESTADO DE SÃO PAULO*, 2010).

The above information would indicate that after decades using public resources, concentrating land ownership, using degrading forms of labor, increasing environmental liabilities, this national production chain offers itself “ready”, “productive” and “technologically efficient” to international groups. While on the one hand these groups might have a tradition of concern for social and environmental issues, on the other, they are becoming part of a strategic program of control of the energy matrix and of national security. Approximately 80% of the sugarcane planted and processed by the industries was grown on their own properties, which is to say, that besides transferring technologies to international capital large tracts of land are also being handed over (PIETRAFESA et al., 2011).

### **Reflections on the internationalization of the sugarcane industry in Goiás: a case study of the municipality of Edéia (GO)**

In the state of Goiás, in addition to Shell, Brenco, Bunge and Louis Dreyfus (LDC) groups, as shown previously, there has been a flow of international capital mainly to the south of the State, principally linked to growth of the biofuel sector. Examples of this are the *Tropical Bioenergia* and the National Sugar and Alcohol company (*CNAA*) plants. In 2011, 100% of their shares were acquired by British Petroleum (BP) (*Exame*, 2011). In 2005, the BP oil company announced its intention to invest US\$ 8 billion in alternative sources of energy (BRITISH PETROLEUM, 2011).

BP has been operating in the US biofuel market since 2006 and by 2012 it had three plants in Brazil, two in the state of Goiás (municipalities of Edéia and Itumbiara) and one in Minas Gerais (municipality of Ituiutaba). A fourth plant was under construction in the municipality of Campo Grande (Minas Gerais) (*GLOBO RURAL*, 2011; *JORNAL DA BIOENERGIA*, 2011). British Petroleum entered the Brazilian biofuel market in 2008 with the acquisition of a 50% stake in the *Tropical Bioenergia* plant in Edéia. The deal was a joint venture with the *Maeda*<sup>3</sup> and *Santelisa Vale* companies, which was a gateway for BP to exploit the production of biofuels in Brazil.

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3. Belongs to the *Brasil Ecodiesel* group.

Another oil company which joined the sugarcane industry was British Petroleum (BP). In 2008, through its agrofuel subsidiary, BP Biofuels, the company acquired 50% of the *Tropical Bioenergia*, a joint venture composed of *LDC Bioenergia* and the *Maeda* Group. The plant operated by *Tropical Bioenergia* is located in the municipality of Edéia, south of Goiás. The unit currently operates at less than full capacity, but could produce up to 435 million liters of ethanol per harvest (MENDONÇA, PITTA, and XAVIER, 2011, p. 8).

According to the local press, *Diário da Manhã* (2011), the government signed an investment pre-contract with BP worth a billion dollars for investment in the Itumbiara plant, which, in addition to doubling its grinding capacity, intends to create a system for the co-generation of power with sugarcane bagasse.

The Public Prosecutor's Office prosecuted the Itumbiara *CNAA* plant due to non-payment of environmental compensation for causing "[...] a considerable environmental impact, as stipulated by article 36 of Federal Law 9,985/2000 during the aforementioned proceedings". The *Tropical Bioenergia* plant in the municipality of Edéia was denounced for irregularities in its working conditions and responded to a civil investigation by the Ministry of Labor, drafted in February 2009, to investigate these allegations of the degrading working conditions of rural workers.

The study is set against this background of the transfer of technological capital and Brazilian resources to foreign companies. The resulting environmental and social liabilities must be evaluated.

Data obtained from the Ministry of Agriculture, Livestock and Supply (MAPA, 2010) indicated that the state of Goiás had 33 sugarcane industries working at full capacity<sup>4</sup>. Of these, 11 produce sugar and ethanol while 22 only produce ethanol. With the 2009/2010 harvest, Goiás became the fourth largest state in terms of sugarcane acreage in Brazil and the second largest producer of ethanol (MAPA, 2010). During 2011 (2011/2012 harvest) the numbers were repeated (PIETRAFESA et al., 2011). According to José Maria, responsible for salary policy at the Goiás Agricultural Workers' Federation (*Fetaeg*), in the 2013/2014 season there will be 39 industrial plants processing sugarcane for the production of energy, ethanol and sugar.

The expansion of the sugarcane industry into the Cerrado biome enjoys comparative advantages in terms of topographical issues, since the land is flat and the soil has improved as a result of other agricultural activities (soybeans and pasture, for example). According to the Agrofuel Secretary of the Ministry of Agriculture, Dr. Manoel Bertone:

[...] The region is suitable for the industry because of its flat, fertile land (which facilitates mechanization), rainfall and even the price of land". [...] Goiás could increase its production because Sao Paulo already "produces lots of sugarcane" and has less room for expansion (*FOLHA DE SÃO PAULO*, 2009).

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4. These data reflect the position on 01/07/2010 (MAPA, 2010).

Besides the availability of land and transportation infrastructure, the recently established Sugarcane Agroecological Zoning<sup>5</sup> is yet another boost to the expansion of sugarcane cultivation in the Cerrado, especially in Goiás. According to projections made by the Brazilian Agricultural Research Corporation (*EMBRAPA*), 157.4 million hectares (18.5% of the national territory) is the area considered for zoning without restrictions (MANZATTO, 2009). Of this total, 64.7 million hectares are considered suitable for the cultivation of sugarcane in Brazil, because of favorable soil conditions (fertility, slope, etc.) and availability of water (SILVA, 2010)<sup>6</sup>. After excluding the Pantanal and the Amazon, the zoning covers the largest area in the Midwest, where there are 16.6 million hectares suitable for the expansion of sugarcane plantation. The research carried out by *EMBRAPA*, to define the zoning of the sugarcane industry identified the most suitable areas in the state of Goiás, totaling more than 12 million hectares, available for expansion of the national sugarcane industry and open to international investors.

With this perspective of expansion, the Goiás State Department of Agriculture announced that over 80 plant projects have been approved indicating future growth of production in the State. A report in the *Folha de São Paulo* newspaper (08/09/2009) on the expansion of sugarcane cropland, which found an increase in production, stated that the sugarcane industry in the State has grown at a faster rate than in other Brazilian regions. According to the newspaper, growth would be 10% in the country as a whole, but “[... ] in recent years, about 20 plants have started operating in the State, which would increase the production of sugarcane in the 2009/2010 harvest by 54% when compared to that of 2008/2009” (*FOLHA DE SÃO PAULO*, 2009).

According to the National Company of Supply (Conab, in Portuguese), an agency linked to the Ministry of Agriculture and Livestock (MAPA, in Portuguese) the area planted with sugarcane to supply the units of production of ethanol, sugar and energy had a slight decrease of 0,1%. The crop of 2014-2015 reached an area of 9.004 million hectares while the harvest of 2015-2016 extended 8.995 million hectares. For Conab’s technicians, the loss of area is due to hydric problems, especially in the Northeast and Southeast of Brazil, where there was a decrease in rainfall in at least three consecutive harvests.

The state of Goiás appears in the Conab’s investigation as the second largest producer of cane in the country (854.200 hectares planted crop in 2014-2015 to 908.000 hectares, with a 6,3% increase) and the first in productivity (77.650 ton per hectare to 78.551, an increase of 1,2%).

It is notice, even with the Brazilian economic crisis, the area of biofuel production continues to expand in the Brazilian Midwest and in the state of Goiás, in particular.

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5. This zoning delimiting lands suitable for the cultivation of sugarcane was established by Law 6,961, on 17/09/2009, which “approved the agroecological zoning of sugarcane and decreed that the *Conselho Monetário Nacional* establish norms for funding the biofuel sector in the zoning terms.

6. This study also considered that the land presently used for grazing, a total of 34.2 million hectares, was suitable for the expansion of sugarcane (SILVA, 2010).



## The municipality of Edéia in the context of the internationalization of the sugarcane sector

The municipality of Edéia is located in the southern part of the state of Goiás, in the mesoregion of the Vale do Rio dos Bois, 111 kilometers from the state capital, Goiânia. It was set up in 1948 by State Law 155<sup>7</sup>, and has a population of 11,266, according to the 2010/IBGE demographic census. Out of this total, 9,538 were living in urban areas while 1,728 were living in the countryside (IBGE, 2010)<sup>8</sup>. These data would indicate that the population distribution of the municipality is different from state and national averages, as its urbanization rate is close to 90%, and the vast majority of its residents are concentrated in urban areas (national average is 80%).

With regard to the social aspects of the municipality, 88.69% of its residents were considered literate, and 2,634 students were enrolled in pre-school, elementary and high school education in 2011. According to an official of the Municipal Department of Education, there have been no rural schools in the municipality for at least 10 years. The few children who live with their families in rural areas use a shuttle service offered by the town hall to transport them to schools on the outskirts of the town.

In 2006, higher education was introduced to Edéia with the setting up of the State University of Goiás (UEG) offering three courses: Technology in Agriculture and Livestock, Technology in Sugarcane Production and Technology in Agribusiness. It can be seen that there are close links between the setting up of UEG in 2006, the installation of the plant and the type of courses offered to the local population. Table 1 shows that the planting of sugarcane began in 2007, the courses started in 2006 and the first classes graduated in 2009 (technological courses last up to three years). Certain public policies and capital go together.

In terms of health, the municipality has six centers, consisting of two hospitals (*Santa Cecília* and that of the Farmer's Union) and four daycare centers, with a total of 26 inpatient beds but with no intensive care unit (SEPLAN, 2011; IBGE, 2009). The sanitation issue is similar to that of other municipalities in the state of Goiás. The public sector provides treated water for 97.3% of the urban population, but there is no sewage system (IBGE, 2008; SANEAGO, 2011). The rural area provides its own services depending on local environmental conditions (wells, springs and cesspits).

The main economic activity in the municipality of Edéia is agriculture. Production in the different branches of the economy is thus distributed: agriculture represents 49.5% of Gross Domestic Product (GDP), services 38.77%, industry 7.08% and public administration 4.65% (SEPLAN, 2008). Although the data are from 2008, it can be seen that agriculture is the dominant sector of the production system.

The agrarian structure of the municipality is characterized by concentration, with an average 540 hectares per productive unit for the non-family units, and an average

7. Information available at the Instituto Brasileiro de Geografia e Estatística (IBGE) website: [http://www.ibge.gov.br/cidadesat/historicos\\_cidades/historico\\_conteudo.php?codmun=520740](http://www.ibge.gov.br/cidadesat/historicos_cidades/historico_conteudo.php?codmun=520740). Accessed on 30/12/2011.

8. Information available at the Instituto Brasileiro de Geografia e Estatística (IBGE) website: <http://www.ibge.gov.br/cidadesat/topwindow.htm?1> accessed on 30/12/2011.

of 37 hectares per family farm. Absolute numbers are distributed as follows: 257 family farms, covering 9,591 hectares and 219 non-family farms covering 118,386 hectares (IBGE, 2006). These data indicate that there is little room in the municipal agrarian structure for family farms, despite the large number of producers in this classification. In 2006 the average number of hectares per production unit indicated that the *latifundio* predominates in the municipality.

As shown in Tables 1 and 2 below, soybeans and livestock are still the main agricultural activities in the economy of Edéia. It can be seen that, with the setting up of the *Tropical Bioenergia S/A* plant, these activities began to decline. The *SEPIN* data (2013) for the mesoregion indicate that there was a reduction in soybean plantations and in the number of cattle and that part of this production moved to neighboring municipalities or even other regions within the State.

There was also a reduction in the milk cow herd. This economic sector is a predominant part of family farming. Even without statistics indicating a direct relationship between this sector and the expansion of sugarcane plantation it is possible to hypothesize that the expansion of one sector led to a reduction in the other.

The production of sugarcane has been on the increase since 2007, and ranked second in terms of agricultural land use in the municipality in 2013. This expansion coincides with the setting up of the *Tropical Bioenergia S/A* plant on 02/04/2007. For the 2011 harvest the CANASAT site reported that there were 16,347 hectares of sugarcane planted in the municipality which increased to 20,087 hectares in 2012. This was an increase of 22% in the area cultivated from one harvest to the next.

Tables 1 and 2 show that soybean and livestock production involves the use of extensive stretches of municipal land. From 2000 to 2003, soybean plantation increased from 34,000 to 60,000 hectares. In subsequent years, however, the area under production gradually decreased, and with the international crisis of 2009 it plunged to 45,000 hectares. However, in 2009, data on the growth of sugarcane crops may have influenced the substitution of soybean plantation. Between 2009 and 2010 soybean production stabilized at 45,000 hectares (this productive system is part of the sugarcane cycle through soil recycling and the planting of corn is also used), but there was a further reduction in the 2011 crop. In 2013 the soybean production reached the lowest number, 35,000 hectares.

**Table 1:** Agricultural Production in Edéia – Per Base Year - Harvested Area (ha)

| Type of Production | 2000   | 2003   | 2006   | 2009   | 2010   | 2011   | 2012   | 2013   |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Rice               | 200    | 200    | 300    | 200    | 200    | 200    | 0      | 0      |
| Beans              | -      | 31     | 83     | -      | -      | -      | -      | -      |
| Corn               | 4,500  | 1,000  | 1,300  | 5,500  | 5,500  | 2,800  | 5,000  | 2,000  |
| Soybeans           | 34,000 | 60,000 | 57,800 | 45,000 | 45,000 | 40,000 | 37,000 | 35,000 |
| Sugarcane          | 0      | 0      | 0      | 13,472 | 14,954 | 15,860 | 12,500 | 17,000 |

Data available up to 2013.

Source: <http://www.imb.go.gov.br/> (municipal statistics -- time series per product)

**Table 2:** Herd numbers in Edéia - Per Base Year - Head

| Type of Production | 2000   | 2003   | 2006   | 2009   | 2010   | 2011   | 2012   | 2013   |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Cattle herd        | 88,330 | 75,810 | 79,430 | 85,850 | 81,550 | 79,300 | 78,200 | 69,500 |
| Herd of milk cows  | 9,580  | 7,580  | 7,950  | 8,010  | 7,340  | 6,650  | 6,500  | 6,300  |

Data available up to 2013.

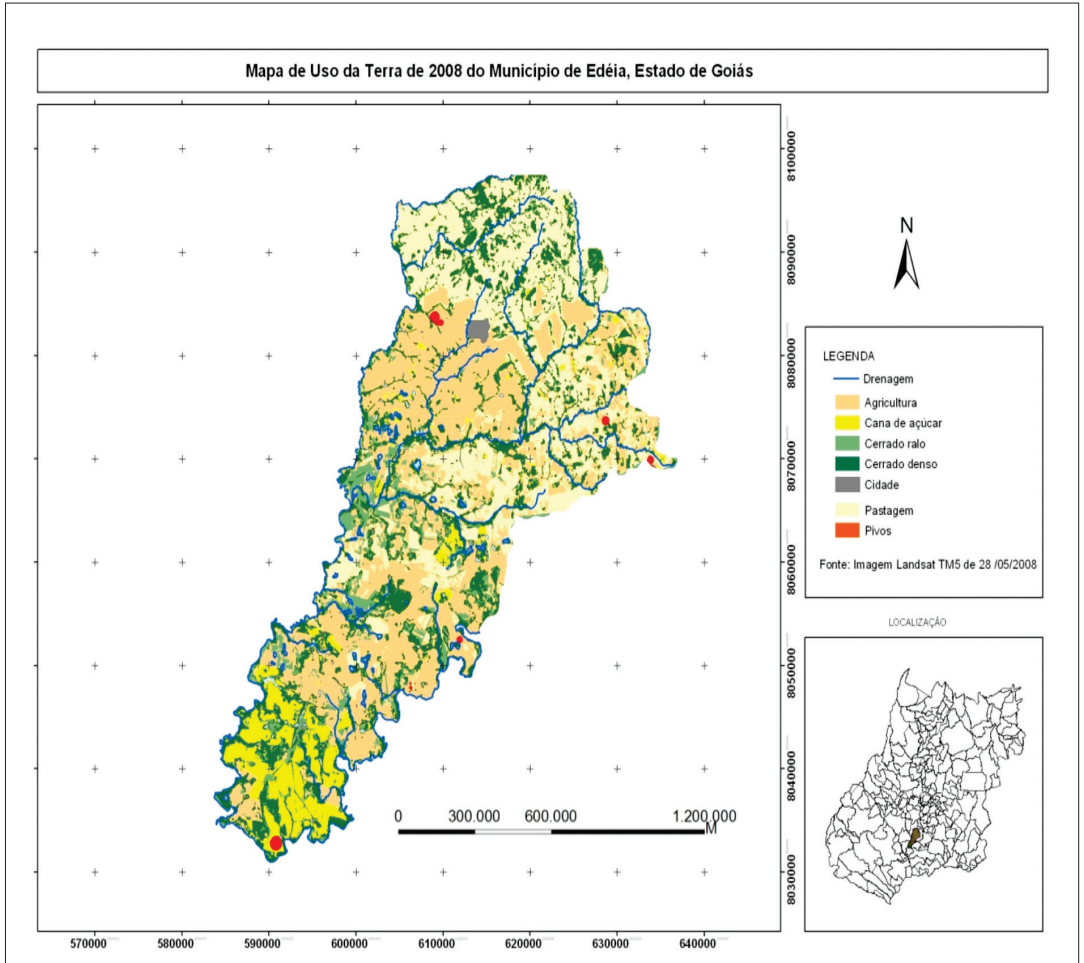
Source: <http://www.imb.gov.br/> (municipal statistics - time series per product)

The Municipal Secretary of the Environment has stated that the *Tropical Bioenergia* (BP) plant is planning to build a second plant about 25 km from Edéia, near the Fala Verdade River. (see Map 3) The land for the building has already been acquired and the projects for the engineering design and environmental license are under way. The Secretary also stated that areas leased for soybean production (2011-2012) in the vicinity of the future plant will be used for sugarcane production as of the 2013 harvest. This can be seen from the data in Table 1, where the soybean area decreased in the 2013 harvest, while sugarcane production increased over the same period.

In the early 2000s, a total of 88,330 head of cattle was recorded. This number decreased until 2013 when 69,500 head were recorded. There could have been a move from cattle fattening to sugarcane, as there was a reduction of more than ten thousand in the cattle herd in the municipality over 10 years. This hypothesis is reinforced by information from people working with the institutions engaged in rural activities. An official from the Goiás Agency for Agricultural Defense (*AGRODEFESA*) and an employee of the Catholic parish of São Sebastião claimed that the number of small farmers is gradually decreasing, as there has also been a reduction in livestock rearing and dairy production in this sector and many are leasing or selling their land for the cultivation of sugarcane or soybeans.

Areas for the cultivation of other agricultural crops are considerably smaller than those given over to soybeans. The production of rice, for example, currently occupies only 200 hectares, corn 5.500 hectares (This crop also rotates with soybeans and sugarcane), and common beans have not been planted since 2008. Figures 1 and 2 below show soil use and crop distribution within the municipality.

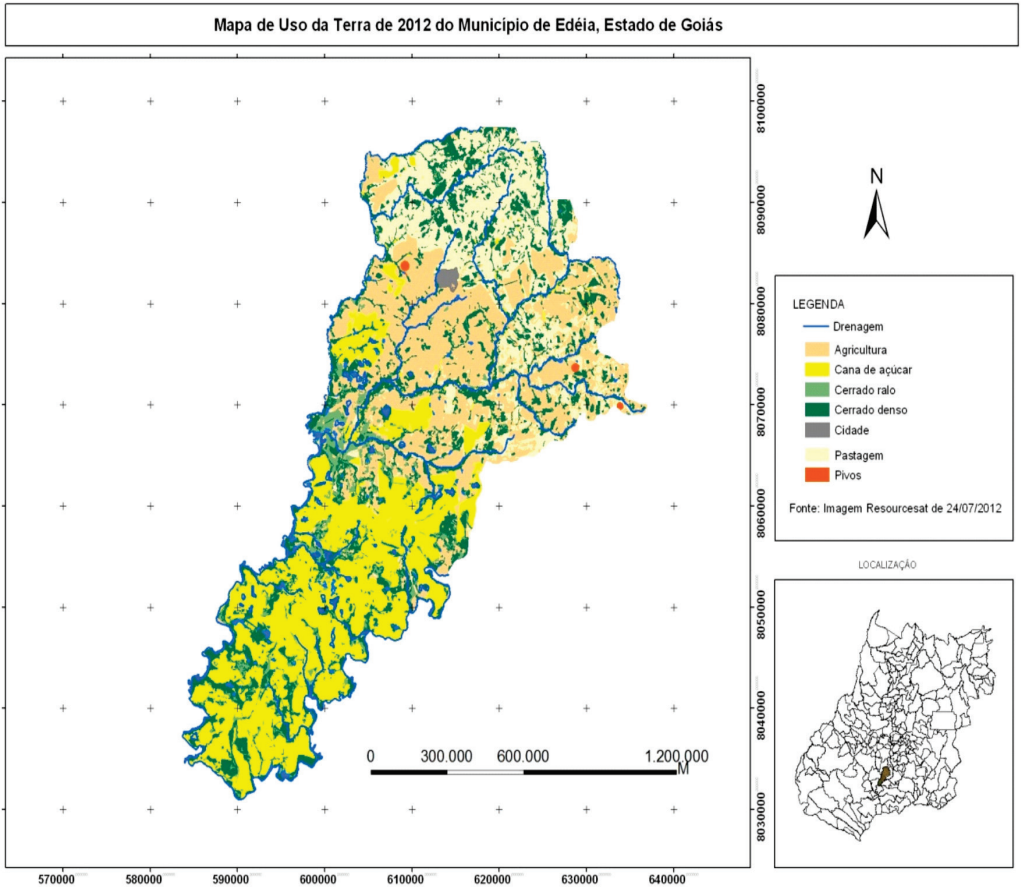
It can be seen from Figures 1 and 2 that the sugarcane plantations expanded in the southern part of the municipality of Edéia, on the borders between the municipalities of Vicentinópolis, Porteirão, and Tuverlândia. According to Virmondes Martins de Arruda Martins (former sugarcane cutter who accompanied this field visit), there are also small stretches of sugarcane cultivation in the northwest and center of the municipality in the vicinity of the Fala Verdade River (identified by the Secretary of the Environment as a possible site for expansion of the *Tropical Bioenergia* plant) and some natural lagoons, formed by springs.



**Figure 1:** Evolution of sugarcane monoculture - municipality of Edéia (Goiás) – 2008

Source: Department of Finance, Goiás (2013)

Drawn up by Maria Gonçalves da Silva Barbalho

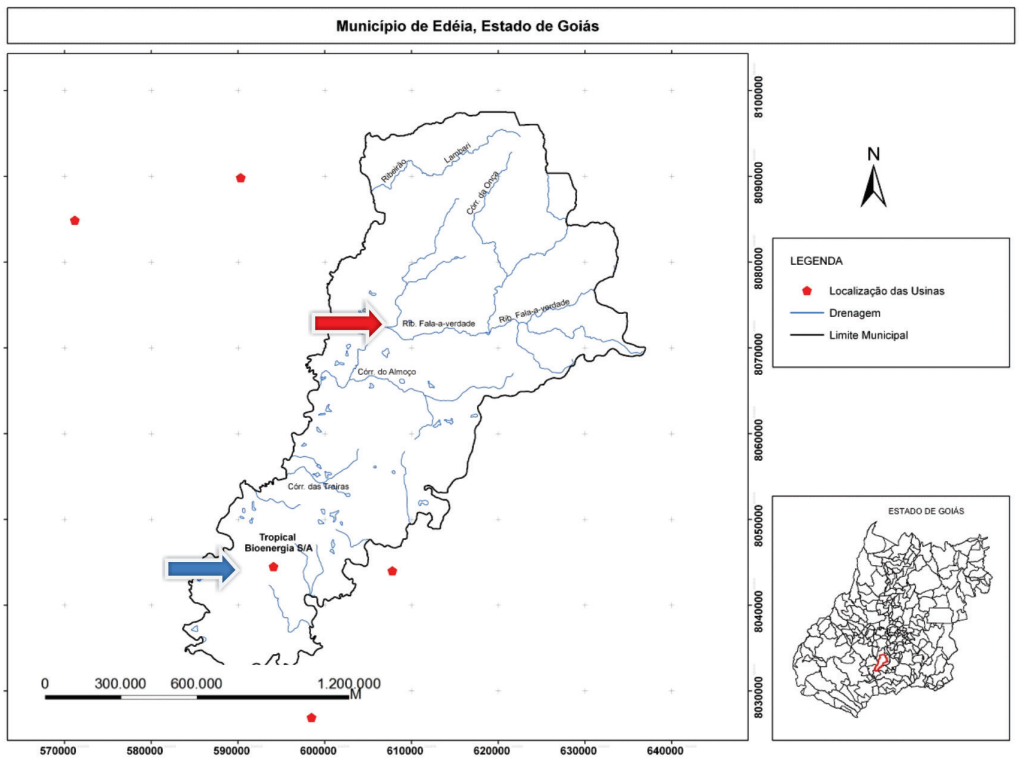


**Figure 2:** Evolution of sugarcane monoculture - municipality of Edéia (GO) – 2012

Source: Department of Finance, Goiás (2013)

Drawn up by Maria Gonçalves da Silva Barbalho

The dos Pombas, Veredão, Turvo and dos Bois Rivers, as well as the Ataque, Fala Verdade and Galheiro Streams flow through the municipality. On comparing Figure 2, which shows the evolution of sugarcane monoculture in 2012 with Figure 3, which presents part of the Parnaíba river basin, within which Edéia is located, it can be seen that the dos Pombas, Veredão, dos Bois and Turvo rivers, as well as some of their tributaries could provide water for sugarcane crops. The existing literature indicates that sugarcane requires large amounts of water if it is to develop fully. This would explain why the new Tropical Bioenergia plant is being established near the Fala Verdade stream.



→ Location of Fala Verdade River. Projection of the second installation of Tropical Bioenergia S/A

→ Location of Tropical Bioenergia S/A plant

**Figure 3:** Map identifying water resources and location of the Edéia Tropical Bioenergia plant and installation of the future industrial plant.

Source: Department of Finance, Goiás (2013)

Drawn up by Maria Gonçalves da Silva Barbalho

## The Tropical Bioenergia plant and environmental liabilities of the expansion of sugarcane plantations in Edéia

The construction of the Edéia *Tropical Bioenergia* plant was finished on August 10, 2006 and it went into operation in October 2008. Initial investment in the plant was in the region of R\$125 million and the owners received tax incentives of about R\$511 million from the State government. In 2007, *Tropical Bioenergia* (BP) also received R\$10 million in funding from the Constitutional Fund for the Midwest (*FCO*) to acquire 12 harvesters, 48 sugarcane transporters, 40 trailers and 20 dollies. In 2011, the plant received another *FCO* loan of R\$7.6 million for the purchase of machinery, spare parts and materials, assembly plants and equipment (*SEPLAN*, 2011).

In an interview, a Goiás Agricultural Defense Agency (*AGRODEFESA*) official said that the setting up of the plant had both positive and negative consequences for the daily lives of Edéia residents. The positive changes included: job creation and greater circulation of money in the town of Edéia, which led to the expansion of the service sector and business. Negative changes included increased urban violence, with the incidence of a new type of crime: armed robberies, for example, which had never occurred beforehand; cases of small farmers selling their land and migrating to the state of Tocantins, and the fact that the sugarcane monoculture has taken over the municipality.

In 2008, the only lawsuit involving environmental impacts in Edéia resulting from the expansion of the sugarcane sector was brought before the courts. The owner of Volta Grande farm sued the *Tropical Bioenergia* plant because of a fire which destroyed part of his property used for cattle grazing<sup>9</sup>. A large portion of the farm of about 825 ha had been leased to *Tropical Bioenergia* for the cultivation of sugarcane. A further 242 ha with a capacity for 754 head of cattle were used for grazing. Both the consultancy firm, Technology on the Environment (*EMA*) and the technical report of the *Centro de Apoio Técnico Pericial* at the Goiás State Public Prosecutor's Office (*CATEP-MP-GO*) found that the entire area intended for sugarcane had been burned, as well as 173.32 ha of grassland, 59.40 ha of open savannah and the banks of the Cágado river. The case was accompanied by the Public Prosecutor in the person of the district attorney, Maria Cecilia de Jesus Ferreira.

According to the Public Prosecutor Office experts, a fire in rural areas can cause the following environmental problems: vegetation destruction through burning; damaged soil organic matter, which provides nutrients to plants and also improves soil structure by increasing the rate of water infiltration; triggering of erosion; increased soil temperatures in the shallowest layer thereby reducing the intensity of soil microfauna activity; and, reduced soil moisture. Literature on the theme corroborates the diagnoses submitted by *MP-GO* environmental experts on the fire-induced damage.

According to Szmrecsányi and Gonçalves (2009), fire alters the chemical, physical and biological composition of the soil and thereby damages the nutrient cycle. Fires can even lead to desertification as a result of the destruction of native forest cover and the lack of protection of springs and water resources which affects rainfall

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9. Lawsuit 2009.0164.3232.

cycles. In addition to the above-mentioned damage, fires release large quantities of carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) into the atmosphere thereby reducing photosynthesis and increasing the destruction of the ozone layer (ZAMPELINI, 1997; SZMRECSÁNYI and GONÇALVES, 2009; *REPORTER BRASIL*, 2009). All these above-mentioned consequences contribute to further global climate change.

The sugarcane sector exerts indirect and direct influences on Brazilian greenhouse gases emissions. The indirect effects on GHGs emissions is result of the use of land in the sugarcane industry. The expansion of bioethanol production occurred in areas previously occupied by pasture and crops (mainly, soy). Once the agriculture and livestock breeding is replace by sugarcane production in one region, these sectors move to other areas, this movement causes the deforestation of Cerrado biome (SAWYER, 2009).

Regarding to direct emissions from ethanol production, Claros Garcia and Von Sperling (2010) argue that the burning of sugarcane fields, fuel consumed in the production cycle and the use of nitrogen to expand the soil fertility are the main factors for greenhouse gas emissions in the ethanol production process. The modernization of harvesting methods decreased but not eliminated the use of burning in the management of all sugarcane plantations. The authors estimated that burning accounts for 28,21% of GHG emissions in ethanol production. The consumption of fossil fuels in mechanical harvesting, loading and transportation emits 21,9% of GHG. The discharge nitrogen in the soil contributed to greenhouse gas emission in 21,53%.

According to *EMA* consultants, in the case of the burning of the sugarcane fields in Edéia the fire was deliberately started simultaneously in two opposite points of the plantation. Evidence of lightning was investigated by satellites of the bodies responsible for climate control in the State of Goiás - the Department of Science and Technology (*Sectec*) – and in the State of Paraná – the Bureau of Meteorology (*SIMEPAR*) - and in the federal government - National Integrated Lightening Detection Network (*RINDAT*), but no trace was found. The *Tropical Bioenergia* Company presented the Meteorological Report of the Department of Science and Technology of the State of Goiás (*Sectec*) in its defense, which stated that there had been cloud formation accompanied by heavy rain, lightning and wind gusts, to justify its claim that the burning was started by lightning. *Tropical Bioenergia*, using a study by Fielder, Merlo and Medeiros (2006), argued that lightning is the main cause of fire in rural areas. But these data were subsequently challenged by the *MP-GO* as that study was conducted in Conservation Units, where human activity is very limited, and yet the Fielder, Merlo, and Medeiros (2006) study pointed out that in the case of the Chapada dos Veadeiros National Park only 11.76% of fires are caused by lightning while the remaining 88.24% have anthropogenic origins.

In contrast to the argument submitted by *Tropical Bioenergia* for that case, a study conducted by researchers Bontempo, Lima, and Ribeiro (2011), at the Federal University of Viçosa, indicates that natural causes are responsible for only 2% of fires in all of Brazil, and accidents account for 8% of the statistics. According to the study, 35.4% of fires are deliberate and 26.8% are due to the negligent use of fire. Thus, it was seen that 62.2% of fires involved human action, but this does not allow one to say that all were of criminal origin.



Experts at the Goiás Public Prosecutor's Office have concluded that there is strong evidence of deliberate burning of the land intended for planting sugarcane on the part of *Tropical Bioenergia*. The fact disrespects Resolution 082/2007 of the State Department for the Environment and Water Resources (*SEMARH*), which prohibits the use of burned sugarcane throughout the production process of the raw material. The first article of the said resolution also prohibits the granting of environmental permits to plants being established in the state of Goiás if they burn sugarcane bagasse while harvesting any material used in its industrialization. According to *EMBRAPA* (2011), burning not only makes harvesting easier and cheaper, but it also increases the concentration of sucrose in the stalks of the plants which consequently expands the production of sugar and ethanol and these advantages justify burning.

The fire on the Volta Grande farm occurred in September 2008. One year later, Public Prosecutor Office experts prepared the technical report at the request of the prosecutor, Dr. Maria Cecilia de Jesus Ferreira. Through satellite images they discovered that the *Tropical Bioenergia* plant was continuing to use the burning of sugarcane as a production method. According to the *MP-GO* team of experts a washing system would be needed to process the entire amount of burnt sugarcane. In the case of raw sugarcane, a waterless system is used. On the day of inspection at the plant, experts witnessed the arrival of a vehicle with the products required for the washing of sugarcane, which would indicate that *Tropical Bioenergia* does have the technology to receive and process burnt cane. The images below demonstrate the existence of harvesters for collecting burnt sugarcane.



**Figure 4:** Detail from the previous picture, the red circles show the vehicles used for harvesting in a burnt area.

**Source:** *Centro de Apoio Técnico Pericial (CATEP - MP-GO)*, Goiás Prosecutor's Office

In judging the merits of the case of the previously-mentioned environmental liabilities, Mr. Justice Hermes Pereira Vidigal found that the complaint of the Volta Grande farm owner was ungrounded, namely that *Tropical Bioenergia* either deliberately or negligently caused the fire which burned his cattle-grazing land. In his statement (attached) the judge considered that there was no proof of recklessness in the performance of their activities on the part of the defendant, as there was a detection and fire-fighting team on the Company's land.

### **Final considerations**

The data presented in this paper highlight the increase in the flow of international capital investment in the sugarcane industry in the state of Goiás, which is in consonance with the rate of national increase. This phenomenon involved not only petroleum-based companies such as Royal Dutch Shell and British Petroleum, but also food production companies. These multinationals acquired ethanol production plants in the last decade and also got incentives for investment in Goiás. The State Government participated with fiscal and financial support in the process of the internationalization of ethanol production. In the case of financial assistance, it was allocated more than R\$17 million from the Midwestern Constitutional Fund (*FCO*) for the purchase of equipment, as announced by the local press.

As the internationalization of the ethanol production chain is relatively recent, dating from the late (noughties), the social impacts of the economic transformation are still imperceptible. What could be seen from the case study in the municipality of Edéia (Goiás) was a certain increase in employment which encouraged migration into the municipality. As well as the positive externalities deriving from the international capital investment cited above, there were also negative changes in terms of the social aspects in Edéia. Given that the municipal administrative structure is fragile, its urban infrastructure cannot cope with a very large migration flow. There are also problems in providing public services, including public security. This is identified with the increasing urban violence in Edéia, and a type of crime never before experienced, namely armed robbery. Another problem involves the precarious lifestyle of family farmers in the region. With the expansion of sugarcane monoculture, it is difficult for family farmers to adapt to the new reality of agricultural production. This has led some farmers to sell their properties, while at the same time, data on milk production has shown a reduction in the number of milk cows. (Table 2)

The phenomenon of the internationalization of ethanol production requires further studies in terms of its social aspects, as well as its environmental and economic aspects. This article was part of a study of investments by British Petroleum, but awakened curiosity for further work on this reality in Brazil and, in particular, the state of Goiás.

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