

**UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
CENTRO DE ESTUDOS E PESQUISAS EM AGRONEGÓCIOS
PROGRAMA DE PÓS-GRADUAÇÃO EM AGRONEGÓCIOS**

**MATOPIBA: MUDANÇAS NO USO DA TERRA NA NOVA FRONTEIRA
AGRÍCOLA DO BRASIL E IMPACTOS SOCIOECONÔMICOS**

JOANA COLUSSI

PORTO ALEGRE

2017

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MATOPIBA: MUDANÇAS NO USO DA TERRA NA NOVA FRONTEIRA AGRÍCOLA DO BRASIL E IMPACTOS SOCIOECONÔMICOS¹

Autor: Joana Colussi

Orientador: Júlio Otávio Jardim Barcellos

Coorientador: Homero Dewes

RESUMO

As mudanças no uso da terra nas últimas décadas foram impulsionadas pela expansão da agricultura e pelo crescimento da demanda internacional por produtos alimentares. No Brasil, um novo território emergiu e se consolidou no cerrado do Norte e Nordeste em menos de 20 anos. Chamada de Matopiba, sigla formada pelas iniciais dos quatro estados que a formam – Maranhão, Tocantins, Piauí e Bahia -, a região é considerada uma das últimas fronteiras agrícolas em grande escala no mundo. As causas e consequências da formação desse território, contudo, ainda são pouco estudadas na literatura. Por conta disso, esta pesquisa busca preencher uma lacuna ao identificar os fatores diretos e indiretos que resultaram na alteração do uso do solo no cerrado nordestino, além de analisar como a dinâmica do agronegócio impactou nos indicadores socioeconômicos da região. Para tanto, a pesquisa baseia-se em dados de sensoriamento remoto dos 337 municípios que compõem a nova fronteira, combinados com censos agrícolas e demográficos, informações de mercado, de investimentos públicos e privados e da atuação de grandes companhias. Além disso, o estudo utiliza entrevistas não-estruturadas com informantes-chave. Os resultados mostram que a formação da região está relacionada com a expansão da agricultura, com a soja ocupando o equivalente a 61% da área cultivada com grãos. A disponibilidade de grandes extensões de terra a preços baixos e a valorização da commodity foram determinantes para o movimento, consolidado a partir dos anos 2000. A influência de instituições formais e informais, como trades e indústrias, também exerceu papel relevante para estruturar as atividades agrícolas no Matopiba – desde a produção, armazenamento, transporte até o comércio. Dentro de um modelo globalizado, empresas multinacionais deram suporte à expansão agrícola, assumindo controle privilegiado da produção por meio do fornecimento de crédito, insumos e garantia de compra. O dinamismo trazido pelo agronegócio fez o Produto Interno Bruto (PIB) e o Índice de Desenvolvimento Humano (IDH) da região crescerem acima das médias nacionais e estaduais em 20 anos. Entretanto, o aumento não se traduziu em melhores condições de vida para toda a população, como indicado pelo alto nível de concentração de renda. O estudo evidencia que ainda não foram estruturadas cadeias produtivas completas, envolvendo indústrias e serviços com capacidade próprias de empuxe. Para alcançar o desenvolvimento regional pleno, o Matopiba precisa de uma ação institucional mais forte, com políticas voltadas à geração de empregos e melhor acesso à educação e à saúde. Embora o agronegócio tenha contribuído para alterar a base econômica e social do Matopiba, não se pode esperar que um setor sozinho reverta deficiências estruturais históricas do território.

Palavras-chave: cerrado, uso do solo, agricultura, Matopiba, desenvolvimento regional

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MATOPIBA: LAND USE CHANGES AND ITS SOCIOECONOMIC IMPACTS IN THE NEW BRAZILIAN AGRICULTURAL FRONTIER²

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Adviser: Júlio Otávio Jardim Barcellos

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ABSTRACT

Land use changes in over the last few decades have been driven by the expansion of agriculture and by the growth of food products demand internationally. In Brazil, a new territory has emerged and consolidated on the North and Northeast Cerrado in less than 20 years. Named “Matopiba”, acronym formed by the initials of the four states that form it – Maranhão, Tocantins, Piauí and Bahia – the region is considered one of the last large scale agricultural frontiers in the world. The causes and consequences of the emergence of this territory, however, are still under investigated in the literature. This research seeks to fill this gap through the identification of direct and indirect factors that have resulted in the land use changes in the Northeastern Cerrado and aims to analyze how the agribusiness dynamics has affected the socioeconomic indicators in the region. To achieve this, this research is based on remote sensing data of the 337 municipalities which make the new agricultural frontier, combined with agricultural and demographic census data, market information, public and private investment and the participation of large companies. Furthermore, this study makes use of non-structured interviews with key informants. The results show that the formation of this region is related to the expansion of agriculture, with soybean crops occupying the equivalent of 61% of the grains cultivated area. The availability of large extensions of land at low prices and the appreciation of the commodity have been determinant to the movement, consolidated from the 2000s decade. The influence of formal and informal institutions, such as trades and industries, has also played a relevant role to structure agricultural activities in Matopiba – from the production, storage, transportation to the market. Within a globalized model, multinational companies have given support to the expansion, taking a privileged position in the control of production through the supply of credit, inputs and purchase guarantees. The dynamism brought by agribusiness caused the Gross Domestic Product (GDP) and Human Development Index (HDI) of the region to grow above the national and state averages over the last 20 years. In spite of that, the growth did not translate into better living conditions for the whole population, as indicated by the high levels of income concentration. The research shows that complete production chains have not yet been structure, that encompass industries and services with an inbuilt pull capacity. To reach full regional development, Matopiba needs stronger instutional action, with policies directed to the generation of jobs and better access to education and health services. Even though agribusiness has contributed to alter the economic and social base of Matopiba, it cannot be expected that a sector alone will revert historical structural deficiencies of the territory.

Keywords: Brazilian cerrado, land use, agriculture, Matopiba, regional development

² Master dissertation in Agribusiness – Matopiba: land use changes and socioeconomic impacts in the new Brazilian agricultural frontier, Center for Studies and Research in Agribusiness, Federal University of Rio Grande do Sul, Porto Alegre, Brazil (98 p.) March 2017.

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LISTA DE ABREVIACÕES

- ABIOVE** - Associação Brasileira das Indústrias de Óleos Vegetais
- AIBA** – Associação de Agricultores e Irrigantes da Bahia
- BA** - Bahia
- CAIs** – Complexos Agroindustriais
- CONAB** – Companhia Nacional de Abastecimento
- DATALUTA** – Banco de Dados da Luta pela Terra
- EMBRAPA** – Empresa Brasileira de Pesquisa Agropecuária
- FAO** – Organização das Nações Unidas para a Alimentação e a Agricultura
- IBGE** – Instituto Brasileiro de Geografia e Estatística (IBGE)
- IDH** – Índice de Desenvolvimento Humano
- IFBA** – Instituto Federal de Educação, Ciência e Tecnologia da Bahia
- IPEA** – Instituto de Pesquisa Econômica Aplicada
- LANDSAT** – Land Remote Sensing Satellite
- MA** - Maranhão
- MAPA** – Ministério da Agricultura, Pecuária e Abastecimento
- MATOPIBA** – Acrônimo formado pelas iniciais dos quatro estados que formam a região: Maranhão, Tocantins, Piauí e Bahia
- MMA** – Ministério do Meio Ambiente
- MCTI** – Ministério da Ciência, Tecnologia e Inovação
- MODIS** – Moderate-Resolution Imaging Spectroradiometer
- NEI** – Nova Economia Institucional
- OCB** - Organização das Cooperativas do Brasil
- OECD** – Organização para Cooperação e Desenvolvimento Econômico
- PAC** – Programa de Aceleração do Crescimento
- PI** - Piauí
- PIB** – Produto Interno Bruto
- PNUD** – Programa das Nações Unidas para o Desenvolvimento
- PROBIO** – Programa Nacional de Conservação da Biodiversidade

PROTERRA – Programa de Redistribuição de Terras e de Estímulo à Agroindústria do Norte e Nordeste

RAIS – Relação Anual de Informações Sociais

SOMABRASIL – Sistema de Observação e Monitoramento da Agricultura no Brasil

TO - Tocantins

UEMA – Universidade Estadual do Maranhão

UESC – Universidade Estadual de Santa Cruz

UFMA – Universidade Federal do Maranhão

UFOB – Universidade Federal do Oeste da Bahia

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CAPÍTULO 1

*“Em busca de terras
férteis e do sonho de
mudar de vida,
agricultores gaúchos
deixaram tudo para
trás rumo a uma parte
pobre no Norte e no
Nordeste. Anos depois,
a saga transformou
a região e consolidou uma
nova fronteira agrícola”.*

(Matopiba Tchê, 2015)

1.1 INTRODUÇÃO GERAL

As investigações recentes sobre as mudanças do uso da terra no território brasileiro têm se concentrado na Amazônia e no Centro-Oeste. Entretanto, a região em que a área plantada com grãos mais cresce no Brasil é o cerrado nordestino (IBGE, 2016). Contudo, as causas e consequências desse movimento em direção a uma nova fronteira agrícola ainda são pouco estudadas na literatura.

Formada por parte dos estados do Maranhão, Tocantins, Piauí e Bahia, a nova região foi batizada de Matopiba (um acrônimo formado pelas iniciais dos quatro estados que a formam) e reconhecida oficialmente pelo governo brasileiro em 2015, quando produziu 10% da safra nacional de grãos (IBGE, 2015). A necessidade de uma delimitação territorial surgiu a partir dos órgãos governamentais, com o objetivo de atrair investimentos e desenvolvimento de pesquisas para a região (Embrapa, 2014).

A forma como o uso do solo se estabelece e se reorganiza difere conforme sua localização, sendo induzida por diversos fatores como transformações socioeconômicas e climáticas. As forças que conduzem essas mudanças são, geralmente, as necessidades humanas e seus processos ambientais (Briassoulis, 2000).

A expansão da agricultura e o crescimento de mercados domésticos e internacionais dos produtos alimentares têm se tornado os mais importantes motores das mudanças no uso do solo no Brasil (Rudel, 2007; Defries *et al.*, 2010). Os avanços tecnológicos e de produtividade tornaram a atividade agrícola mais rentável e atraente, aumentando o interesse em novas áreas (Lambin e Meyfroidt, 2011).

Nesse contexto, o cerrado tem sido o eixo de expansão agrícola intensiva nas últimas quatro décadas no país. A região tornou-se estratégica na incorporação de novas áreas por características que permitiram a expansão da produção nos padrões da agricultura moderna. A estrutura física, com vasta extensão de terras mecanizáveis e

condições climáticas, são alguns fatores que favoreceram a produção intensiva (Franco, 2001). O bioma cerrado ocupa aproximadamente 204 milhões de hectares do território nacional (2.039.386 km²), cerca de 25% do território brasileiro, distribuídos principalmente na região central do Brasil. A vegetação tem como característica a diversidade de ecossistemas com fisionomias que englobam as formações florestais, savânicas e campestres (Embrapa Cerrados, 2006 e Brasil, 2007).

A primeira fronteira agrícola no cerrado foi aberta na região Centro-Oeste, ainda na década de 1970, dentro de um amplo contexto de eventos e fatores favoráveis – desde características físicas propícias da região, passando pelo baixo preço relativo das terras, incentivo estatal, migração de novos agentes (agricultura e empresas) até o aumento da demanda interna e externa por alimentos (Frederico, 2009).

A partir da década de 1990, dentro de um novo contexto de políticas neoliberais e maior controle da produção pelo capital privado, começa a ser explorado o cerrado do Norte e Nordeste – objeto de estudo desta pesquisa. Embora a conversão de áreas de vegetação nativa tenha iniciado nos anos 1990, no Oeste da Bahia, foi a partir dos anos 2000 que a região se consolidou como uma nova fronteira agrícola – considerada hoje a última em grande escala no mundo (OECD/FAO, 2015). A trajetória da região e a análise das causas próximas e adjacentes que resultaram na formação do Matopiba é o tema central do capítulo 2 deste trabalho.

Além das causas das mudanças no uso e na ocupação das terras, a pesquisa traz uma compreensão de como esse movimento culminou em um novo dinamismo econômico, com o surgimento de polos de desenvolvimento focados na agricultura intensificada (Miranda et al., 2014). O expressivo crescimento do setor primário causou um influxo de investimentos relacionados ao agronegócio. As necessidades da atividade criaram novas demandas de comércio e serviços, por conta da modernização da

agricultura que envolve o uso de máquinas, fertilizantes, defensivos, sementes, serviços técnicos, crédito entre outros (Santos, 2016; Elias, 2013). Partindo do papel exercido por grandes companhias na ocupação da nova fronteira agrícola, o segundo artigo analisa como a presença do agronegócio impactou nos indicadores socioeconômicos em 20 anos e aponta caminhos para o desenvolvimento sustentado da região.

1.2 MOTIVAÇÃO E JUSTIFICATIVA DE PESQUISA

Pela primeira vez, em 2015, o Nordeste brasileiro produziu mais grãos do que o Sudeste. No período de 2001 a 2013, o cerrado nordestino foi a região onde a expansão da agricultura foi mais significativa no Brasil (Graesser *et al.*, 2015). E o horizonte é promissor: enquanto a safra de grãos cresce 3,5% no Brasil, em média, o avanço chega a 20% ao ano no Matopiba (IBGE, 2015; Colussi, 2015).

A expansão da soja no Matopiba segue tendência nacional de crescimento da commodity, porém em uma velocidade superior. A cultura, que em 1995 ocupava 591 mil hectares na nova região, passou a ocupar 3,39 milhões de hectares em 2014. A produção saltou de 1,29 milhão de toneladas para 8,64 milhões de toneladas (Figura 1).

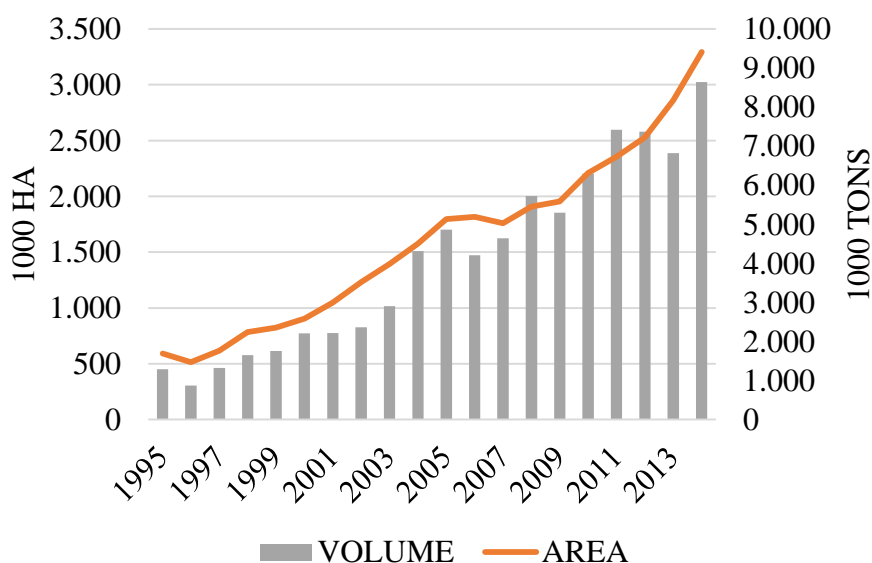


Figura 1: Variação da área e do volume de soja na região do Matopiba em 20 anos.
Fonte: Dados do IBGE (2015).

Na próxima década, na safra 2025/2026, a área plantada de grãos na região deverá crescer 13,7%, atingindo entre 8,7 milhões e 10,3 milhões de hectares cultivados. A produção de grãos também deve aumentar: de 19,4 milhões de toneladas no ciclo 2014/2015 para 24,5 milhões de toneladas na safra 2025/2026. No limite superior, o volume poderá chegar a 27,9 milhões de toneladas (Brasil, 2016).

Embora levantamentos e estimativas de safras comprovem a importância do Matopiba para a produção brasileira de grãos, do ponto de vista científico pouco se sabe sobre esse pedaço do Brasil que há menos de duas décadas era esquecido no interior do Norte e Nordeste e hoje ajuda a abastecer com alimentos a população mundial.

Por conseguinte, o ponto de partida da pesquisa é desenvolver um entendimento geral sobre as causas próximas e adjacentes que resultaram na criação do Matopiba. Além de identificar as forças diretas e indiretas que influenciaram na formação do território, o estudo analisa o conjunto de instituições que facilitaram o acesso a recursos como terra, crédito, insumos, tecnologia e infraestrutura. Em termos científicos, os resultados dessa investigação ajudam a lançar luz sobre uma região pouco conhecida até mesmo no meio acadêmico brasileiro, preenchendo uma lacuna na literatura.



Figura 2: Lavoura de algodão irrigada no Oeste da Bahia
Fonte: Fotografia Tadeu Vilani / Foto cortesia Zero Hora

Embora seja consenso que a expansão da agricultura em grande escala e mecanizada tenha o potencial de aumentar o desenvolvimento econômico, pelo menos em alguns contextos (Bragança, 2016), não está claro como a dinâmica do agronegócio impactou nos indicadores socioeconômicos do Matopiba. Dessa forma, o estudo é importante também para dimensionar os reflexos da agricultura na região e indicar caminhos para nortear políticas governamentais com vistas a um desenvolvimento pleno e sustentado do Matopiba. Apesar da nova fronteira possuir realidades distintas com particularidades próprias, fruto de diferenças históricas, culturais e políticas, a região enfrenta desafios semelhantes, com territórios relacionados em uma mesma lógica de produção.

E como a demanda global por produtos agrícolas continua aumentando, e a nova fronteira ainda tem áreas para serem convertidas em lavouras, é provável que esse processo de mudança do uso da terra tenha continuidade nos próximos anos – até porque a legislação ambiental no cerrado é menos rigorosa do que na Amazônia, por exemplo. Enquanto os proprietários de terras na Amazônia devem reservar 80% de sua propriedade como reserva legal, os produtores do cerrado devem reservar 20% de sua propriedade, a não ser que seus bens se enquadrem na Amazônia Legal, onde a reserva requerida aumenta para 35% (Françoso *et al.* 2015).

Considerar as características de cada bioma é fundamental também para formular estratégias de conservação e infraestrutura adequadas, além de entender os impactos da produção de alimentos e das mudanças no uso da terra em cada ambiente (Bowman *et al.*, 2012). Por fim, dada a importância das mudanças na cobertura do solo para a futura produção agrícola, há a necessidade de informações precisas sobre a distribuição espacial de terras agropastoris, transições históricas de uso da terra e as

diferentes áreas potencialmente disponíveis para expansão e intensificação (Lambin *et al.* 2000).

1.3 OBJETIVOS

1.3.1 Objetivo geral

Analisar as mudanças no uso da terra no Matopiba identificando as causas diretas e indiretas que resultaram na formação de uma nova fronteira agrícola no Brasil e seus impactos socioeconômicos na região.

1.3.2 Objetivos específicos

- a) Quantificar a expansão e evidenciar a territorialidade das atividades agrícolas na região, com destaque à produção de soja, milho e algodão.
- b) Descrever a influência das instituições, formais e informais, na migração de produtores e no acesso à terra, capital, tecnologia e infraestrutura.
- c) Analisar o papel exercido por grandes companhias e trades na nova ocupação do solo no cerrado do Norte e Nordeste.
- d) Entender como a dinâmica do agronegócio impactou nos indicadores socioeconômicos do Matopiba nos últimos 20 anos.

1.4 FUNDAMENTAÇÃO CONCEITUAL E TEÓRICA

1.4.1 Mudanças no uso da terra e novas fronteiras agrícolas

Os conceitos atribuídos à cobertura e ao uso da terra guardam íntima relação entre si e costumam ser aplicados alternativamente (IBGE, 2013). O uso da terra, dentre as várias definições existentes, é associado a uma série de operações desenvolvidas pelos homens, com a intenção de obter produtos e benefícios, através do uso dos recursos da terra (Bie, Leeuwen, Zuidema, 1996 apud IBGE, 2013).

O uso da terra está relacionado com a função socioeconômica (agricultura, habitação, proteção ambiental) da superfície básica. (Bossard, Feranec, Otahel, 2000, apud IBGE, 2013). Já a cobertura da terra é definida como os elementos da natureza, como a vegetação (natural e plantada), água, gelo, rocha nua, areia e superfícies similares, além das construções artificiais criadas pelo homem, que recobrem a superfície da terra (Bie; Leeuwen, Zuidema, 1996, Burley, 1961 apud Anderson *et al.*, 1979).

O uso do termo fronteira como resultado de povoamento e colonização, ao invés do usual de limite político, é atribuído a diferentes autores – com descrições distintas. O termo *front*, acrescido do adjetivo agrícola, refere-se às áreas de expansão de uma agricultura moderna (Latour, 1994). O *front* agrícola configura-se como uma região funcional à ação dos agentes mais relevantes, como grandes empresas e produtores, o que permite sua delimitação (Frederico, 2009).

A origem de novas fronteiras agrícolas é caracterizada pela existência inicial de áreas abundantes, na maior parte desocupadas, e por uma migração de capital e de pessoas (Di Tella, 1982). A conversão do uso e cobertura do solo tende a ser maior quando as terras são mais acessíveis, os preços de produtos agrícolas mais altos, os salários no meio rural mais baixos e, ainda, quando há mais oportunidades para o comércio exterior, como a exportação de commodities agrícolas (Kaimowitz e Angelsen, 1998).

Por conta disso, as ações humanas estão mudando de forma expressiva a cobertura da terra, seja na prática de agricultura de subsistência ou de produção agrícola intensificada (Foley *et al.*, 2005). A conversão de terras para a agricultura já modificou 70% das pastagens naturais, 50% das savanas, 45% das florestas temperadas e 27% das florestas tropicais no planeta (Ramankutty *et al.*, 2008).

Em geral, as causas dessas mudanças estão associadas à influência de fatores diretos e indiretos (Geist & Lambin, 2002). Nos países tropicais, as causas diretas estão relacionadas as ações humanas que afetam diretamente o meio ambiente, podendo essas serem divididas em três categorias: expansão das áreas agrícolas e das pastagens, extração madeireira e expansão da infraestrutura (Perz *et al.*, 2007; Walker *et al.*, 2000).

As causas indiretas no processo de mudança do uso da terra, por sua vez, estão relacionadas a aspectos econômicos, institucionais, tecnológicos e demográficos. Esses fatores estão, em geral, associados ao crescimento de mercados, urbanização, expansão populacional e políticas governamentais (Geist & Lambin, 2002). A forma como a terra é utilizada influencia diretamente as características socioeconômicas e ambientais de uma região, o que deveria ser influenciado por fatores externos, como políticas e intervenções de controle e incentivo em determinadas cadeias produtivas (de Oliveira, 2015).

No Brasil, o aumento do controle do desmatamento na floresta tropical da Amazônia e a escassez de terra em regiões de fronteira mais antigas levaram os agricultores, os estados e o governo federal a buscar novas áreas de desenvolvimento no cerrado (Brannstrom *et al.*, 2008; Barretto *et al.*, 2013). As dificuldades de baixa fertilidade e elevada acidez do solo na região foram resolvidas com o uso de fertilizantes. A produção do solo, associada ao baixo preço das terras, foram os principais motivos que permitiram a incorporação agrícola dos cerrados (Rezende, 2002; Cunha, 1993). As inovações tecnológicas ocorridas entre as décadas de 1960 e 1980 também ajudaram a permitir o cultivo intensivo de soja nessas áreas (Bragança *et al.*, 2015).

As transformações em países tropicais, seja por forças humanas ou estruturais, se entrelaçam com a influência das instituições, formais ou informais. As políticas

governamentais para a aquisição de terras, as baixas taxas de juros e a oferta de cultivares de soja adequadas, por exemplo, ajudaram a atrair agricultores do sul do Brasil para novas fronteiras (Kaimowitz & Smith, 2001).

Teorias em geral convergem na ideia de que fronteiras passam de um estágio populista ou pioneiro, onde os pequenos proprietários dominam a paisagem, para uma fase capitalizada em que atores mais poderosos consolidam a terra em grandes propriedades (Balanza, 2005; Foley *et al.*, 2005). Nas fronteiras contemporâneas, o papel do capital corporativo e da agricultura de mercadorias passa a ser uma causa indireta de expansão, por meio da consolidação de fronteiras inicialmente abertas pelos pequenos pioneiros, até constituir sua principal causa direta (Rudel, 2007). A combinação de atores corporativos como principais impulsionadores da expansão da fronteira e a ausência de planejamento estadual dão origem às chamadas fronteiras neoliberais, com menor atuação do Estado e maior influência do capital privado (Brannstrom, 2009).

1.4.2 Modernização e industrialização da agricultura

A produção agrícola brasileira passou por um processo de modernização baseado em mudanças técnico-científicas, hoje caracterizadas pelo agronegócio. Esse processo ocorreu paulatinamente com a introdução de máquinas e implementos agrícolas e adubos e defensivos químicos (Foschiera, 2005).

A agricultura no Brasil teve, entre as décadas de 1960 e 1980, o Estado como principal indutor e patrocinador da modernização, por meio de políticas de financiamento, pesquisa, assistência técnica e programas de desenvolvimento. A característica principal desse modelo de desenvolvimento foi a articulação entre indústria e agricultura, que juntas criaram os complexos agroindustriais (CAIs) (Rocha, 2015). O complexo agroindustrial brasileiro se constitui a partir da década de 1970, com

a internalização dos setores industriais, meios de produção para a agricultura (insumos e bens de capital) e a articulação da agricultura com as agroindústrias (Müller, 1982).

O processo de integração técnica entre agricultura e indústria foi marcado, de um lado, pela mudança na base técnica dos meios de produção utilizados pela agricultura, materializada na presença crescente de insumos e máquinas industriais. De outro lado, ocorreu uma integração de grau variável entre a produção primária de alimentos e matérias-primas (Delgado, 2001).

Com uma infraestrutura estabelecida, o Estado começa a perder força nas tomadas de decisões, dando maior espaço aos programas de planejamento agrícola conduzidos por políticas neoliberais que se instalaram no Brasil, na década de 1990. A partir de então, o capital privado passou a assumir o controle da produção, por meio de financiamento, fornecimento de insumos e produtos químicos e do controle da compra (Rocha, 2015).

Nesse período grandes empresas mundiais, agroindústrias e tradings passaram a ocupar gradativamente o espaço deixado pelo Estado e começaram a financiar as produções agrícolas mais lucrativas e com grandes nichos de mercado, como no caso da soja (Frederico, 2009). A instalação de empresas de financiamento e comercialização ou processamento industrial de grãos nas regiões produtivas resultou na monopolização dos territórios. Empresas estabelecem monopólio sobre o território utilizando-se de estratégias corporativas para poder desenvolver suas atividades (Oliveira, 2014).

E justamente nessa década surge uma fronteira em expansão nas regiões Norte e Nordeste brasileiro, em áreas de cerrado adquiridas a preços baixos por produtores oriundos da região Sul e também das fronteiras consolidadas (Alves, 2006). Mas essa ocupação não ocorre sozinha. O Estado, por meio de suas instituições, e as tradings

deram suporte à expansão da agricultura moderna em novos territórios brasileiros, como será mostrado ao longo da pesquisa.

CAPÍTULO 2

“Acessos difíceis, infraestrutura precária e, em alguns lugares, nem mesmo energia elétrica e água potável. Um verdadeiro fim de mundo. Nessas terras inóspitas, que nem os nativos viam futuro, agricultores gaúchos abriram estradas, armaram barracas, enterraram alicerces e lançaram as primeiras sementes de grãos no solo coberto por cerrado”.

(Matopiba Tchê, 2015)

LAND USE CHANGE IN THE DEVELOPMENT OF A NEW AGRICULTURAL FRONTIER OF BRAZIL: THE CASE OF MATOPIBA

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ABSTRACT

The expansion of agriculture and the growth of international food products market have become important factors driving the changes in land use in the world in the last few decades. Brazil, the second largest grain producer, has seen the rise of a new agricultural frontier in the Northern and Northeastern Cerrado region of the country in less than 20 years. This region is called Matopiba, an acronym formed by the initials of the four states that form it – Maranhão, Tocantins, Piauí and Bahia. This paper seeks to fill a gap in the literature by focusing on the drivers of land use and land cover changes in the new agricultural frontier. This article has two main goals: it develops a general understanding of the proximate and underlying causes driving the creation of Matopiba and analyzes a set of institutions that facilitated access to resources. To achieve these goals, the study relies on remote sensing data, combined with agricultural census statistics, market information, and public and private investment records. In addition, the study makes use of non-structured interviews with key informants. Results show that most of the land use change in Matopiba was due to agriculture expansion, with soybean occupying the equivalent to 61% of the cultivated area in the region. The availability of large extensions of land at low prices and the high commodity prices in the international market were determinants factors for the emergence of the new agricultural frontier in Brazil. These economics opportunities encouraged the migration of farmers from southern Brazil to the region. In addition, the study demonstrates that institutions influenced the access to land, capital, and technology through the concession of credit. Formal and informal institutions were important to structure agribusiness in Matopiba – from production, through storage and transportation to trade.

Key-words: Brazil, cerrado, Matopiba, agriculture, frontier, land use change, land cover change, proximate causes, underlying factors

1. INTRODUCTION

Land use activities, which convert natural landscapes with management practices, have transformed a large proportion of the Earth's surface. By opening areas of native vegetation, practicing subsistence agriculture or through intensified agricultural production, human actions are changing the land cover in an impressive way (Foley *et al.*, 2005).

In the last few decades, the expansion of agriculture and the growth of domestic and international food products market have become important factors driving the land use changes in Brazil (Rudel, 2007; Defries *et al.*, 2010). The expansion of commodity frontiers is premised on the existence of an exceptionally high profit attracting investments, generated by factors such as cheap labor, technological innovation, or legal and economic incentives for accessing land (Barbier, 2012; Di Tella, 1982).

Brazil, the second largest grain producer after the United States, has seen the risen of a new agricultural frontier in the Northern and Northeastern Cerrado region of the country in less than 20 years – following the consolidation of areas open previously on the Brazilian Savanna, or Cerrado. The new frontier called Matopiba, an acronym formed by the initials of the four states that form it – Maranhão, Tocantins, Piauí and Bahia – is identified as one of the few Cerrado areas with land still available to soybean production in Brazil, and it is one of the last large scale agricultural frontiers in the world (OECD/FAO, 2015). This new frontier is the Brazilian region where agricultural expansion has been the most significant in the period between 2001 and 2013 (Graesser *et al.*, 2015). Officially recognized by the federal government in 2015, when it produced 10% of the national grain harvest, the region is still little explored in the literature.

This paper seeks to fill a gap in the literature by focusing on the drivers of land use and land cover changes in the Matopiba. In addition, the study examines how farmers engage with a set of institutions to facilitate the flow of production resources that result in certain decisions of land use and land cover change. Thus, this article has two main goals: (1) it develops a general understanding of the proximate and underlying causes driving the creation of Matopiba; and (2) analyzes a set of institutions that facilitated access to resources and, consequently, resulted in the new agricultural frontier in Brazil.

To achieve our goals, the study relies on remote sensing data, combined with agricultural census statistics, market information and public and private investment information. In addition, the study makes use of non-structured interviews with key informants, collected on fieldwork in the main agribusiness poles of Matopiba.

The paper is divided into six parts, including this introduction. In the second part, we present conceptual framework about land use and land cover changes on tropical countries and, also, the roles of institutions in this process. The third part describes the study area and the methods and data. The fourth section looks at the agricultural increase in Matopiba and the origins of the expansion. In the next part, we discuss the cheap land, migration, credit, technology, education and investments. Thus, in the last section shows the conclusions.

2. CONCEPTUAL FRAMEWORK

It is a consensus in the literature that there is not a simple way to explain land use and cover change, especially in tropical countries with large quantities of unexplored areas – as in Brazil. Traditionally, studies about the causes of these changes in Latin America focus on socio-political or economic variables as drivers of these changes, and in general, the causes of these changes are associated with direct and indirect factors, or the proximate and underlying causation framework (Geist & Lambin, 2002).

The proximate causation is associated with human actions that directly affect the environment, which can be divided into three categories: expansion of agricultural areas and pastures, wood extraction and infrastructure expansion (Pfaff, 1999; Walker, Moran & Anselin, 2000; Geist & Lambin, 2001; Perz, Caldas, Arima & Walker, 2007). Humans have always sought to increase their control over the environment, in part though expanding agriculture (Ellis *et al.*, 2013).

The underlying causes of the land use change are, in turn, related to economic, institutional, technological and demographic aspects, such as market growth, urbanization, population growth and governmental policies (Geist & Lambin, 2002). For example, the development of policies that facilitate credit or market access to farmers can encourage the conversion of forests into agricultural fields (Carr, 2004). Likewise, the development of new agricultural technology might stimulate new forms of land use, as well as new economic factors might influence the decision making process for land use due to a change in prices, may that be of products or services (Caldas *et al.*, 2013).

To establish a clear link between indirect factors and changes in land use is harder than relating these changes to direct causes (Kaimowitz & Angelsen, 1998). For instance, one of the indirect factors that are more frequently cited in the literature, and also one of the most controversial ones, is population pressure. According to the Malthusian tradition, population would grow very rapidly in relation to the available resources, thus becoming an impediment to growth on the long run (Malthus, 1798). In another view, rapid population growth and the increase of demographic density in agriculture would lead to a technological change, generated by innovation and diffusion of products (or processes) used as factors in the production growth. That would result, consequently, in an increase in productivity and economic growth (Boserup, 1965).

Theoretically, population may influence land use by changing the number of families in the rural setting that look for cultivable land or wood to extract, by effects on the job market and by increasing the demand for agricultural and forestry products (Kaimowitz & Angelsen 1998). Also, among the demographic factors that affect changes in land cover, migration is appointed as one of the most important ones,

because the increase in population due to internal migration tends to stimulate the evolution of frontiers and the consolidation of lands (Carr, 2004).

Take for instance the case of the Brazilian Cerrado. On this region, agricultural colonization had a strong influence of migration when soybean producers from Southern Brazil bought great extensions of land at below market-prices in relation to their states of origin (Brannstrom, 2005), and at that time, the performance of the government was decisive for the occupation of the Cerrado. Agriculture in Brazil had, between the 1960s and 1980s, the state as the main inductor and sponsor of modernization, through policies of financing, research, technical assistance and development programs (Rocha, 2015). In the Midwest Cerrado, having the State as reference via development programs, financing policies, research and technical assistance.

Beginning in the 1970s, the Brazilian government and allied international development interests created and sustained agronomic research and land-settlement programs that catalyzed agricultural development in the Cerrado. While government scientists developed the technology necessary to cultivate crops in the Cerrado, a set of policies for infrastructure, farm improvements, and land purchases laid the groundwork for agricultural expansion. A good example was the Brazilian government Proterra Program (Land Redistribution Program, 1971–1978), which provided loans at negative real interest rates to small farmers, covering up to 80 percent of costs for land purchases in the Legal Amazon and parts of Cerrado (Jepson, 2010).

Besides, through special funds, technical assistance and investments in infrastructure, such as rural electrification, warehouses and roads, stimulated migration and the conversion of native vegetation into intensive capital agriculture through private colonization initiatives, especially in Mato Grosso (Jepson, 2006; Salim, 1986).

Thus, the transformation that took place in the Cerrado resulted in a capital-intensive agriculture that, later on, influenced the price of land in the region. With increases in land prices in the region, producers started to look for new agricultural frontier still unexplored and, consequently, cheaper, such as the Western Bahia and Southern Piauí and Maranhão (Warnken, 1999). Not even the precarious infrastructure conditions on these regions stopped the arrival of agricultural investments, which were attracted by low land prices and favorable climate for soybean cultivation (Brasil, 2015).

The agricultural frontiers characterized by the initial existence of abundant land, mostly unoccupied, and by a substantial migration of capital and people. For an agricultural frontier to emerge, free or cheap uncultivated land must suddenly acquire potential value through an abnormal rent (Di Tella, 1982). The combination of corporate actors as primary drivers of frontier expansion, and the absence of state planning gives rise to so-called neoliberal frontiers (Brannstrom, 2009).

Although, the proximate and underlying causation frame work give a good understand of the driving forces behind land use and land cover change, it is very important to understand the role of institutions in influencing the agents' decision-making process.

2.1 The roles of institutions

Agriculture is an area in which institutions, in the most varied levels of analysis, are especially important. Land ownership, minimum price policies, land reform as well as food security policies are elements that have important effects over the actions of those that make the agro-industrial systems (Azevedo, 2000). Among the structural approaches is the New Institutional Economics (NIE), which considers how institutions

evolve or are managed to manufacture market advantages and shape economies or economic distribution (Fogel, 1997).

These institutions include rules through which it is possible to understand the organization of societies. These rules are divided into formal and informal. The former are formalized, usually imposed by governments (agricultural policies) while the latter are created by society, such as code of ethics, family ties, cultural values. Institutions are the rules of the game in a society, are the devised constraints that shape human interactions, in different aspects, as political (public agencies, political parties, regulatory agencies), economic (firms, trades, cooperatives and farmers), social (church, clubs and associations) and educational (schools and universities) (North, 1990). Also, institutions have become fundamental for contemporary theories of land use and land cover change to structure the interaction dynamics between society and the environment (Turner, Meyer & Skole, 1994; Ostrom, Janssen & Anderies, 2007).

On this context, institutions influence access to land, capital, technology and labor force, hence they are potentially significant to explain land use processes (Jepson, 2010). By establishing game rules, either formal or informal, the role of institutions is to restrict human action – determining how and where natural resources will be explored and representing restrictions and opportunities for individuals, families and communities (North, 1991; Jepson, 2010).

Some main mechanisms may induce a sudden increase in the rent in modern commodity frontiers. First, a change in the accessibility of a region, through the construction of roads, railways or improvements in waterways, and through new storage or processing facilities, will diminish the cost of production and increase rents (Angelsen, 2010). Second a change in land productivity. Third, rent increases can be created through technological innovation such as improvement in cultivation techniques

or machinery (Kaimowitz & Smith, 2001). Fourth, producer prices and demand may change abruptly. Lastly, subsidies or other policies such as tax exemptions can directly affect the profitability of agriculture by depressing the cost of agricultural inputs, such as labor, capital or raising the producer prices (Hecht, 1985; Jepson, 2006; Binswanger, 1991).

Some scholars of the New Institutional Economics suggest that organizations contribute to reduce the agricultural production's complexity and insecurity – characterized by climate risks and market fluctuations. In any of its forms, the organizations can provide stability to the decision making process and, in turn, reduce the activity's volatility (Dequech, 2006).

Besides the conceptual standard linked to the New Institutional Economics, which defines institutions as the rules of the game in a society, there is another group of economists who associate institutions with customs and behavior patterns, that operate in different contexts. For the line of thought called Evolutionary Institutionalism or Neo-Institutionalism, what matters most is the way things are done, not the set of rules or governance structure that guide them (Hodgson, 2006).

Institutions are enduring systems of socially ingrained rules. They channel and constrain behavior so that individuals form new habits as a result. People do not develop new preferences, wants or purposes simply because “values” or “social forces” control them. Instead, the framing, shifting and constraining capacities of social institutions give rise to new perception and dispositions within individuals. Upon new habits of thought and behavior, new preferences and intentions emerge. As a result, shared habits are the constitutive material of institutions (Hodgson, 2004).

In the case of Matopiba, an historical analyze of the role of institution can help to understand the development of this region. For instance, the price of land, access to

credit, technology and education were some of the factors that motivated the land use changes in the region, and the influence exerted by the institutional environment probably resulted in the consolidation of a new agricultural frontier in Brazil.

3. STUDY AREA, METHODS AND DATA

3.1 Study area

This study encompasses a region called Matopiba, an area around 73 million hectares across 337 municipalities in four Brazilian states: Maranhão, Tocantins, Piauí and Bahia (Figure 1). To give an idea, the extent of this new agricultural frontier is equivalent to twice the size of Germany and almost three times the size of the United Kingdom, encompassing 324 thousand rural properties and 6 million inhabitants (IBGE, 2006).

The name that was given to the region, still unknown by a large part of the specialized literature, is an acronym which refers to the first two letters on the names of the states that form it. Before the official denomination “Matopiba³”, the region was also called “Mapitoba”, “Mapito” and “Bamapito”. Considering the geographical division of the area, 38% belongs to Tocantins (27.7 thousand hectares in 139 municipalities), 33% to Maranhão (23.9 thousand hectares in 135 municipalities), 18% to Bahia (13.2 thousand hectares in 30 municipalities) and 11% to Piauí (8.2 thousand hectares in 33 municipalities) (Embrapa, 2014).

³ In 2015, the Matopiba region was officially recognized by the Brazilian federal government as a new agricultural frontier based on an agriculture intensified by high productivity technology. For that intent, the Economic Development Plan of Matopiba was created with a focus on infrastructure, technological development and strengthening of the rural middle class (Decree nº 8447, May 6th 2015). In that same year, for the first time, the region produced more grains than the Southeast Region of the country, reaching almost 20 million tons – representing 10% of the national production (IBGE, 2015).



Figure 1: Geographical Delimitation of the Matopiba Region

It is important to notice that one of the main criteria used in the territorial delimitation of this region was the Cerrado area, which comprises 91% of the territory. The rest of Matopiba is comprised by the Amazon biome (7,3%) and Caatinga biome (1,7%) (Miranda *et al.*, 2014). Over the biomes, there is still a delimitation of a political-administrative called Legal Amazon, which covers 62% of Matopiba. Under the new Brazilian Forest Code, instituted in 2012, the rural properties inserted in the cerrado biome must protect 20% of the property for legal reserve. In the Legal Amazon, the percentage of protection established by law is 35% (Embrapa, 2014).

The predominant climate is semi-humid tropical (78% of its territory) with average temperatures above 18 degrees Celsius in all months of the year and well-defined dry periods that last from 4 to 5 months (IBGE, 2002).

Soil fertility is usually low, however, it contains physical characteristics that are favorable for agricultural use – good permeability and high porosity (Embrapa, 2006).

Regarding soil characteristics, the predominant class is latossolo (38% of the territory), with generally low fertility, however, containing favorable physical characteristics to agricultural use. The second most prevalent class is neossolo, present in 25% of the region and characterized by low natural fertility and high permeability (Embrapa, 2006). Matopiba's grain production, especially soybean, corn and cotton, was able to be expanded with the help of technology – which allowed the correction of the soil considered to be of low fertility in order to make it productive (Embrapa, 2014).

3.2 Methods and data

To analyze land use changes in Matopiba, this study uses remote sensing combined with geographic information systems data produced by the Brazil National Diversity Project (*Probio*) for the year 2002 and by the TerraClass Project (Mapping the Vegetation Use and Cover of Cerrado) for the year 2013 (Brasil, 2015). These studies, coordinated by the Brazilian Ministry of the Environment, covers 91% of Matopiba's area. It is important to highlight that using Landsat 5 satellite, Probio was responsible for a complete mapping of the vegetation cover of all six Brazilian biomes in a level of detail compatible with the cartographic scale of 1:250.000 (Brasil, 2007). The TerraClass project Cerrado, in turn, was conceived to map land use and land cover for the year of 2013, with a methodology derived from TerraClass Amazon.

Despite using the Landsat and similar resolution scales (1:250.000), the image classification provided by TerraClass Cerrado was more detailed than the classification provided by Probio, thus preventing a direct comparison of all of the information generated. Nonetheless, it was possible to compare the information between the two studies due to the fact that both present classifications for agricultural areas. This land use class has a peculiar vegetation pattern different from Cerrado, thus allowing a visual identification in an efficient and robust way. However, the same can't be done for

classes of natural vegetation and pastures, which have close characteristics of different spectral differentiation. In addition, to image classification provided by the previous sources, and seeking for a more refined analysis of the agricultural land use in Matopiba, this study also uses time series of soybean data produced by vegetation indexes of Moderate-Resolution Imaging Spectroradiometer (Modis) developed by Soma Brasil (Brazilian Agriculture Observation and Monitoring System) (Embrapa, 2014).

The remote sensing land use data for Matopiba (2002, 2012 and 2013) are combined with secondary agriculture census data and information gathered over 12 days of field research in 2015. The fieldwork was comprised of non-structured interviews with key informants in the main agribusiness poles of Matopiba: Luís Eduardo Magalhães and Barreiras (Bahia State), Bom Jesus and Uruçuí (Piauí State), Balsas and Tasso Fragoso (Maranhão State) and Campos Lindos (Tocantins State). The key informant interviews addressed questions about the beginning of the conversion from native vegetation to agriculture and the region's development over the years. Key informants were selected for their knowledge, role in a setting and pioneering characteristics (Brannstrom, 2005; Poggie, 1972). In other words, we identified the first farmers that cultivated grains in each area and had a leadership role in the formation the Matopiba, such as presidents of entities, cooperatives and firms that helped to create an organizational structure that allowed the agricultural expansion. In the text, informants are referred to by their institutional position rather than by name.

4. RESULTS

4.1 Agricultural expansion in Matopiba

The agricultural expansion in Matopiba has been occurring since the 1990s. If we consider the period 1995-2014, it is possible to note that the planted area for soybean, corn, cotton, rice and bean grew 143%, with a 370% increase in produced volume (Figure 2).

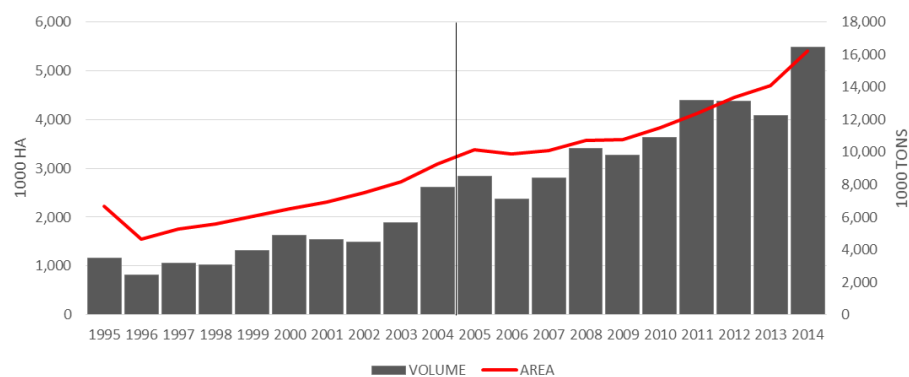


Figure 2: Area and volume variation of the soybean, corn, cotton, rice and beans in the Matopiba
Source: IBGE data (2015).

If we divide the period in two decades, it is also possible to observe that the expansion rate in the area was larger for the period of 2005 to 2014 (when it grew 60%), compared to the growth of the previous decade (around to 38%). The largest variation in planted area during the most recent decade points to the period in which the region effectively started to be consolidated as a new agricultural frontier. In other words, when the conversion of native vegetation to agriculture gained the impulse from market, migration, technological change and institutional factors.

The remote sensing data for this period allows to observe a significant change in land use in Matopiba (Figure3). Through these data, it is possible to notice that agriculture in 2002 was concentrated on southern Matopiba (Western Bahia state), where the movement of conversion from native Cerrado vegetation to crops in the Brazilian Northeast region started. However, in 2002 some agricultural occupation

spots were identifiable, even if still in an incipient form, in Maranhão, Piauí and Tocantins. In that year, agriculture occupied 1.39 million hectares in Matopiba, 2,07% of the total area mapped in the study Probio (Brasil, 2007).

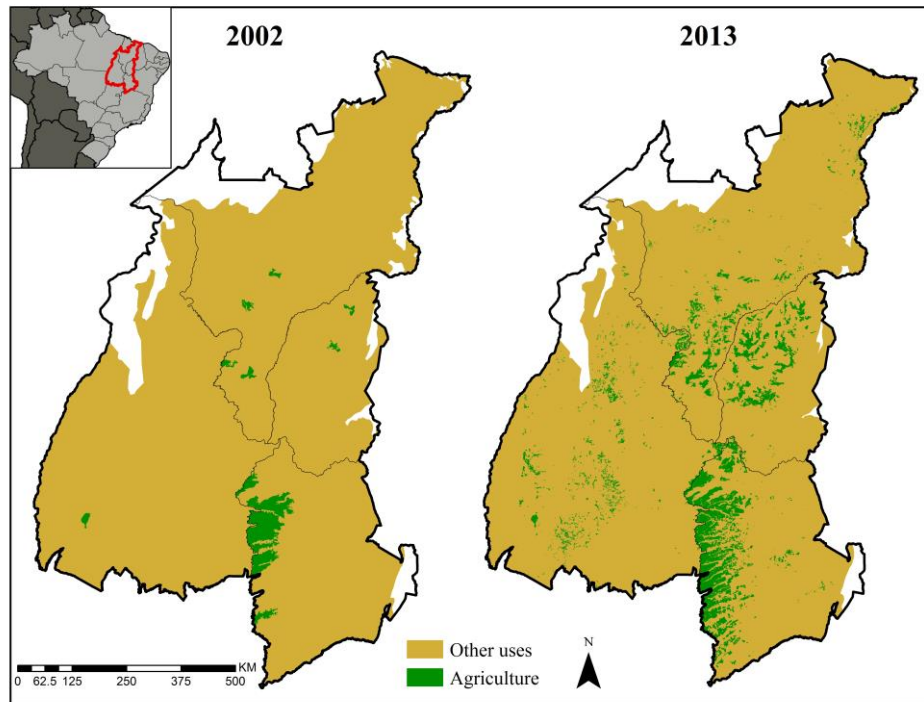


Figure 3: Agricultural use and land cover in Matopiba region in 2002 and 2013
Source: Elaboration of the authors from Probio (2002) and TerraClass Cerrado data (2013).

The remote sensing data for 2013 shows an agricultural expansion to the remaining states that form Matopiba, resulting in a strong intensification of activity in a little over 10 years. In spite of Bahia still concentrating the highest percentage of land intended for agriculture, it is possible to see that agriculture has spread through the whole Matopiba region, with a more visible concentration in some points – such as Western Bahia, Southern Maranhão and Southern Piauí. In 2013, the crops in the region occupied 7.09 million hectares, equivalent to a 409% growth in agricultural area in the period from 2002 to 2013 (Brasil, 2015; Brasil, 2007).

In Matopiba, the greatest stimulus for the conversion came from soybeans expansion, which appreciated in the international market over the last decade by

increasing global demand for food. Remote sensing analysis for 2012 shows that the crops are present in the majority of areas where land use was altered in Matopiba (Figure 4), thus occupying 2.9 million hectares – equivalent to 61% of the cultivated area with temporary crops in the new Brazilian agricultural frontier (Soma Brasil, 2012).

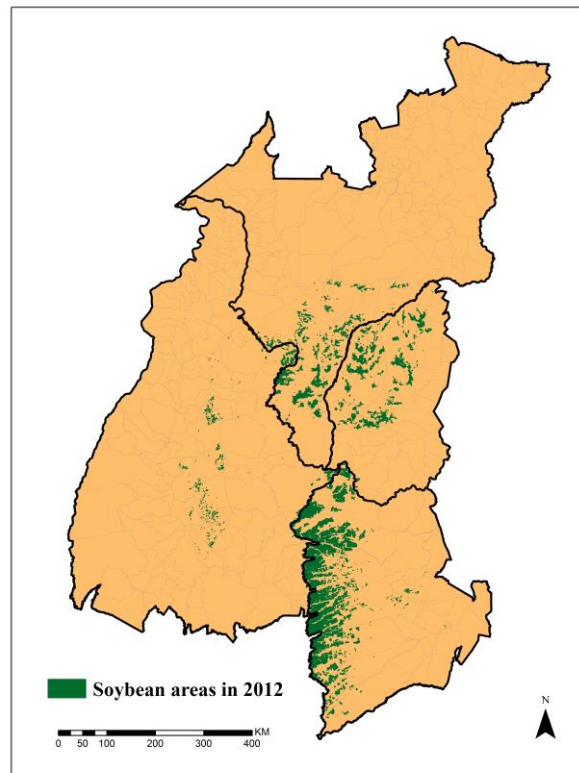


Figure 4: Soybean areas in Matopiba region.
Source: Elaboration of the authors from Soma Brasil data (2012).

It is important to highlight that no other crop had higher or similar impact as soybean in the demographic and economic conditions in Brazil's agricultural frontiers (Warnken, 1999). For instance, in 1995, Matopiba had 51 municipalities producing soybeans, which jumped to 115, in 2004 and 150 municipalities in 2014 (IBGE, 2015).

Not different from the rest of Brazil, the expansion of the oleaginous seed culture in Matopiba follows a national trend of commodity growth, however at a much faster rate. While the cultivated area with the product grew in Brazil on an average of

8% per year from 1995 to 2014, in the new agricultural frontier the average increase was 23% per year (IBGE, 2015). The soybean crop, which in 1995 occupied 591 thousand hectares in Matopiba, occupied 3,39 million hectares in 2014 – a 457% increase in 20 years, a jump from 1.29 million tons to 8.64 million tons in the same period, equivalent to 568% variation (IBGE, 2015).

However, it is important to highlight that the soybean expansion happened at distinct rates in the four states that form the region (Figure 5). The greatest growth was in Tocantins, which increased by 36 times the cultivated area, going from 20 thousand hectares to 719 thousand hectares in 20 years. Piauí and Maranhão displayed similar performance (IBGE, 2015).

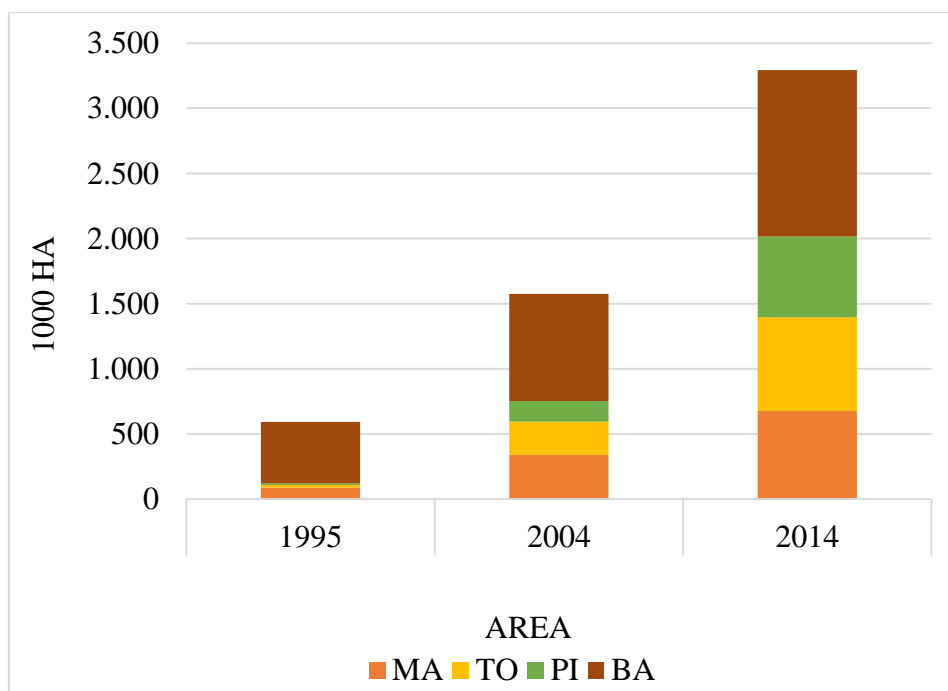


Figure 5: Variation in soybean cultivated area over 20 years in Matopiba.
Source: IBGE data (2015).

The greatest expansion rate in Tocantins is justified by the history of the region. The state was the last to have native vegetation converted into agriculture. While in Tocantins the changes in land use started to gain magnitude from the 2000s, in Bahia the movement started in the early 1990s. If, Tocantins had the greatest expansion rate,

on the other hand, Bahia has the largest soybean cultivated area (1,2 million hectares) and 90% of Matopiba's cotton production (323 thousand hectares). Besides, Bahia takes the lead in irrigated area with 1,544 irrigation pivots or 84,3% of Western Bahia (IBGE, 2014; Embrapa, 2014).



Figure 6: Corn farming with irrigation in Balsas, in Maranhão State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Despite the prevalence of soybeans agricultural production in the area, other crops also gained importance in the 20 years, such as cotton and corn. Corn cultivated area almost doubled in Matopiba – from 5,62 million tons in 2005 to 10,76 million tons in 2014 (IBGE, 2015). In the case of cotton, the cultivated area increased from 222 thousand hectares in 2005 to 359 thousand hectares in 2014, or 60% in the period (Figure 7).

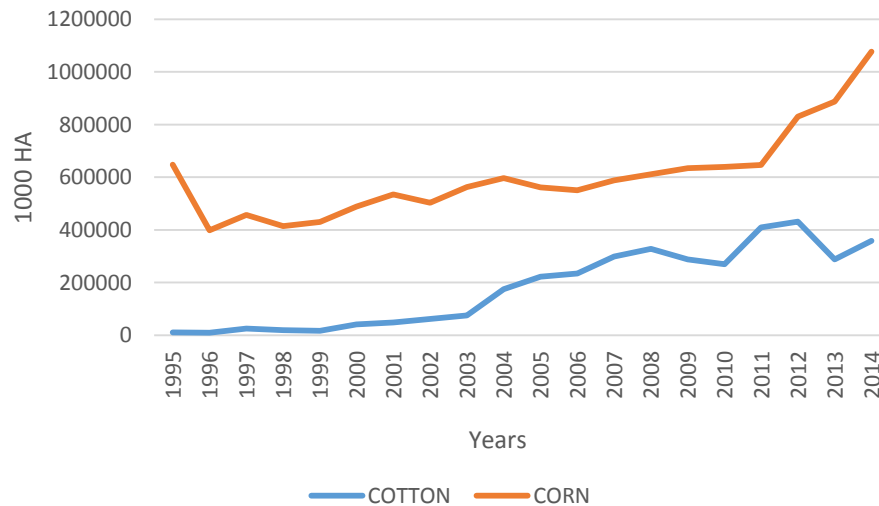


Figure 7: Variation in cotton and corn cultivated area over 20 years in Matopiba.
Source: IBGE data (2015).

In the next decade, in the seasons 2025/2026, the grain planted area in the region is expected to expand 13,7%, reaching between 8,7 million and 10,3 million cultivated hectares. The grain production in states that form the Matopiba should also increase from 19,4 million tons in the 2014/2015 seasons (last year without dry) to 24,5 million tons in the crop 2025/2026 with an expectation that could reach 27,9 million tons (Brasil, 2016).

5. DISCUSSION

The expansion of the Matopiba started in the early 1990s in Western Bahia by the immigration of Southern farmers, suppliers of agricultural inputs, and poor farmers from rural Northeastern Brazil, often in an uneasy context of rapid urbanization, limited upward mobility, and uneven distribution of amenities (Haesbaert, 1997).

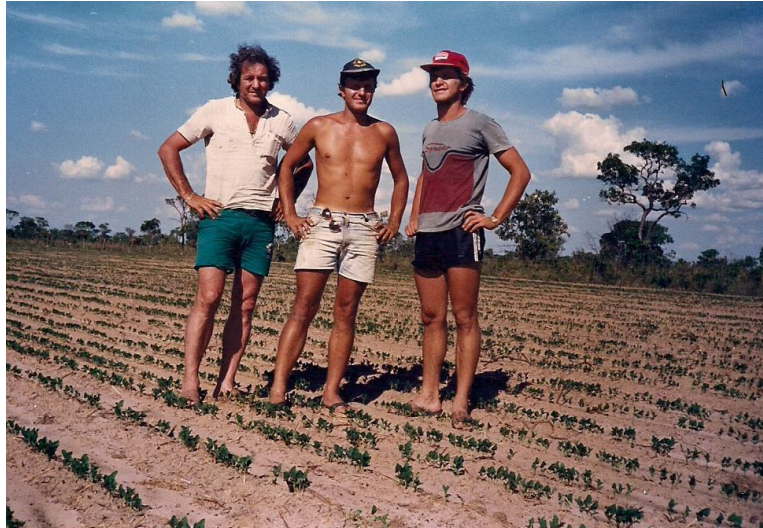


Figure 8: Franciosi Brother's, from Rio Grande do Sul State, in the early 1990s, when they arrived in the Western Bahia.
Source: Personal archive

The beginning of Matopiba's formation in Bahia can be explained by better conditions in infrastructure and the relative closer proximity to Southern Brazil. In addition, the low land cost, high solar insolation, flat topography, and proximity to population centers in Northeastern Brazil made western Bahia lucrative for agricultural production (Brannstrom, 2005). Modern farming, based primarily on soybean cultivation, transformed and consolidated this region with municipalities as Luis Eduardo Magalhães and Barreiras becoming references for soybeans production.

The availability of large extensions of land at lower prices than in other regions was one of the determinant market factors for the appearance of the Matopiba agricultural frontier. Like in the earlier stages of the Cerrado colonization, farmers envisioned higher profits in the frontier by selling land in the south to buy larger areas in the region (Key Informant Interview A, 2015). For instance, in 2002, a hectare of land in Rio Grande do Sul, one of the Southern states where a large portion of the migrant farmers come from, cost on average US\$ 2,040 while a hectare of native vegetation for agriculture in Matopiba was sold for US\$ 86 (Figure 9).

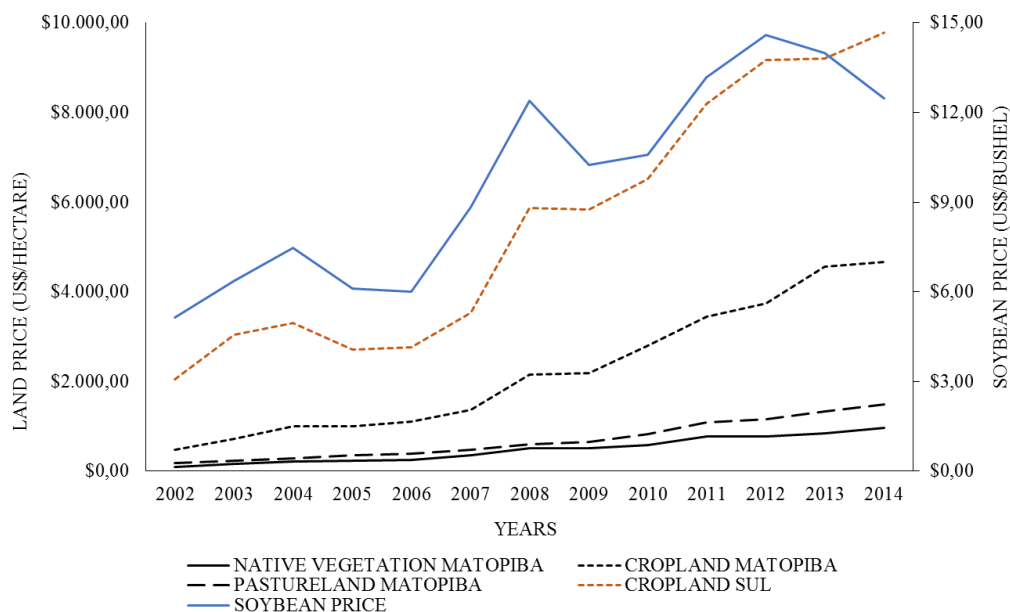


Figure 9: Variation of land price in areas of native vegetation, agriculture and cattle farming in Matopiba, agricultural area in Rio Grande do Sul and soybean listing on the Chicago Stock Exchange

Source: Informa Economics data and Chicago Stock Exchange (2016).

Thus, in a hypothetical situation, a farmer that sold a 100 hectares in Rio Grande do Sul could buy 2,4 thousand hectares of native vegetation in Matopiba. After converting it into cultivable land, this hectare would be worth US\$ 478 in the new agricultural frontier, an immediate appreciation of 455% (Informa Economics FNP, 2016).

It is important to mention that the opening of most of the areas in Matopiba occurred before the new Brazilian Forest Code, approved in 2012. According to this law, the areas of land inserted in the cerrado biome must preserve and protect 20% of the property to compose the legal reserve, when the occupation occurred after July 1989. If rural property is included in the limits of the Legal Amazon, this percentage rises to 35%, also for occupation before July 1989. While in Rio Grande do Sul the legal reserve is 20% of the properties (Françoso *et al.* 2015; Embrapa, 2014).

Besides the land price difference between Matopiba and Rio Grande do Sul, it is also important to observe that between 2002 and 2014, the soybean price increased

143% in Chicago Stock Exchange – the referential price setter for the commodity in the world (Figure 9). Even at distinct expansion rates, it is possible to notice a correlation between the increase in land value with the variation of soybean price. With strong commodity price in the international market, lands appreciated faster due to the possibility of greater profitability for soybean production.

However, by envisioning opportunities to reach greater profits and by expanding the cultivated area, southern migrant farmers were the driving forces behind the opening of new areas in Matopiba. On the 2000 Census, 10,863 residents in Matopiba declared that they were born in the southern state of Rio Grande do Sul. In 2010, this number rose to 13,559 – a 25% increase (IBGE, 2000, 2010), although the migration was concentrated in the agribusiness polos like the cities of Luís Eduardo Magalhães and Barreiras (Bahia state). For instance, in this county the gaúchos (people borned in the Rio Grande do Sul state) represented 15% of the 2010 migrants – totaling 2,818 people out of a total 19,109 residents born in other Brazilian states (IBGE, 2000; IBGE, 2010). In neighboring city of Barreiras (Bahia State), 2,921 declared been borned in Rio Grande do Sul, 11% of the total. Gaúcho migration is also significant in the city of Balsas (Maranhão State) where 1,201 residents were gaúchos in 2010, a 9.4% percentage among migrants.



Figure 10: Brothers Manganelli, from Rio Grande do Sul, in the 1990s, when they arrived in Piauí
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

To settle in Matopiba, however, migrants faced the resistance of local population, arguing that “migrants are not friends of nature” and spreading jokes such as “conserve nature by killing a gaúcho”, the local inhabitants accusing the Southern farmers of having devastated the native vegetation of the Northeast (Brannstrom, 2005).

When the first gaúcho farmers arrived in Bom Jesus (Piauí State), in 1997, the population organized a protest against the presence of the so-called “outsiders” and “Cerrado destroyers”. At the time, a group of 10 farmers tried to undo the idea that planting soybeans at the top of the plateau was a myth. A little over 10 years later, Bom Jesus was named Agribusiness Piauí State Capital (Key Informant Interview B, 2015).



Figure 11: Entrance of the city of Bom Jesus, in Piauí State
 Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

To the gaúcho migrants that enhanced the cultivated area by trading small properties in the South for large extensions of land in Matopiba, the soybean crop earnings increased in greater proportion than the growth in cultivated area due to the productivity in Matopiba surpassed the average productivity in Rio Grande do Sul even in the first years of conversion from native vegetation to agriculture. During the 20 years analyzed on this research, the average volume of soybean harvested in the new agricultural frontier was lower than in Rio Grande do Sul in only three years. In relation to Brazil, the productivity was similar in most years, although surpassed the national average in seven years (Figure 12).

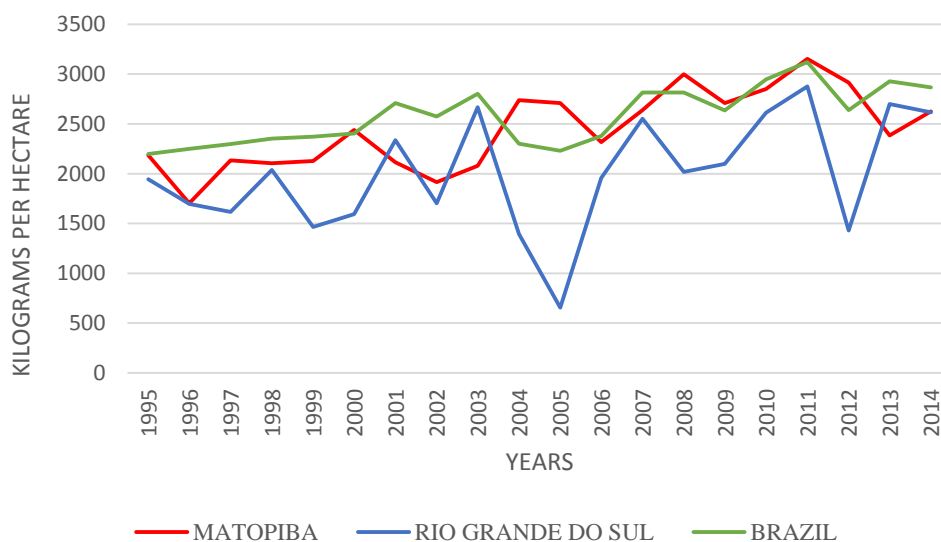


Figure 12: Variation of average soybean productivity in the municipalities that form Matopiba, in Rio Grande do Sul State and in Brazil over a 20 years period.
Source: IBGE data (2015).

The superior soybean yield in Matopiba's in relation to Rio Grande do Sul can be explained by different factors, as the regional climate conditions with regular rainfall during the crop cycle – especially in January and February, when the plant is in the period of grain filling and requires humidity. The high productivity, even higher than national average in some years, is imputed also to the level of investments in biotechnology, machinery and equipment that enhance the efficiency of the activity. With specific technological packages for tropical agriculture, developed by research institutes and multinationals that operate on the main world agricultural markets, farmers were able to overcome adversities in Matopiba. The possibility of correcting low soil fertility, of choosing varieties adapted to Cerrado's reality and the control of plagues and diseases helped ensure high productivity in the region. In 2016, the Foundation Bahia in partnership with Embrapa put on the market the first seed with IPRO technology developed specifically for Matopiba region (Embrapa, 2016).



Figure 13: Cotton farming in Luís Eduardo Magalhães, in Bahia State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

The good soybean yield in Matopiba can also be attributed to crop rotation, such as corn and cotton, and to the possibility of having a second harvest – after the soybean harvest. The high temperature in the region, even in winter, allows for an interim corn harvest, differently from Southern Brazil where it is only possible to cultivate one product during the summer, since soon afterwards, the subtropical climate brings low temperatures. Crop rotation increases yield and profit of agricultural activity, allowing for a sustained production.

Besides the possibility to plant more than one crop in the same cycle, the fast growth in grain production in the last decades was supported by Governmental interventions to increase product offer in face of a growing global demand and domestic markets (Garrett, 2013). In the case of Matopiba, the credit availability by public and private institutions was fundamental to the development of agriculture – especially at the beginning of expansion when the investment needs were greater. The purchase of land and machinery by farmers was achieved with the help of bank loans; especially from institutions such as Banco do Brasil (Brazil Bank) and Banco do Nordeste (Northern Bank).

However, at the beginning of the expansion, credit was mainly from private origin. One of the pioneers in Western Bahia, a southern migrant, reported that in the late 1980s, credit was very restrict because financial institutions did not believe in the agriculture of the region (Key Informant Interview C, 2015). The shortage of money to finance the harvest and investments was minimized by the action of large firms in the sector – such as trades and inputs resellers.

During this period, large global companies, grain exporters and suppliers of inputs increased the power of regulation. At the same time, the State, the main financier of the modernization model, started playing a less important role. Since then, Brazilian agriculture has become increasingly subordinated to private capital, due to the increased power of multinational companies producing agricultural inputs and equipment (Frederico, 2009).

These firms provided seeds, fertilizers and pesticides for farmers to enable the harvests in exchange for a guarantee on the sales of grains, from which the supply of inputs was deducted. In this way, even when there were no bank loans, there were other ways to finance production costs. Agricultural cooperatives, input providers and grain buyers played different roles in the less diversified and competitive supply chain, where the land and credit market were not in full operation.

In Matopiba, these organizations were fundamental in giving support to agricultural expansion, by creating a funding and trade structure that stimulated migration and investments and, consequently, the development of agriculture in the region. Thus, private firms had strong influence in the decision making of agents by helping to finance agricultural production in the new frontier, especially when the main credit institutions in Brazil were not structured with agricultural policies aimed at the states that would form Matopiba. By facilitating access to credit, these institutions

encouraged a conversion of Cerrado into agriculture and reduced uncertainties related to the activity – providing stability to farmers' investments.



Figure 14: Corn harvest in Campos Lindos, in Tocantins State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Apart from having influenced the access to land, capital and technology through the concession of credit, the rules of the game in society brought by institutions were fundamental in the restructuring of agribusiness in Matopiba – from production, through storage and transportation to trade. Western Bahia, for instance, received investments from multinationals firms such as Cargill and Bunge, which helped the supply chain. These firms boosted the growth of soybean areas and continue to be the most important firms of the sector in the region (Key Informant Interview D, 2015).

However, since the 2000s, large investments started to reach the other states of Matopiba. In 2003, the city of Uruçuí (Piauí state) got a Bunge soybean crushing plant and in 2007 the firm Algar installed a processing unit in Porto Franco (Maranhão State). In addition to these plants, a dozen input traders and storage units were installed in the area, which helped decrease the storage deficit in face of the production growth. Even with private investment, the storage capacity in Matopiba was not enough to support the production in the region. The storage capacity in Matopiba is 7.5 million tons, which is

less than half of the 2014 harvest in the region (Conab, 2014). The main static storage capacities are in Western Bahia and in the Balsas region (Maranhão State). By analyzing the spatial distribution of the warehouses, it is possible to observe some regions without silos or with a very small grain storage capacity (Embrapa, 2015). Although still slow, the region has received construction of logistics infrastructure that can benefit the expansion and consolidation of modern agriculture in the region.



Figure 15: Way to village Nova Santa Rosa, in Urucuí, Piauí State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

In 1999, the Santa Rosa Wheat Farmer's Cooperative (Cotrirosa), from Northeastern Rio Grande do Sul, acquired a 70 thousand hectares' area of Cerrado in Southern Piauí. In that year, with one hectare being sold in Rio Grande do Sul it was possible to buy 50 hectares in Piauí (Key Informant Interview E, 2015). The Cotrirosa installed an unit with warehouses to store grains and this warehouse has an input shop to enable the migration of 70 small farmer's families from the South.

From the 2000s, companies like Bunge, Ceagro and CHS installed grain receiving unites in Southern Piauí, where the agriculture develop on the top of plateaus – located in at more than 600 meters of altitude. On Bom Jesus and Uruçuí

municipalities, for example, the access is only possible through unpaved roads built by the migrant farmers. In these places, where there was no infrastructure, the conversion of native vegetation to agriculture was only possible through formal and informal institutions.



Figure 16: Tents where migrants lived when they arrived at Matopiba
Source: Personal archive

In Maranhão, the concentration of private investments occurred in Balsas, municipality with the largest soybean cultivated area in the state (almost 170 thousand hectares) and in Tasso Fragoso, second largest producer (almost 150 thousand hectares) – both in Southern Maranhão (IBGE, 2014). Even though agricultural colonization started in the early 1990s decade, it was after the year 2000 that agriculture flourished in the region – with the arrival of several groups of large national and international producers, such as Agroinvest, Insolo, Los Grobo and SLC Agrícola.

The organization of farmers in class associations also helped to develop agribusiness in Matopiba. The most influential non-state actor in environmental policy is, such as the Association of Farmers and Irrigation users in Bahia (AIBA), a powerful association of approximately 1200 irrigation and dry land farmers. Since the early 1990s, AIBA has urged state and federal governments for improved infrastructure,

increased subsidies, restructured farm debt, reductions in the value-added tax on diesel fuel, and reduced environmental licensing fees (Brannstrom, 2005).

The association generates data and environmental information to support strategic actions in the region, such as mapping and demarcation of permanent preservation areas and monitoring of water use licenses. Besides, the Aiba was responsible for the implantation of the experimental units of the forest fire monitoring and combat project, installed in the municipalities of São Desidério, Luís Eduardo Magalhães and Barreiras (AIBA, 2016).

Founded em 1990, Aiba was the first private association of farmers in the Matopiba. In 2006, the entity was responsible for the activation of the Fund for the Integrated and Sustainable Development of the West of Bahia (Fundesis), to promote the socioeconomic growth of the Western Bahia State. The association also promotes annually, since 2005, the Bahia Farm Show – largest agricultural technology fair in Brazilian North and Northeast (AIBA, 2016).

The private investments in Matopiba have also boosted public investments in the region, such as infrastructure and education. The Growth Acceleration Program (Programa de Aceleração do Crescimento, PAC) from the Federal Government identified 3.9 thousand constructions that were concluded, are in underway or are planned to be executed on the areas of energy, logistics, urban and social construction. The creation of infrastructure works aim at guaranteeing the supply of inputs to agricultural production, like grain transportation and production chain competitiveness (Embrapa, 2014).

Public education was also an important factor of influence in land use and land cover change in Matopiba. The establishment of teaching and research institutions allowed the dissemination of technical knowledge and, consequently the development

of qualified labor force in the region – facilitating the inclusion of the population in the development process. For instance, in Western Bahia, three universities campuses were created: Federal University of Western Bahia (Ufob), inaugurated in 2013 in Luís Eduardo Magalhães; Santa Cruz State University (Uesc) and Bahia Federal Institute of Education, Science and Technology (IFBA), both in Barreiras. In Southern Piauí, the cities of Uruçuí and Bom Jesus are also references in higher education for having three public university campuses. In Southern Maranhão, the action of a group of producers attracted workers and professionals, strengthening the role of educational establishments – such as Maranhão Federal University (UFMA), installed in 2013, and the Maranhão State University (UEMA).

The concentration of public and private investments in Matopiba, whether in processing industries, trade, services or infrastructure, transformed the region in new agribusiness poles. The term is used to label articulations between the agricultural and the industrial sectors, and cannot be dissociated of activities that guarantee food production, transformation, distribution and consumption (Davis & Goldberg, 1957).

While in Bahia, Maranhão e Piauí states the public and private investments resulted in agribusiness poles, in Tocantins the influence of the formal and informal institutions was less than in other states. The municipality with the greatest soybean cultivated area, Campos Lindos (70 thousand hectares), has no industrial plants, gathers few commercial spots and services (IBGE, 2014). The weak action of organizations meant agribusiness did not evolve in a structured way, restricting the effects of agricultural expansion to the fields. Campos Lindos did not received investments as universities, services, trades, firms or construction of infrastructure. Thus, the Tocantins region do not transformed in agribusiness poles. But, the situation has been much worse. In 2000, when soybean crops occupied an area ten times smaller in the

municipality, all of the houses in the city had a straw cover, there were no paved roads and the inhabitants moved around mounted on animals. Nowadays, the city has an average of two motorcycles per inhabitant, most urban streets are paved and some small agricultural sector shops are emerging (Key Informant Interview F, 2015).

By detailing the influence of institutions in each one of the agribusiness poles in Matopiba, it is possible to note that the region has distinct realities – with more or less structured institutions – influencing land use and land cover change. Despite differences in the actions of institutions, the region has similar challenges, like the need to improve conditions of infrastructure and logistics.



Figure 17: One of the main avenues of access to Balsas, in Maranhão State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

The Economic Development Plan of Matopiba, launched by the Federal Government in 2015, states that investments in infrastructure and logistics are priority, as just as the technological development and improvement in income, job and professional qualification (Decreto nº 8.447, May, 6, 2015). To complement the plan, in 2016, Brazil and Japan signed a cooperation agreement to allow Japanese businessmen to invest resources in works that facilitate the transportation of grains in Matopiba – reducing the so-called “custo Brasil” – the cost of doing business in Brazil (Brasil,

2016). It is important to remember that Japan was one of the main funders of the colonization in Brazil's Midwest Region between 1970s and 1980s, securing resources to guarantee soybean supply to Japan (Hollerman, 1988; Yoshioka, 1992).

6. CONCLUSION

A brief review of Matopiba history shows that since the beginning of the 1990s the region has undergone transformations in land use and land cover changes with the migration of farmers from Southern to the Northeast part of Cerrado. Even though the agricultural colonization of Matopiba has started in the early 1990s, it was only in the beginning of the 2000s that the agribusiness started to emerge with more strength in the region due to the conversion of native vegetation areas to agriculture, especially with the soybean.

In our study, remote sensing analysis showed that the agriculture crops are present in the majority of the areas where land use was altered in Matopiba, with soybean occupying the equivalent to 61% of the cultivated area in the region. The availability of large extensions of land at low prices and the good commodity prices in the international market were determinants factors for the emergence of the new agricultural frontier in Brazil. The greatest stimulus for the conversion came from soybeans expansion, which appreciated in the international market over the last decade by increasing global demand for food, specially. The global demand for agricultural products is increasing and this process of land cover change in the Matopiba is likely to continue in the years.

These economics opportunities encouraged the migration of farmers from southern Brazil to the region. In 2002, for instance, the paper shows that with the sale of one hectare in Rio Grande do Sul was possible to buy 24 hectares of native vegetation in Matopiba. Besides the land price difference between Matopiba and Rio Grande do

Sul, it is also important to observe that between 2002 and 2014, the soybean price increased 143% in Chicago Stock Exchange.

In addition, the study evidences that institutions influenced the access to land, capital and technology through the concession of credit. The credit availability by public and private institutions was fundamental to the development of agriculture – especially at the beginning of expansion when the investment needs were greater. Thus, formal and informal institutions were important to structure the agribusiness in Matopiba – from production, through storage and transportation to trade.

With the agricultural potential to keep growing in the next few years, Matopiba has common challenges to overcome, especially better infrastructure and logistics. The handicaps that were found, especially during field research, indicate the lack of a stronger action by formal institutions. Thus, although the expansion and consolidation of modern agriculture in the Matopiba in last two decades, the future of region depends of more efficient policies that will result in more structured agribusiness.

REFERENCES

- ANGELSEN, A. (2010). Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences*, 107(46), 19639-19644.
- AIBA (2016). Associação de Agricultores e Irrigantes da Bahia. Serviços. Available in: <<http://aiba.org.br/servicos>> Access in May, 30, 2017.
- AZEVEDO, P. F. (2000). Nova economia institucional: referencial geral e aplicações para a agricultura. *Instituto de Economia Agrícola*.
- BARBIER, E. B. (2012). Scarcity, frontiers and development. *The Geographical Journal*, 178(2), 110-122.
- BINSWANGER, H. P. (1991). Brazilian policies that encourage deforestation in the Amazon. *World Development*, 19(7), 821-829.
- BOSERUP, E. (1965). The condition of agricultural growth. *The Economics of Agrarian Change under Population Pressure*.

BRANNSTROM, C. (2005). Environmental policy reform on north-eastern Brazil's agricultural frontier. *Geoforum*, 36(2), 257-271.

BRANNSTROM, C. (2009). South America's Neoliberal Agricultural Frontiers: Places of Environmental Sacrifice or Conservation Opportunity. *AMBIO* 38 (3):141–149.

BRASIL (2007). Ministério do Meio Ambiente. Biodiversidade do Cerrado e Pantanal: áreas e ações prioritárias para conservação. Available in: <[http://www.mma.gov.br/biodiversidade/biodiversidade-brasileira/ %C3%A1reas-priorit%C3%A1rias/item/493](http://www.mma.gov.br/biodiversidade/biodiversidade-brasileira/%C3%A1reas-priorit%C3%A1rias/item/493)>Access in May, 20, 2016.

BRASIL (2007). Ministério do Meio Ambiente. Mapeamento de Cobertura Vegetal dos Biomas Brasileiros. Available in: <<http://mapas.mma.gov.br/mapas/aplic/probio>>Access in May, 20, 2016.

BRASIL (2015). Ministério do Meio Ambiente, Ministério da Agricultura, Pecuária e Abastecimento, Ministério da Ciência, Tecnologia e Inovação. Mapeamento do Uso e Cobertura Vegetal do Cerrado – TerraClass Cerrado (Base 2013). 69 p. Available in: <<http://www.mma.gov.br/biomas/cerrado>>Access in July, 20, 2016.

BRASIL (2016). Ministério da Agricultura, Pecuária e Abastecimento. Projeções do Agronegócio. 7ª edição. MAPA: Brasília/DF

CALDAS, M. M., GOODIN, D., SHERWOOD, S., CAMPOS KRAUER, J. M., & WISELY, S. M. (2013). Land-cover change in the Paraguayan Chaco: 2000–2011. *Journal of Land Use Science*, 10(1), 1-18.

CARR, D. L. (2004). Proximate population factors and deforestation in tropical agricultural frontiers. *Population and environment*, 25(6), 585-612.

DAVIS, J. H., & GOLDBERG, R. A. (1957). Concept of agribusiness. Boston: Harvard University, 1957. p. 136.

DEFRIES, R. S., RUDEL, T., URIARTE, M., & HANSEN, M. (2010). Deforestation driven by urban population growth and agricultural trade in the twenty-first century. *Nature Geoscience*, 3(3), 178-181.

DEQUECH, D. (2006). The new institutional economics and the theory of behaviour under uncertainty. *Journal of Economic Behavior & Organization*, 59 (1), 109-131.

DI TELLA, G. (1982). The Economics of the Frontier. In *Economics in the Long View*, eds. C. Kindleberger and G. di Tella, 210–27. Palgrave Macmillan UK.

ELLIS, E. C. et al. (2013). Used planet: a global history. *Proceedings of the National Academy of Sciences of the United States of America* 110 (20):7978–85.

EMBRAPA (2014). Desenvolvimento Territorial Estratégico para Região do Matopiba. Grupo de Inteligência Territorial Estratégica (Gite). Available in: <<https://www.embrapa.br/gite/projetos/matopiba/index.html>> Access in April, 6, 2016.

EMBRAPA (2006). Centro Nacional de Pesquisa de Solos (Rio de Janeiro, RJ). Sistema Brasileiro de Classificação de Solos. 2ª Edição. 306 P. ISBN 85-85864-19-2.

EMBRAPA CERRADOS (2006). Cobertura Vegetal dos Biomas Brasileiros: Mapeamento de Cobertura Vegetal do Bioma Cerrado. Brasília, DF: Ministério do Meio Ambiente Available in: <http://www.mma.gov.br/component/k2/item/7626?Itemid=926>>Access in April, 12, 2016.

EMBRAPA (2016). Cultivar de soja IPRO para o Matopiba é lançada na Bahia Farm Show. Available in: <https://www.embrapa.br/web/portal/busca-de-noticias/-/noticia/13025219/cultivar-de-soja-ipro-para-o-matopiba-e-lancada-na-bahia-farm-show>>Access in October, 16, 2016.

FOGEL, R. W. (1997). Douglass C. North and economic theory. *The Frontier of the New Institutional Economics, San Diego, Academic, 997*.

FOLEY, J. A., DEFRIES, R., ASNER, G. P., BARFORD, C., BONAN, G., CARPENTER, S. R., ... & HELKOWSKI, J. H. (2005). Global consequences of land use. *Science, 309 (5734), 570-574*.

FRANÇOSO, R.D. *et tal.* (2015). Habitat loss an the effectiveness of protected areas in the Cerrado Biodiversity Hotspot. *Natureza & Conservação, 13, 35-40*.

FREDERICO, S. (2009). O novo tempo do cerrado: expansão dos fronts agrícolas e controle do sistema de armazenamento de grãos. Tese de Doutorado, Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, São Paulo.

GARRETT, R. D., LAMBIN, E. F., & NAYLOR, R. L. (2013). Land institutions and supply chain configurations as determinants of soybean planted area and yields in Brazil. *Land Use Policy, 31, 385-396*.

GEIST, H. J., & LAMBIN, E. F. (2001). What drives tropical deforestation. *LUCR Report series, 4, 116*.

GEIST, H. J., & LAMBIN, E. F. (2002). Proximate Causes and Underlying Driving Forces of Tropical Deforestation Tropical forests are disappearing as the result of many pressures, both local and regional, acting in various combinations in different geographical locations. *BioScience, 52(2), 143-150*.

GRAESSER, J., AIDE, T. M., GRAU, H. R., & RAMANKUTTY, N. (2015). Cropland/pastureland dynamics and the slowdown of deforestation in Latin America. *Environmental Research Letters, 10(3), 034017*.

HAESBAERT, R. (1997). Des-territorialização e identidade: a rede “gaúcha” no Nordeste. *Niterói: EdUFF, 11-44*.

HECHT, S. B. (1985). Environment, development and politics: capital accumulation and the livestock sector in eastern Amazonia. *World development, 13(6), 663-684*.

- HODGSON, G. M. (2004). Veblen and Darwinism, *International Review of Sociology/Revue Internationale de Sociologie*, Cambridge University, Vol. 14, No. 3.
- HODGSON, G. M. (2006). What are Institutions? *Journal of Economic Issues* 40, 1, 1-25.
- HOLLERMAN, L. (1988). *Japan's economic strategy in Brazil: challenge for the United States*. Free Press.
- IBGE (2002). Instituto Brasileiro de Geografia e Estatística. Mapa de Clima do Brasil. Available in: <<http://www.visualizador.inde.gov.br>>Access in April, 16, 2016.
- IBGE (2006). Sistema IBGE de Recuperação Automática – SIDRA. Censo Agropecuário 2006. Available in: <<http://www.sidra.ibge.gov.br>>Access in April, 16, 2016.
- IBGE (2010). Instituto Brasileiro de Geografia e Estatística. Censo Demográfico. Available in: <<http://www.sidra.ibge.gov.br/bda/popul/default.asp?z=t&o=25&i=P>>Access in April, 16, 2016.
- IBGE (2015). Instituto Brasileiro de Geografia e Estatística. Área Plantada/Colhida. Available in: <<http://www.sidra.ibge.gov.br>>Access in April, 16, 2016.
- JEPSON, W. (2006). Private agricultural colonization on a Brazilian frontier, 1970–1980. *Journal of Historical Geography*, 32(4), 839-863.
- JEPSON, W., BRANNSTROM, C., & FILIPPI, A. (2010). Access regimes and regional land change in the Brazilian Cerrado, 1972–2002. *Annals of the Association of American Geographers*, 100(1), 87-111.
- KAIMOWITZ, D., & ANGELSEN, A. (1998). *Economic models of tropical deforestation: a review*. Cifor.
- KAIMOWITZ, D., & SMITH, J. (2001). Soybean technology and the loss of natural vegetation in Brazil and Bolivia. In *Agricultural technologies and tropical deforestation*. CABI Publishing, Wallingford, Oxon, UK.
- Key Informant Interview A (2015). Farmer and president of the Bahia's Association of Farmer and Irrigation Users, June, Luís Eduardo Magalhães, Bahia.
- Key Informant Interview B (2015). Pioneer migrant farmer, June, Bom Jesus, Piauí.
- Key Informant Interview C (2015). Pioneer migrant farmer, June, Luís Eduardo Magalhães, Bahia.
- Key Informant Interview D (2015). Farmer and secretary of Industry and Trade in Luís Eduardo Magalhães, June, Luís Eduardo Magalhães, Bahia.

Key Informant Interview E (2015). Farmer and president of the Santa Rosa Wheat Farmer's Cooperative (Cotrirosa), June, Urucuí, Piauí.

Key Informant Interview F (2015). Pioneer migrant farmer, June, Campos Lindos, Tocantins.

LAMBIN, E. F., TURNER, B. L., GEIST, H. J., AGBOLA, S. B., ANGELSEN, A., BRUCE, J. W., ... & GEORGE, P. S. (2001). The causes of land-use and land-cover change: moving beyond the myths. *Global environmental change*, 11(4), 261-269.

LAMBIN, E. F., GEIST, H. J., & LEPERS, E. (2003). Dynamics of land-use and land-cover change in tropical regions. *Annual review of environment and resources*, 28(1), 205-241.

MALTHUS, T. R. (1926). First essay on population 1798. Macmillan and co.

MIRANDA, E. E. de.; MAGALHÃES, L. A.; CARVALHO, C. A. de. (2014). Proposta de Delimitação Territorial do Matopiba. Available in: <https://www.embrapa.br/gite/publicacoes/NT1_DelimitacaoMatopiba.pdf> Access in April, 02, 2016.

NORTH, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge university press.

NORTH, D.C (1991). Institutions. *Journal of Economic Perspective*, v.5, p.97-112, Winter.

OECD/FAO - Food and Agriculture Organization of the United Nations. Relatório Perspectivas Agrícolas 2015-2024. Available in: <<http://www.fao.org.br/download/PA20142015CB.pdf>> Access in May, 20, 2016.

OSTROM, E., Janssen, M. A., & Anderies, J. M. (2007). Going beyond panaceas. *Proceedings of the National Academy of Sciences*, 104(39), 15176-15178.

PFAFF, A. S. (1999). What drives deforestation in the Brazilian Amazon: evidence from satellite and socioeconomic data. *Journal of Environmental Economics and Management*, 37(1), 26-43.

PERZ, S. G., CALDAS, M. M., ARIMA, E., & WALKER, R. J. (2007). Unofficial road building in the Amazon: socioeconomic and biophysical explanations. *Development and Change*, 38(3), 529-551.

POGGIE Jr, J. (1972). Toward quality control in key informant data. *Human Organization*, 31(1), 23-30.

PROBIO (2002). Project for Conservation and Sustainable Use of Brazilian Biological Diversity. Activities Report. Brasilia: Ministry of Environment. 73p.

ROCHA, C. E. R. (2015) O processo de territorialização da agricultura moderna e expansão da produção de soja no município de Porto Nacional - TO. Carlos Eduardo Ribeiro Rocha. - Porto Nacional, TO: UFT, 2015. 121 p.; il.

RUDEL, T. K. (2007). Changing agents of deforestation: from state-initiated to enterprise driven processes, 1970–2000. *Land use policy*, 24(1), 35-41.

SALIM, C. A. (1986). As políticas econômica e tecnológica para o desenvolvimento agrário das áreas de cerrados no Brasil: avaliação e perspectivas. *Cadernos de Ciência & Tecnologia*, 3(2), 297-342.

TURNER, B. L., MEYER, W. B., & SKOLE, D. L. (1994). Global land-use/land-cover change: towards an integrated study. *Ambio. Stockholm*, 23(1), 91-95.

WALKER, R., MORAN, E., & ANSELIN, L. (2000). Deforestation and cattle ranching in the Brazilian Amazon: external capital and household processes. *World development*, 28(4), 683-699.

WARNKEN, P. F. (1999). *Development and growth of the soybean industry in Brazil*. Iowa State University Press.

YOSHIOKA, Y. (1992). Development of agricultural policy in postwar Japan. *Agriculture and Trade in the Pacific*, 91-100.

CAPÍTULO 3

“As sementes lançadas no Matopiba não vingaram só no campo. Aos poucos, transformaram-se em alento para um pedaço do Brasil historicamente castigado pela pobreza e pela falta de perspectivas. Com a força das lavouras, cresceram cidades, comércio, serviços e emprego”.

(Matopiba Tchê, 2015)

FORMATION OF AGRIBUSINESS AND ITS IMPACTS ON THE SOCIOECONOMIC DEVELOPMENT OF MATOPIBA (BRAZIL)

Joana Colussi^a, Marcellus Marques Caldas^b, Gabriel Granco^c, Júlio Otávio Jardim Barcellos^d and Homero Dewes^e

ABSTRACT

The Cerrado region has become strategic in the incorporation of new agricultural areas in Brazil due to its physical and environmental characteristics which have allowed the expansion of production in modern agricultural patterns. Within this globalized model, a new land use in the Brazilian Cerrado has emerged, this time in the North and Northeast regions. Named Matopiba, an acronym formed by the initials of the four states that encompass it – Maranhão, Tocantins, Piauí and Bahia -, the region is considered the last large scale agricultural frontier in the world. Departing from the role played by large companies and trades in the occupation of this frontier, this paper has the objective of analyzing how the dynamics of agribusiness has impacted the socioeconomic indicators of this region over the last 20 year. In order to accomplish that, the research details the performance of multinational firms and the relations established with the productive sector. In addition, it brings secondary data from the 337 municipalities that form the agricultural frontier, based on the demographic census and on the Annual Social Information Relation (RAIS). The research shows that multinational enterprises such as Cargill, Bunge, Louis Dreyfus, ADM and Multigrain have given support to the expansion of agriculture in the region and have promoted an organization of the territory that has allowed them a privileged position the control over production through the provision of credit, inputs and purchase guarantees. In the spaces where these firms established relations, a new economic dynamism has emerged, with Gross Domestic Product (GDP) and Human Development Index(HDI) growing above national and state averages during this period. Despite this, the increase has not translated into better living conditions for the entire population as indicated by the high level of income concentration. This high concentration shows the need to develop production chains that have a greater capacity to generate jobs. A full regional development plan requires a stronger institutional action, with policies that address issues such as increase in income and better access to education and health. Even though agribusiness contributed to alter the economic and social base of Matopiba, it cannot be expected that one sector alone could tackle historic structural shortcomings.

Keywords: Agriculture, new frontier, trades, companies, regional development

1. INTRODUCTION

Over the last forty years, the Cerrado was converted from a deserted land into the agricultural heart of Brazil, leading the country to the position of second biggest producer of soybean and the main exporter of products such as soybean, beef and poultry (Jepson, 2010). The main causes behind changes in land use in this region were

public development policies, agronomic technologies and the world demand for agricultural commodities (Warnken, 1999; Myers *et. al.*, 2000; Mueller, 2005; Brannstrom, 2008).

Land use and occupation with technified crops in large properties, dedicated to grain production, exemplify how the modernization of agriculture in the Cerrado took place (Rocha, 2015). This process was built from models that had already been structured in other countries, encompassing innovations such as agricultural machinery, chemical products, new varieties and management tools. In opting for the modernizing model of agriculture, the state was sure that this was a project that would bring about the expansion of agricultural production and of the industrial sector in Brazil (Matos and Pessoa, 2011).

Firstly, in the Midwest Cerrado, on the early 1970s decade, having the State as reference via development programs, financing policies, research and technical assistance. From the 1990s decade, the North and Northeast Cerrado, with private capital taking over control of the production through credit supply, inputs and purchase guarantees.

With the help of neoliberal policies, large companies took over upstream agricultural production, providing credit and inputs, and downstream, in grain distribution and processing. Within this globalized model emerged a new agricultural frontier in the Brazilian Cerrado, called Matopiba. The name is an acronym formed by the initials of the four states that form it – Maranhão, Tocantins, Piauí and Bahia. The region is identified as one of the few Cerrado areas with land still available to soybean production in Brazil, and it is one of the last large scale agricultural frontiers in the world (OECD/FAO, 2015).

The changes in land use and occupation in Matopiba brought new dynamism to the region, with the emergence of agricultural development centers focused on intensified agriculture (Miranda *et al.*, 2014). The expressive growth of agriculture from the 1990s decade caused an inflow of investments related to agribusiness in the new region, giving origin to competitive areas of grain production (Santos, 2016). The requirements of the activity created new demands for trade and services because the modernization of agriculture entails the use of machines, fertilizers, pesticides, seeds, technical services, rural credit among other (Elias, 2013).

The agribusiness in Matopiba seems to have transformed the region with an inflow of investments, thus creating new demands for trades and services. Although the dynamics of the agribusiness have made the region very competitive, it is not clear how this agribusiness dynamic have affected the region socioeconomic development. This paper will shed lights on this subject on this new agricultural frontier, seeking to fill a gap in the literature.

Departing from the role enacted by large firms and tradings on the occupation of the new agricultural frontier on the Brazilian Cerrado, this article aims at analyzing how the agribusiness dynamics has affected Matopiba's socioeconomic indicators. To reach this objective, this research details the actions of multination firms in the region and the relations established with the productive sector. Furthermore, the study brings secondary data from the 337 municipalities that compose the new agricultural frontier, based on demographic census and the Annual Social Information Report (RAIS), of the Brazilian Government.

The paper is divided into six parts, including this introduction. In the second part, we present conceptual framework about the modernization of agriculture and the power of private capital, in addition to territorial and socioeconomic transformations

resulting from agribusiness. The third part describes the study of the analyzed area and the fourth exposes the methods and data used in this research. The following section brings results and a discussion over the performance of large firms installed in Matopiba and about the changes in social and economic indicators in the new agricultural frontier. Lastly, there are final considerations.

2. CONCEPTUAL FRAMEWORK

2.1 Modernization of agriculture and the power of private capital

Based on models structured in other countries, the process of modernization of Brazilian agriculture was designed with the objective of strengthening agricultural production, increasing industrialization and improving the country's trade balance. The transformation included technical innovations introduced in Brazil after the Second World War, such as agricultural machinery, chemical products, new varieties and tools. Industrialization has brought the idea that agriculture has become a branch of production, such as industry (Kageyama *et al.*, 1990).

As a result of the modernization and industrialization of agriculture, coupled with the specialization of segments and strong State regulation, agro-industrial complexes (AICs) have emerged. The Brazilian agro-industrial complex is formed effectively from the 1970s decade, with the internalization of the industrial sectors, means of production for agriculture (inputs and capital goods) and the articulation of agriculture with agro-industries (Müller, 1982). The constitution of AICs represented the beginning of the process of rural industrialization and, consequently, of the productive restructuring of capital in Brazil (Matos and Pessoa, 2011).

With the development of new agricultural systems, based on the "Green Revolution" technology package, large companies developed greater control over global grain production and trade. New possibilities of domination appeared for the large

agribusiness societies (Dorel, 1985). The dependence relationship between agriculture and industry was made possible by two factors: agriculture began to use artificial means (inputs, machines and chemicals) and the population adhered to a processed food diet, supplied by agro-industries (such as canned and processed goods, soybean derivatives, wheat and chicken). Artificial foodstuffs have taken the market, guaranteeing the reproduction of agro-industrial capital (Matos and Pessoa, 2011).

Since the 1980s, new events have once again transformed the standard of organization of world agriculture. The decade marked the incorporation, by the producers of the developed countries, of the so-called new technologies. The movement resulted in the "Third Agricultural Revolution," which was not immediately incorporated by Brazilian farmers, who would only begin to adopt technologies, albeit selectively, from the 1990s decade (Silva, 1998).

During this period, large global companies, grain exporters and suppliers of inputs increased the power of regulation. At the same time, the State, the main financier of the modernization model, started playing a less important role. Since then, Brazilian agriculture has become increasingly subordinated to private capital, due to the increased power of multinational companies producing agricultural inputs and equipment. By building their production, storage and transportation systems, large agro-industries and world trades have stimulated the specialization of places through the expansion of modern agriculture. In this way, they gradually occupied the space left by the State and began to finance the most profitable agricultural productions with large market niches, as in the case of soybeans (Frederico, 2009). The changes that occurred marked the exhaustion of the dynamics of Brazilian agriculture through the AICs, with the weakening of the state's role as a financier and regulator of agriculture (Mazzali, 2000).

Since the 1990s, the re-articulation of the financing of agricultural production has been at the mercy of the market (Frederico, 2009). And precisely in this decade a new agricultural frontier arises in the Brazilian Cerrado, in areas of the North and Northeast acquired at low prices by producers from the South and from the consolidated borders in the Midwest (Alves, 2006). The combination of corporate actors as the main drivers of the expansion of the frontier and the absence of state planning resulted on the so-called neoliberal frontiers (Brannstrom, 2010). And since the 2000s, especially with the agri-food crisis of 2008, the interest of transnational capital in the acquisition of land and investments in underdeveloped or developing countries has intensified – especially where there is still arable land (Pereira & Pauli, 2016). Highly capitalized and controlling the production through the provision of credit, inputs and storage, large agribusiness firms have helped to shift socio-economic dynamism into new agricultural frontiers - as we will see in the results section.

2.2 Territorial and socioeconomic transformations from agribusiness

The agricultural frontier is more than just expansion of production into new areas, but rather an expansion of population, modernization and environmental and social impacts. The expansion of the agricultural frontier is related to the expansion of market needs (Pereira & Pauli, 2016).

These consumption needs of modern agriculture have increased the economic and demographic importance of urban centers. The new urban of the agricultural frontiers is composed of cities that are functional to the productive requirements of the modern rural. Cities ceased to be cities located in the countryside to become rural cities (Santos, 2005).

In the last decades, the urban growth in the Cerrado was related to the intensive appropriation of land for agricultural activities. The region became strategic in the

incorporation of new areas. The environmental conditions of the Cerrado areas helped disseminate the political purposes supported by the importation of the model disseminated in the Green Revolution package. The presence of extensive plains made possible the practice widely used in modern agriculture (Silva, 2001).

Agronomic characteristics were essential to determine the areas where large-scale, export-oriented expansion occurred in the countryside of Brazil. Although growth is linked to institutional and economic factors, its location was also influenced by the prevalence of Cerrado soils (Bragança, 2016).

This transformation reorganized the Brazilian inland, resulting in new regionalizations. Among these, the ones that specialize in agricultural production are located in spaces where small cities are predominant and constitute Agribusiness Productive Regions (Elias, 2015). These networks link all the activities inherent to globalized agribusiness: agricultural enterprises, seed industries, chemical inputs and agricultural implements companies, research laboratories, service providers, agribusiness and logistics companies (Elias, 2013).

The territorialisation of grain financing and marketing companies, within agribusiness dynamics, has led to changes in agricultural frontiers - attracting investments and creating new demands for trade and services, with repercussions on social and economic indicators. And while some authors differentiate the concept of growth and development (Furtado, 2000), other scholars consider that in the medium and long term the two phenomena are the same (Bresser-Pereira, 2006) – showing that this differentiation is still far from consensus in economics.

3. STUDY AREA

The region called Matopiba has an area around 73 million hectares across 337 municipalities in four Brazilian states: Maranhão, Tocantins, Piauí and Bahia (Figure 1).

The name that was given to the region, still unknown by a large part of the specialized literature, is an acronym which refers to the first two letters on the names of the states that form it. Considering the geographical division of the area, 38% belongs to Tocantins (27.7 thousand hectares in 139 cities), 33% to Maranhão (23.9 thousand hectares in 135 cities), 18% to Bahia (13.2 thousand hectares in 30 cities) and 11% to Piauí (8.2 thousand hectares in 33 cities) (Embrapa, 2014).



Figure 1: Geographical Delimitation of the Matopiba Region

One of the main criteria used in the territorial delimitation of this region was the Cerrado area, which comprise 91% of the territory. The rest of Matopiba is comprised by the Amazon biome (7,3%) on the northeastern boundary and Caatinga biome (1,7%), on the eastern boundary (Miranda *et al.*, 2014).

In 2015, the Matopiba region was officially recognized by the Brazilian federal government as a new agricultural frontier based on an agriculture intensified by high productivity technology. For that intent, the Economic Development Plan of Matopiba

was created with a focus on infrastructure, technological development and strengthening of the rural middle class (Decree n° 8447, May 6th 2015). In that same year, for the first time, the region produced more grains than the Southeast Region of the country, reaching almost 20 million tons – representing 10% of the national production (IBGE, 2015). Matopiba's grain production, especially soybean, corn and cotton, was expanded with the help of technology – which allowed the correction of the soil considered to be of low fertility in order to make it productive (Embrapa, 2014).

4. METHODS AND DATA

To understand how the agribusiness dynamics affected the formation of the territory and the socioeconomic indicators of Matopiba, this research was organized in two phases. On phase one, the study deals with the performance of multinational companies present in the new agricultural region and how relations with the productive sector were established. Through a survey of the DATALUTA Network - Database of Struggle for Land, the survey shows the relation between foreign or Brazilian companies and foreign capital present in Matopiba, as well as the area of action and the municipality location. This information is used to understand the role of production agents and the transformations verified from the presence of these industrial conglomerates.

On a second phase, the research brings forth secondary data from 337 municipalities that comprise the new Brazilian agricultural frontier, based on the demographic census. The information gathered refers to the Gross Domestic Product (GDP); the Human Development Index (HDI), which displays indicators of longevity, education and income; the Gini Coefficient, an indicator used to quantify income concentration; and the change in formal employment in the region. The original data was collect in the Brazilian demographic census of 1991, 2000 and 2010, through the

Brazilian Institute of Geography and Statistics (IBGE), and in the Annual Report on Social Information (RAIS), though the Brazilian Ministry of Labor and Employment.

4. RESULTS AND DISCUSSION

4.1 Performance of large agricultural companies in Matopiba

The agribusiness dynamic formed in Matopiba make up a new globalized region of production, in which the organizational links are led by large firms such as Cargill, Bunge, Louis Dreyfus Company, ADM, Multigrain and SLC Agrícola among others. These companies arrived in the new agricultural region soon after the migration of farmers, ensuring all logistics and grain disposal and offering credit for production costs. The first structures to be installed were the silos and the warehouses, fundamental for the storage and conservation of the grains. Soon after, came the offices, responsible for the negotiation of production and agricultural inputs.



Figure 2: Unit receiving grain of Bunge in Uruçuí, in Piauí State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

The number of foreign or Brazilian companies with foreign capital present in Matopiba, with units receiving grain or processing and also as landowners. Survey of the DATALUTA Network shows that 30 groups have investments in this new

agricultural region – especially focused on the production of soybean, corn, cotton and sugarcane. The majority of the capital of these companies is from the United States, China and Japan (Table 1).

Table 1: Foreign and Brazilian companies with foreign capital present in Matopiba

Companies	Origin of capital	Location	Land use
Adecoagro Brasil Participações S.A.	USA	Barreiras (BA) and Dianópolis (TO)	Grains in rotation*
ADM do Brasil Ltda	USA	Porto Nacional (TO)	Grains in rotation*
Agrex do Brasil S.A.	Argentina and Japan	Luís Eduardo Magalhães (BA) and Porto Nacional (TO)	Grains in rotation*
Agrícola Xingu	Japan	Correntina (BA) and São Desidério	Grains in rotation* and cotton
Grupo Arakatu Ltda	Japan	Luís Eduardo Magalhães (BA)	Grains in rotation* and cotton
BrasilAgro	Brazil and Argentina	Baianópolis (BA), Correntina (BA), Jaborandi (BA), Ribeiro Gonçalves (PI) and São Raimundo das Mangabeiras (MA)	Land market**
Brasil Iowa Farms	USA	Luís Eduardo Magalhães (BA)	Grains in rotation*
Bunge Alimentos S.A.	USA	Luís Eduardo Magalhães (BA), Balsas (MA), Porto Franco (MA), Campos Lindos (TO), Pedro Afonso (TO), Porto Nacional (TO) and Uruçuí (PI)	Grains in rotation*
Calyx Agropecuária Ltda. (Louis Dreyfus Company)	France	Correntina (BA) and Jaborandi (BA)	Grains in rotation*
Cantagalo General Grains	Brazil, USA, Japan and United Kingdom	Baixa Grande do Ribeiro (PI)	Grains in rotation*
Cargill Agrícola S.A	USA	Barreiras (BA), Jaborandi (BA), São Desidério (BA), Riachão (MA), Tasso Frágoso (MA) and Dianópolis (TO)	Grains in rotation*
Chongqing Grains Group	China	Barreiras (BA)	Grains in rotation*
CHS	USA	Porto Nacional (TO)	Grains in rotation*
ED&F Brasil S.A.	Netherlands	Luís Eduardo Magalhães (BA)	Coffee

Genagro Produtos e Serviços Agropecuários	United Kingdom	Jaborandi (BA)	Grains in rotation* and sugar cane
Grupo Espírito Santo	Portugal	Formoso do Araguaia (TO)	Grains in rotation* and sugar cane
Insolo Agroindustrial S.A.	Brazil and USA	Baixa Grande do Ribeiro (PI), Palmeira do Piauí (PI), Ribeiro Gonçalves (PI), Santa Filomena (PI) and Uruçuí (PI)	Grains in rotation* and cotton
Kobra Agrícola	Netherlands	Luís Eduardo Magalhães (BA) and São Desidério (BA)	Grains in rotation* and cotton
Internacional Paper do Brasil Ltda.	USA	Palmeirante (TO)	Monoculture of trees
Louis Dreyfus Company	France	Luís Eduardo Magalhães (BA)	Grains in rotation*
Maeda S.A. Agroindustrial	Japan	São Desidério (BA)	Grains in rotation*
Mitsui	Japan	Balsas (MA), Tasso Fragoso (MA), Barreiras (BA), Correntina (BA), Formoso do Rio Preto (BA), Jaborandi (BA), São Desidério (BA), Monte Alegre do Piauí (PI) and Santa Filomena (PI)	Grains in rotation*
MSU Brasil Agropecuária S.A	Argentina	Luís Eduardo Magalhães (BA)	Grains in rotation*
Multigrain	USA and Japan	Correntina (BA), Luís Eduardo Magalhães (BA), São Desidério (BA), Balsas (MA), Porto Franco (MA), Riachão (MA) and Guarai (TO)	Grains in rotation*
Olam International	Nigeria	Luís Eduardo Magalhães (BA)	Cotton and coffee
Radar	Brazil, USA and Netherlands	Alto Paranaíba (MA), Balsas (MA) and Santa Filomena (PI)	Land market**
São João do Pirajá Empreendimentos e Participações S.A.	USA	Barreiras (BA), Correntina (BA), Formoso do Rio Preto (BA), Jaborandi (BA), São Desidério (BA), Monte Alegre do Piauí (PI) and Santa Filomena (PI)	Land market**
SLC Agrícola S.A.	Brazil and USA	Barreiras (BA), Correntina (BA), Formoso do Rio Preto (BA), Jaborandi (BA), São Desidério (BA), Balsas (MA), Buriti (MA), Tasso Fragoso (MA), Monte Alegre do Piauí (PI) and Santa Filomena (PI)	Grains in rotation* and cotton
Sollus Capital	Argentina	Jaborandi (BA), Balsas (MA), João Lisboa (MA), Bom Jesus (PI) and	Land market**

Campos Lindos (TO)

Tiba Agro S.A.	Brasil and USA	Barreiras (BA), Correntina (BA), Formoso do Rio Preto (BA), Jaborandi (BA), São Desidério (BA), Monte Alegre do Piauí (PI) and Santa Filomena (PI)	Land market**
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* Grains in rotation refer to soybean, corn and colza.

** Companies that acquire farms for agricultural improvement or just real estate speculation.

Source: DATALUTA - Banco de Dados da Luta Pela Terra, 2017. www.fct.unesp.br/nera

Most of the companies installed in Matopiba are formed entirely by foreign capital or by Brazilian companies with foreign capital. These companies establish a monopoly over the territory using corporate strategies to develop their activities, since Brazilian law restricts the acquisition of land by foreigners. In this way, foreign companies associate with Brazilian companies, which own the land and evade foreign companies from the legislation restriction (Oliveira, 2014).

Representing the major investments on the sector in Matopiba, the large firms perform diversified tasks. The operation of these companies on the new agricultural frontier is characterized by the land purchase, acquisition of inputs by farmers, provision of access to rural credit, the establishment of rules and regulations derived from a technological pattern and by the transportation and storage system operated by them while delivering inputs and receiving grains from the farmers (Santos, 2016).

One of the most significant actions of the large companies in Matopiba is through production financing. By granting credit to farmers, companies can buy the beans even before they are planted. By lending money to producers, they guarantee the receipt of the crop as payment at the time of harvest (Frederico, 2009).



Figure 3: Road that connects Balsas (Maranhão) a Campos Lindos (Tocantins)
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Thus, a good part of the producers ends up selling their production in advance to large exporting companies out of the need to obtain credit for planting and also because of the deficiency in the storage and transport infrastructure in the region. Poor transportation means at the agricultural frontiers and the lack of competition between modes increase the dependence of farmers on the few agents who control logistics systems (Contel, 2001). The option for private financing, rather than taking credit offered by public banks, is often also due to the greater ease in releasing money. Large companies are thus able to control agricultural circuits and much of production – by providing credit, selling inputs and receiving grains.

Despite the massive presence of large companies in Matopiba, the number of grain processing units is still small. Out of the 117 plants installed in Brazil, according to the Brazilian Association of Vegetable Oil Industries (Abiove), only eight are in the region - all with soybean crushing units (Table 2).

Table 2: Soybean processing plants in Matopiba

PROCESSING PLANTS/VEGETABLE OIL	COMPANIES
Porto Franco (MA)	Algar Agro
Luís Eduardo Magalhães (BA)	Bunge
Uruçuí (PI)	Bunge
Barreiras (BA)	Cargill
Porto Nacional (TO)	Granol
Cariri do Tocantins (TO)	Fazendão do Agronegócio
Cariri do Tocantins (TO)	Fazendão do Agronegócio
Cariri do Tocantins (TO)	Fazendão do Agronegócio

Source: Brazilian Association of Vegetable Oil Industries (Abiove), 2016

In refining and packaging activities, subsequent steps to processing the oil to final product, only three units (out of a total of 67 in Brazil) are installed in Matopiba: Algar Agro, in Porto Franco (MA); Bunge, in Luís Eduardo Magalhães (BA); And Cargill, in Barreiras (BA) (Abiove, 2015). The presence of few units of industrialization proves that much of the production of the new agricultural frontier is destined for export or for processing in other regions. The choices of transnational corporations are guided by political and economic adjustments that best suit them (Scoppola, 1996).

There has not yet been evidence of structuring more complex and complete production chains, involving industries and services with own capacity of empowers in Matopiba. The axis of dynamism has been the cultivation of grains, commodities vulnerable to fluctuations in the international market (Buainain, 2015).

The small aggregation of value to agricultural products can be related, among other factors, to the low number of cooperatives operating in the region. Matopiba has 39 cooperatives linked to the agricultural sector, out of which 17 are in Maranhão, 15 in Tocantins and 7 in Bahia. Piauí does not have any cooperative unit, according to Organization of Cooperatives of Brazil (OCB). To draw a comparison, only in Rio Grande do Sul, the state of origin of many of the migrants producing Matopiba, there are 127 active cooperatives linked to the agricultural sector (OCB, 2016). The discrepancy between South and North is explained by the history of the cooperative

system in Brazil - concentrated in the South. The traditionally associative behavior of the southern population, a reflection of the culture brought by European immigrants, is not found in the Northeast, which tends towards individualistic behavior (Santos, 2012).

On the trade and service sectors, the main agricultural machinery manufacturers in the world, such as John Deere, Massey Ferguson, Case IH and New Holland established dealership in Matopiba. Likewise, seeds and chemical industries such as Monsanto, Bayer, Basf and Syngenta are also present in the region. Although it seems that these firms are the same ones found in others regions, they are smaller in numbers. However, the services perform are the same thus creating the same funding structure.



Figure 4: Commerce and services in Luís Eduardo Magalhães, in Bahia Estate
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

These companies were fundamental in giving support to the agricultural expansion by creating a funding and trade structure that stimulated migration and investments in the region. The development of market conditions seems to facilitate the socioeconomic development of the population when compared with other regions.

4.2 Variation of social and economic indicators in the Matopiba

The transformations over the 20-year period have occurred in the regions where these firms are located or in the spaces where they have established relations. Agro-

industrial activities, brought upon by new land uses, entailed changes in a region that is historically characterized by less favorable indicators than the rest of the country.

The historical disparity in life conditions of the population that lives in the Matopiba region can be detected through the HDI variation in 20 years (Table 3). In 1991, when the conversion of areas of native vegetation into the new agricultural frontier was incipient, the average HDI of the municipalities that comprise the region barely reached 60% of the Brazilian HDI, and was classified as very low. In 2000, the HDI of Matopiba was 70% of the national average and in 2010 it reached 83% of the Brazilian HDI, being classified as Medium (Table 3).

Table 3: HDI variation in Matopiba and in Brazil over 20 years

Human Development Index (HDI)*	1991	2000	2010
Matopiba (average 337 municipalities)	0.286	0.423	0.605
Brazil	0.493	0.612	0.727

* The index goes from 0 to 1, meaning that the closer to 1, the higher the human development. Classified by bands: from 0,800 to 1 (Very High); from 0,700 to 0,799 (High); from 0,600 to 0,699 (Medium); from 0,500 to 0,599 (Low) and from 0 to 0,499 (Very Low).

Source: Author's own calculation based on data from PNUD, 2015.

Even though Matopiba's HDI is still lower than Brazil's average, the improvement of the indicator over two decades was significant. While the national HDI average grew 47% from 1991 to 2010, the index of the municipalities within the new agricultural frontier increased 111%. The agriculture expansion and the formation of agribusiness dynamic were not the only factors to improve the region's income. Cash transfer policies, growth of the employment rate and minimum wage appreciation, especially since the 2000s decade, in the period when Lula was president, had positive impacts on the Brazilian population living conditions (Sociais, 2013).



Figure 5: Corn harvest in Balsas, in Maranhão State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

To reduce distortions brought up by a wide national comparison, an individual analysis of the municipalities that form Matopiba was performed. The HDI performance registered regional differences. The cities that are part of Matopiba in Bahia and in Maranhão had a variation that was above regional average. On the other hand, the municipalities that form the region in Piauí registered inferior growth in comparison to the state's average growth. Regarding Tocantins, it is not possible to do a comparison because all of the cities of this state are part of the Matopiba (Table 4).

Table 4: HDI variation in Matopiba and state average – 1991, 2000 e 2010

Human Development Index (HDI)	1991	2000	2010
Maranhão (average 135 municipalities – Matopiba)	0.266	0.390	0.576
Maranhão (state average)	0.268	0.392	0.576
Tocantins (average 139 municipalities - Matopiba)*	0.303	0.457	0.640
Tocantins (state average)*	0.303	0.457	0.640
Piauí (average 33 municipalities - Matopiba)	0.293	0.412	0.580
Piauí (state average)	0.258	0.384	0.571
Bahia (average 30 municipalities - Matopiba)	0.295	0.429	0.606
Bahia (state average)	0.295	0.427	0.594

* The numbers referring to Tocantins are the same because all municipalities in this State are part of Matopiba, impeding a comparison as it was done in the other states
Source: Author's own calculation based on data from PNUD (2014)

The difference in performance can be explained by regional differences and historic peculiarities on the formation of the agribusiness dynamic and economic specificities. Despite differences on the variation of the indicator, the average HDI of municipalities that comprise Matopiba is usually the same or superior to the average HDI of their respective states, confirming a positive impact caused by the presence of agribusiness.

Likewise, Matopiba's Gross Domestic Product (GDP) grew at higher rates than the national average. From 2000 to 2013, the region's GDP grew 541%, while the Brazilian growth average during the same period was 352% (IBGE, 2015). In the comparison between the GDP growth of the municipalities that are part of Matopiba and the average of their respective states, in the period from 2000 to 2013, there is also a greater variation in favor of the new agricultural region (Table 5).

Table 5: Matopiba's GDP variation in comparison to respective States – 2000 to 2013

Maranhão (average 135 municipalities - Matopiba)	528%
Maranhão (State average)	468%
Tocantins (average 139 municipalities - Matopiba)*	548%
Tocantins (State average)*	548%
Piauí (average 33 municipalities - Matopiba)	715%
Piauí (state average)	416%
Bahia (average 30 municipalities - Matopiba)	534%
Bahia (state average)	340%

* The numbers referring to Tocantins are the same because all municipalities in this State are part of Matopiba, impeding a comparison as it was done in the other States
Source: Author's own calculation based on data from IBGE (2015)

The impacts of agribusiness on the economic dynamics of Matopiba can also be seen through the evolution of formal employment in a decade. Data from the Annual Social Information Report (RAIS) of the Ministry of Labor and Employment show that the number of formal jobs in the municipalities of Matopiba grew 65.4% from 2006 to 2015, while the average of the four states (Maranhão, Tocantins, Piauí and Bahia) varied 45.1% in the same period.

When the activities of the economy are analyzed individually in Matopiba, it can be seen that the formal employment of agriculture (within the farm gate) and agribusiness (before, inside and after the farm gate) had a smaller variation than the total average of other activities (Figure 6).

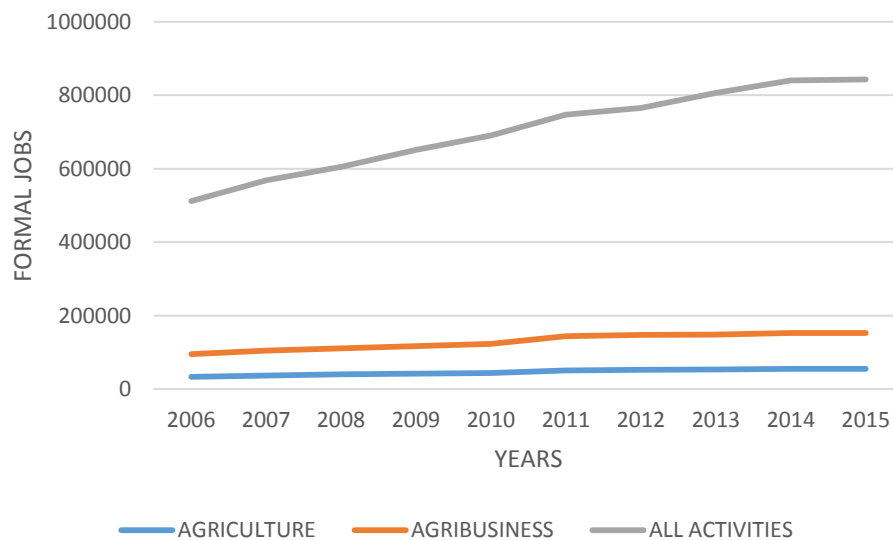


Figure 6: Formal Employment Variation Matopiba - 2006 to 2015
Source: Author's own calculation based on data from RAIS/MTE (2016)

The fact that agriculture and agribusiness have had worse performance than other activities in the Matopiba region can be explained by three factors. The first is that formal employment in agriculture (within the farm gate) is usually unrepresentative. The intensive use of grain production systems reduces the need to employ large numbers of professionals. The number of formal agricultural workers is extremely small, especially when compared to the number of hectares cultivated. In addition, the small number of formal workers contrasts with the large number of informal workers temporarily hired (Bernardes, 2005).



Figure 7: Cook who got a job on a farm in Campos Lindos, in Tocantins
 Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Second, because the region specializes in the cultivation of grains, most of which are exported without processing - limiting the creation of jobs in other agro-industrial activities. If a more relevant industrial sector was developed from agricultural specialization, like the production of poultry and pigs, for example, the multiplier effect would be more visible. And finally, the agribusiness linkage to other activities, especially services, that concentrate formal employment. Although agribusiness represents a small part of formal employment, if it is the dynamic center of the regional economy, its role is fundamental - since the income and employment of other sectors is activated by the income generated in agriculture.

The income increase on the new agricultural frontier, however, was not evenly distributed for the entire population of Matopiba. The analysis of the Gini index, an indicator used to measure income concentration, shows that inequality is higher in the municipalities of the region in comparison to the Brazilian average (Table 6).

Table 6: Gini Index variation in Matopiba and in Brazil over a 20 year period

Gini Index*	1991	2000	2010
Matopiba average (337 municipalities)	0.5327	0.5900	0.5622
Brazil	0.6366	0.5929	0.5331

* Numerically, the Gini Index goes from zero to one. Zero represents total equality, meaning everyone has the same income. One represents the opposite, which means higher income concentration.

Source: Author's own calculation based on data from IPEA, 2014

On an individual analysis per state, it is possible to confirm that income inequality is higher in Matopiba municipalities also when compared to the state's respective average. The finding refers to Maranhão, Piauí and Bahia only, since it is not possible to analyze this relation in Tocantins (Table 7).

Table 7: Gini Index variation in Matopiba municipalities and in their respective states over a 20 year period

Gini Index*	1991	2000	2010
Maranhão (135 municipalities - Matopiba)	0.5112	0.5812	0.5712
Maranhão (state average)	0.5039	0.5766	0.5646
Tocantins (139 municipalities)	0.5533	0.6013	0.5505
Tocantins (state average)	0.5533	0.6013	0.5505
Piauí (33 municipalities)	0.5496	0.5589	0.5726
Piauí (state average)	0.5999	0.5511	0.5450
Bahia (30 municipalities)	0.5292	0.6123	0.5642
Bahia (state average)	0.5381	0.5699	0.5349

Source: Author's own calculation based on data from IPEA, 2014

Social inequality is verified as well when considering gross income distribution in Matopiba. Out of the 250.238 rural establishments in the region, 80% are very poor (they generate 5,22% of the gross income in the region), 14% are poor (8,35% of gross income) and 5,79% are middle class (generate 26,74% of gross income). The so-called rich class detains only 0,42% of establishments and generate 59,8% of total gross income in the region (Embrapa, 2015).



Figure 8: City of Campos Lindos, in Tocantins State, has most streets without sidewalks

Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Some economists require more than a simple structural change and improvement in living standards to characterize effective economic development. They also require a decrease in inequality. However, the increase on income inequality in a region could translate into a positive relation with subsequent economic growth (Forbes, 2000). Periods of development are often followed by income concentration and poverty reduction. Economic development, on the long term, is a necessary condition to achieve other objectives, but on the short term it usually conflicts with them (Bresser-Pereira, 2014).

The finding that, despite expansion of agribusiness, the social indicators of Matopiba still lag behind national and state averages, shows that regional development depends on a set of variables, often with effects to be felt on the long run. The high concentration of income in Matopiba also highlights the need to develop other productive chains that have great capacity to generate income and jobs both in the countryside and in the city (Alves *et al.*, 2015).



Figure 9: Wealth and social deprivation lives side to side in Campos Lindos, in Tocantins State
Source: Photographer Tadeu Vilani / Photo courtesy Zero Hora

Matopiba has ample possibilities for the development of the production chains of poultry and pigs, for example. The capacity for expansion of grain production, labor, infrastructure and land tenure structures are the initial conditions for this. Even so, the development and consolidation of these activities in a non-traditional region will depend on the sum of the actions of public and private sectors, and the entrepreneurial vision of local actors is necessary to stimulate the investments. These chains are great generators of employment and income and, when present and consolidated, contribute to the elevation of the economic and social development indexes of the regions where they are established (Santos Filho *et al.*, 2016).

5. CONCLUSION

The research shows that multinationals supported the expansion of agriculture in the region and promoted an organization of the territory that allows them a privileged control of production. By retaining land or technical systems for storage, logistics and processing, these companies can exert a power over the beans even before planting.

Large companies finance the producers, granting credit for the cost of the crops and, thus, guaranteeing in advance the reception of the grains.

Although it seems that these firms are the same ones found in others regions, they are smaller in numbers. The flows of information, commodities and capital of the agricultural circuits are extremely concentrated in the new agricultural frontier. However, the services they perform are the same thus creating the same funding structure than other agricultural regions in Brazil. It is clear that within Matopiba there are peculiarities, resulting from cultural and political inheritances. But, in spite of differences, the territories are related within a logic, resulting from the joint action of world companies and large grain producers.

Despite the massive presence of large companies in Matopiba, the number of grain processing units is still small, as is that of agricultural cooperatives. The presence of few units of grain processing proves that much of the production on the new agricultural frontier is destined for export or for processing in other regions. The data confirms that more complex and complete production chains, involving industries and services with own capacity of empowers in Matopiba, have not yet been structured. The axis of dynamism is the cultivation of grains, in particular soybeans and corn.

Even so, the greatest socio-economic transformations over the two-decade period considered here happened in the regions where these firms are located, with a significant improvement in indicators such as HDI and GDP. Even though Matopiba's HDI is still lower than Brazil's average, the improvement of the indicator over two decades was relevant. Likewise, Matopiba's GDP grew at higher rates than the national average. In the comparison between the GDP growth of the municipalities that form part of Matopiba with the average of their respective states, a greater variation is also verified in favor of the new agricultural region.

The impacts of agribusiness on the economic dynamics of Matopiba can also be seen through the evolution of formal employment in a decade. Although agribusiness represents a small part of formal employment, if it is the dynamic center of the regional economy, its role is fundamental – since the income and employment of other sectors is activated by the income generated in agriculture.

This income increase, however, did not translate into equally better living conditions for the entire population. The research shows that the wealth was not evenly distributed, since inequality is still higher in municipalities within Matopiba in relation to the rest of the country. The same is valid for comparisons of municipalities within the region to their respective state averages, reinforcing the prevalence of income concentration.

Even though agribusiness contributed to alter the economic and social base of Matopiba by increasing primary production and attracting investments, as demonstrated by this research, it cannot be expected that one sector alone could tackle historic structural shortcomings in a region. Although the potential for dynamism is lower in Matopiba due to the reduced number of raw material processing industries, the research shows that the region's economy depends essentially on agribusiness. And for the industry to generate deeper changes, it is necessary to have full regional development plan and a stronger institutional action, with policies that address issues such as increase in income and better access to education and health.

REFERENCES

ALVES, E.; SOUZA, G. da S. e; MIRANDA, E. E. de. (2015). *Renda e pobreza rural na região do Matopiba*. Campinas: Embrapa, 46 p. (Embrapa. Nota técnica GITE, 10).

ALVES, V. E. L. (2006). *Mobilização e modernização nos cerrados piauienses: formação territorial no império do agronegócio* (Doctoral dissertation, Universidade de São Paulo).

- BERNARDES, J. A. (2005). Circuitos espaciais da produção na fronteira agrícola moderna: BR-163 mato-grossense. *Geografias da soja: BR-163 - Fronteiras em mutação*. Rio de Janeiro: Arquimedes Edições, 13-38.
- BRAGANÇA, A. (2016). The causes and consequences of agricultural expansion in Matopiba. *Climate Policy Initiative*. INPUT – Iniciativa para o Uso da Terra. Rio de Janeiro.
- BRANNSTROM, C., Jepson, W., FILIPPI, A. M., REDO, D., XU, Z., & GANESH, S. (2008). Land change in the Brazilian Savanna (Cerrado), 1986–2002: comparative analysis and implications for land-use policy. *Land Use Policy*, 25(4), 579-595.
- BRESSER-PEREIRA, L. C. (2006). O conceito histórico de desenvolvimento econômico. *Texto para discussão EESP/FGV*, 157.
- BRESSER-PEREIRA, L. C. (2014). Desenvolvimento, progresso e crescimento econômico. *Lua Nova*, 93, 33-60.
- BUAINAIN, A. M., & GARCIA, J. R. (2015). Evolução recente do agronegócio no cerrado nordestino. *Estudos Sociedade e Agricultura*.
- CONTEL, F. B. (2001). Os sistemas de movimento do território brasileiro. Santos, Milton & Silveira, Maria Laura. *O Brasil. Território e Sociedade no início do século XXI*. 2ed. Rio de Janeiro-São Paulo: Record.
- DOREL, G. (1985). *Agriculture et Grandes Entreprises aux états-Unis*. Paris: Economica.
- ELIAS, D. (2006). Agronegócio e desigualdades socioespaciais. In: Elias, Denise; Pequeno, Renato (Org.). *Difusão do agronegócio e novas dinâmicas socioespaciais*. Fortaleza: BNB, p. 25-82.
- ELIAS, D. (2013). Regiões produtivas do agronegócio: notas teóricas e metodológicas. In: Bernardes, Julia Adão; SILVA, Cátia Antônia da; Arruzzo, Roberta Carvalho (Org.). Espaço e energia. *Mudanças no paradigma sucroenergético*. Rio de Janeiro: Lamparina Editora, p. 49-73.
- ELIAS, D. (2015). Reestruturação produtiva da agropecuária e novas regionalizações no Brasil. In: Alaves, V. E. L (org). *Modernização e regionalização nos Cerrados do Centro Norte do Brasil: Oeste da Bahia, Sul do Maranhão e do Piauí e Leste de Tocantins*. Rio de Janeiro: Consequência Editora, pg. 25-44.
- EMBRAPA. (2014). Desenvolvimento Territorial Estratégico para Região do Matopiba. Grupo de Inteligência Territorial Estratégica (Gite). Available in: <<https://www.embrapa.br/gite/projetos/matopiba/index.html>> Access in April, 6, 2016.
- FORBES, K. J. (2000) A reassessment of the relationship between inequality and growth. *The American Economic Review*.

- FREDERICO, S. (2009). O novo tempo do cerrado: expansão dos fronts agrícolas e controle do sistema de armazenamento de grãos. *Tese de Doutorado*, Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, São Paulo.
- FURTADO, C. (2000). Teoria e política do desenvolvimento econômico, 10ª ed., São Paulo, Paz e Terra.
- IBGE (2015), Instituto Brasileiro de Geografia e Estatística. PIB dos Municípios 1999-2012. Available in: <<http://www.sidra.ibge.gov.br/bda/pesquisas/PIBMun/default.asp/>> Access in 10 Sep. 2016.
- IBGE (2015), Instituto Brasileiro de Geografia e Estatística. Mapa de Pobreza e Desigualdade – Municípios Brasileiros. Available in: <<http://cidades.ibge.gov.br/xtras/home.php>> Access in 10 Set. 2016.
- JEPSON, W., BRANNSTROM, C., & FILIPPI, A. (2010). Access regimes and regional land change in the Brazilian Cerrado, 1972–2002. *Annals of the Association of American Geographers*, 100(1), 87-111.
- KAGEYAMA, A. (1990). coord. O novo padrão agrícola brasileiro: do complexo rural aos CAIs. DELGADO, GC, GASQUES, JG, VILLA VERDE, CM, org. *Agricultura e políticas públicas*. Brasília: IPEA.
- MATOS, P. F., & PESSOA, V. L. S. (2011). Modernization of agriculture in Brazil and new uses of territory/A modernizacao da agricultura no Brasil e os novos usos do territorio. *Geo Uerj*.
- MAZZALI, L. (2000). O processo recente de reorganização agroindustrial: do complexo à organização " em rede". UNESP.
- MIRANDA, E. E. de.; MAGALHÃES, L. A.; CARVALHO, C. A. de. (2014). Proposta de Delimitação Territorial do Matopiba. Available in: <https://www.embrapa.br/gite/publicacoes/NT1_DelimitacaoMatopiba.pdf> Access in April, 02, 2016.
- MUELLER, C. C. (2005, July). Impacts of the soybean boom on the Cerrado of Brazil's Center-West region. In *Cerrado Land-Use and Conservation: Assessing Trade-Offs Between Human and Ecological Needs (XIX Annual Meeting of the Society for Conservation Biology)* (pp. 15-19).
- MÜLLER, G. (1982). Agricultura e industrialização do campo no Brasil. *Revista de Economia Política*, 2(6), 47-77.
- MYERS, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403(6772), 853-858.
- OECD/FAO - Food and Agriculture Organization of the United Nations. Relatório Perspectivas Agrícolas 2015-2024. Available in: <<http://www.fao.org.br/download/PA20142015CB.pdf>> Access in May, 20, 2016.

- OLIVEIRA, A. U. de. (2014). Políticas Públicas e o Agronegócio na Amazonia Legal/Cerrado: Conflitos Socioterritoriais – in *Território em Conflitos, Terra e Poder*. Ed. Kelps, Goiâni.
- PEREIRA, L. I., & PAULI, L. (2016). O processo de estrangeirização da terra e expansão do agronegócio na região do Matopiba/The process of land grabbing and expansion of agribusiness in Matopiba. *Campo-Território: Revista de Geografia Agrária*, 11(23 Jul).
- PNUD (2015), Programa das Nações Unidas para o Desenvolvimento. Ranking IDHM Municípios 2010. Available in: <<http://www.pnud.org.br/atlas/ranking/Ranking-IDHM-Municipios-2010.aspx>>. Access in 07 set. 2016.
- ROCHA, C. E. R. (2015) O processo de territorialização da agricultura moderna e expansão da produção de soja no município de Porto Nacional - TO. Carlos Eduardo Ribeiro Rocha. - Porto Nacional, TO: UFT, 2015. 121 p.; il.
- SANTOS, C. D. (2016). Difusão do agronegócio e reestruturação urbano-regional no Oeste Baiano. *GeoTextos*, 12(1).
- SANTOS, E. L. O. (2012). A presença de cooperativas na área de produção de grãos: um estudo da participação nordestina do Matopiba. *Revista Teoria e Evidência Econômica*, 18(39).
- SANTOS FILHO, J. I. D., Talamini, D. J. D., Scheuermann, G. N., & Bertol, T. M. (2016). Potencial do Matopiba na produção de aves e suínos. *Revista de Política Agrícola*, 25(2), 90-102.
- SANTOS, M. (2005). A urbanização brasileira (Vol. 6). Edusp.
- SCOPPOLA, M. (1996). Entreprises multinationales et politiques nationales sur les marchés agricoles mondiaux. *Économie rurale*, 234(1), 54-57.
- SILVA, J. F. G. D. (1998). A nova dinâmica da agricultura brasileira. Universidade Estadual de Campinas, Instituto de Economia.
- SILVA, L. L. (2001). O papel do Estado no processo de ocupação das áreas de Cerrado entre as décadas de 60 e 80. *Caminhos de Geografia*, 2(2).
- SOCIAIS, I. (2013). Uma análise das condições de vida da população brasileira. Rio de Janeiro: IBGE.
- WARNKEN, P. F. (1999). The development and growth of the soybean industry in Brazil. *Iowa State University Press*.

CAPÍTULO 4

*“O Nordeste que fala tchê está
longe do paraíso, ainda padece
com infraestrutura precária,
desigualdade social, conflitos
funditários e insegurança jurídica.
Mas as imperfeições de hoje
nem de longe lembram a região
que há poucos anos parecia
fadada à seca e à miséria
permanente. As terras inférteis
tornaram-se produtivas,
catapultaram a economia
e revigoraram a esperança”.*

(Matopiba Tchê, 2015)

CONSIDERAÇÕES FINAIS

A nova fronteira agrícola brasileira, chamada de Matopiba, passou por transformações significativas nos últimos 20 anos. As mudanças do uso da terra na região estão relacionadas com a expansão da agricultura, com a soja ocupando o equivalente a 61% da área cultivada com grãos nesse período. A disponibilidade de grandes extensões de terra a preços baixos e a valorização da commodity no mercado internacional foram determinantes para o surgimento da nova fronteira, consolidada a partir dos anos 2000. A influência de instituições formais e informais, como trades e indústrias, também exerceu papel relevante na formação do território.

A dinâmica do agronegócio impactou ainda no campo dos indicadores socioeconômicos. Em duas décadas, o IDH e o PIB dos municípios da região tiveram variação superior à média nacional e também à média dos quatro Estados que formam o Matopiba. Apesar da melhora nos indicadores, o estudo evidencia que o aumento da renda não se traduziu em melhores condições de vida para toda a população, já que a desigualdade ainda é maior na nova fronteira agrícola se comparada com o Brasil e com os próprios Estados onde a região está inserida.

O cenário constatado indica que o Matopiba carece de novas atividades econômicas e industriais para consolidar o seu desenvolvimento. Ainda não foram estruturadas cadeias produtivas completas na região, envolvendo indústrias e serviços com capacidade próprias de empuxe. O eixo do dinamismo é o cultivo de grãos, em particular a produção e exportação de soja.

Mas isso não quer dizer que o impacto do agronegócio tenha sido negativo, pelo contrário. A consolidação de lavouras e de tecnologia trouxe uma nova realidade econômica à região e abriu caminho para a verticalização da produção – com

beneficiamento de grãos e criação de gado, frango e suínos, a exemplo do que ocorreu no Sul e no Centro-Oeste – fronteiras agrícolas consolidadas há mais tempo.

Para que a mesma trajetória se repita no Matopiba, porém, é necessária uma atuação mais forte das instituições, especialmente as formais responsáveis por políticas públicas voltadas à renda, infraestrutura, educação e saúde. A região carece não somente de investimentos voltados à produção agrícola, como melhor logística para escoamento das safras, mas também programas direcionados a melhoria das condições de vida da população, como capacitação de trabalhadores e maior acesso à educação.

O Matopiba é fortemente marcado pelo contraste da riqueza e da carência social, que só será amenizado quando os investimentos em logística, organização rural e educação forem direcionados e concretizados de maneira eficiente. Para que isso aconteça, o papel do Estado precisa ser fortalecido, com políticas voltadas ao desenvolvimento sustentável de uma região com potencial para continuar crescendo.

REFERÊNCIAS

- ALVES, V.E.L. **Mobilização e modernização nos cerrados piauienses: formação territorial no império do agronegócio.** 2006. Tese (Doutorado) - Universidade de São Paulo, São Paulo, 2006.
- ANDERSON, J.R.; HARDY, E.E.; ROACH, J.T. Sistemas de classificação do uso da terra e do revestimento do solo para utilização com dados de sensores remotos. In: SISTEMAS de classificação do uso da terra e do revestimento do solo para utilização com dados de sensores remotos. [S.l.]: IBGE, 1979.
- BALANZA, P.P. **Populist and capitalist frontiers in the Amazon: diverging dynamics of agrarian and land-use change.** 2005. Tese (Doutorado) - Clark University, 2005.
- BARRETTO, A. G. et al. Agricultural intensification in Brazil and its effects on land-use patterns: an analysis of the 1975–2006 period. **Global Change Biology**, Oxford, v. 19, n. 6, p. 1804-1815, 2013.
- BOWMAN, M.S. et al. Persistence of cattle ranching in the Brazilian Amazon: A spatial analysis of the rationale for beef production. **Land Use Policy**, Butterworths, v. 29, n. 3, p. 558-568, 2012.

BRAGANÇA, A. The causes and consequences of agricultural expansion in Matopiba. Rio de Janeiro: INPUT, 2016. (Climate Policy Initiative)

BRAGANÇA, A.; ASSUNÇÃO, J.; FERRAZ, C. Technological Change and Labor Selection in Agriculture: Evidence from the Brazilian Soybean Revolution. 2015. (Working Paper)

BRANNSTROM, Christian et al. Land change in the Brazilian Savanna (Cerrado), 1986–2002: comparative analysis and implications for land-use policy. **Land Use Policy**, Butterworths, v. 25, n. 4, p. 579-595, 2008.

BRANNSTROM, C. South America's neoliberal agricultural frontiers: Places of environmental sacrifice or conservation opportunity. **AMBIO: A Journal of the Human Environment**, Oxford, v. 38, n. 3, p. 141-149, 2009.

BRASIL. Ministério do Meio Ambiente. **Mapeamento de Cobertura Vegetal dos Biomas Brasileiros**. 2007. Disponível em: <http://mapas.mma.gov.br/mapas/aplic/probio> Acesso em: 20 maio 2016.

BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. **Projeções do Agronegócio**. 6ª ed. Brasília/DF, 2015.

BRIASSOULIS, H. **Analysis of land use change**: theoretical and modeling approaches. West Virginia University: Regional Research Institute, 2000.

COLUSSI, J. Matopiba Tchê. **Zero Hora**, Porto Alegre, Reportagem Especial, 2016. 20p.

CUNHA, A.S. et al. **Uma avaliação da sustentabilidade da agricultura nos cerrados**. Brasília: Ipea, 1993.

DEFRIES, R.S. et al. Deforestation driven by urban population growth and agricultural trade in the twenty-first century. **Nature Geoscience**, London, v. 3, n. 3, p. 178-181, 2010.

DELGADO, G.C. Expansão e modernização do setor agropecuário no pós-guerra: um estudo da reflexão agrária. **Estudos avançados**, São Paulo, v. 15, n. 43, p. 157-172, 2001.

DI TELLA, G. The economics of the frontier. In: **ECONOMICS in the long view**. Palgrave Macmillan UK, 1982. p. 210-227.

DOS SANTOS, C.D. Difusão do agronegócio e reestruturação urbano-regional no Oeste Baiano. **GeoTextos**, Bahia, v. 12, n. 1, 2016.

ELIAS, D. Regiões produtivas do agronegócio: notas teóricas e metodológicas. In: BERNARDES, J.A.; SILVA, C.A.; ARRUIZZO, R.C. (Org.). **Espaço e energia**. Mudanças no paradigma sucroenergético. Rio de Janeiro: Lamparina Editora, [2013]. p. 49-73.

EMBRAPA. **Desenvolvimento Territorial Estratégico para Região do Matopiba. Grupo de Inteligência Territorial Estratégica (Gite)**. 2014. Disponível em: <<https://www.embrapa.br/gite/projetos/matopiba/index.html>> Acesso em: 6 abr. 2016.

EMBRAPA CERRADOS. **Cobertura Vegetal dos Biomas Brasileiros: Mapeamento de Cobertura Vegetal do Bioma Cerrado**. Brasília, DF: Ministério do Meio Ambiente, 2006. Disponível em: <<http://www.mma.gov.br/component/k2/item/7626?Itemid=926>> Acesso em: 12 abr. 2016.

FOLEY, J.A. et al. Global consequences of land use. **Science**, Washington, v. 309, n. 5734, p. 570-574, 2005.

FOSCHIERA, A. A. A produção agrícola no Brasil. **Revista Interface**, Natal, n. 02, 2005.

FRANCO, J.B.S. O papel da EMBRAPA nas transformações do cerrado. **Caminhos de Geografia**, Uberlândia, v. 2, n. 3, p.31-40, 2001.

FRANÇOSO, R.D. et al. Habitat loss and the effectiveness of protected areas in the Cerrado biodiversity hotspot. **Natureza & Conservação**, Curitiba v. 13, n. 1, p. 35-40, 2015.

FREDERICO, S. **O novo tempo do cerrado: expansão dos fronts agrícolas e controle do sistema de armazenamento de grãos**. 2009. 273 f. Tese (Doutorado) - Faculdade de Filosofia, Letras e Ciências Humanas da Universidade de São Paulo, São Paulo, 2009.

GEIST, H. J.; LAMBIN, E.F. Proximate causes and underlying driving forces of tropical deforestation: Tropical forests are disappearing as the result of many pressures, both local and regional, acting in various combinations in different geographical locations. **BioScience**, Washington, v. 52, n. 2, p. 143-150, 2002.

GRAESSER, J. et al. Cropland/pastureland dynamics and the slowdown of deforestation in Latin America. **Environmental Research Letters**, London, v. 10, n. 3, p. 034017, 2015.

IBGE. Instituto Brasileiro de Geografia e Estatística. **Manual Técnico de Uso da Terra**. Rio de Janeiro, 2013.

KAIMOWITZ, D.; ANGELSEN, A. **Economic models of tropical deforestation: a review**. Cifor, 1998.

KAIMOWITZ, D.; SMITH, J.. Soybean technology and the loss of natural vegetation in Brazil and Bolivia. In: **AGRICULTURAL technologies and tropical deforestation**. Wallingford, Oxon, UK: CABI Publishing, 2001.

LAMBIN, E. F.; ROUNSEVELL, M. D. A.; GEIST, H. J. Are agricultural land-use models able to predict changes in land-use intensity? **Agriculture, Ecosystems & Environment**, Amsterdam, v. 82, n. 1, p. 321-331, 2000.

LAMBIN, E.F.; MEYFROIDT, P. Global land use change, economic globalization, and the looming land scarcity. **Proceedings of the National Academy of Sciences**, Washington, v. 108, n. 9, p. 3465-3472, 2011.

LATOUR, B. **Jamais fomos modernos**. São Paulo, Editora 34, 1994.

MIRANDA, E.E.; MAGALHÃES, L.; CARVALHO, C.A. Proposta de delimitação territorial do Matopiba. Campinas: GITE/EMBRAPA, 2014. (Nota Técnica, n. 1)

MÜLLER, Geraldo. Agricultura e industrialização do campo no Brasil. **Revista de Economia Política**, São Paulo, v. 2, n. 6, p. 47-77, 1982.

OECD/FAO - Food and Agriculture Organization of the United Nations. **Relatório Perspectivas Agrícolas 2015-2024**. Disponível em:
<<http://www.fao.org.br/download/PA20142015CB.pdf>> Acesso em: 20 Maio 2016.

OLIVEIRA, T.E. **Dinâmica da produção de alimentos no bioma Pampa**. 2015. Tese (Doutorado) - Programa de Pós-Graduação em Agronegócios, Centro de Estudos e Pesquisas em Agronegócios, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2015.

OLIVEIRA, A. U. Políticas Públicas e o Agronegócio na Amazonia Legal/Cerrado: Conflitos Socioterritoriais. In: TERRITÓRIO em Conflitos, Terra e Poder. Goiânia: Ed. Kelps, 2014.

PERZ, S.G. et al. Unofficial road building in the Amazon: socioeconomic and biophysical explanations. **Development and Change**, Oxford, v. 38, n. 3, p. 529-551, 2007.

RAMANKUTTY, N. et al. Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000. **Global Biogeochemical Cycles**, Washington, v. 22, n. 1, 2008.

REZENDE, G. C. Ocupação agrícola e estrutura agrária no cerrado: o papel do preço da terra, dos recursos naturais e da tecnologia. Rio de Janeiro: Ipea, 2002.

ROCHA, C.E.R. **O processo de territorialização da agricultura moderna e expansão da produção de soja no município de Porto Nacional - TO**. 2015. Tese (Doutorado) - Universidade Federal do Tocantins, Porto Nacional, 2015.

RUDEL, T.K. Changing agents of deforestation: from state-initiated to enterprise driven processes, 1970–2000. **Land use policy**, Butterworths, v. 24, n. 1, p. 35-41, 2007.

SPERA, S.A. et al. Land-use change affects water recycling in Brazil's last agricultural frontier. **Global change biology**, Oxford, v. 22, n. 10, p. 3405-3413, 2016.

WALKER, R.; MORAN, E.; ANSELIN, L. Deforestation and cattle ranching in the Brazilian Amazon: external capital and household processes. **World development**, Oxford, v. 28, n. 4, p. 683-699, 2000.