AGROFUELS IN BRAZIL

WHAT IS THE OUTLOOK FOR ITS FARMING SECTOR?

John Wilkinson
Selena Herrera

Brazil
2008
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ADEC</td>
<td>Association of Cultural and Educational Development (Associação de Desenvolvimento Educacional e Cultural)</td>
</tr>
<tr>
<td>ADM</td>
<td>Archer Daniels Midland Company</td>
</tr>
<tr>
<td>ANP</td>
<td>National Petroleum Agency (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis)</td>
</tr>
<tr>
<td>ATER</td>
<td>Collective Rural Extension Service and Technical Assistance (Assistência Técnica e Extensão Rural Coletiva)</td>
</tr>
<tr>
<td>BASA</td>
<td>Amazonian Bank (Banco da Amazônia)</td>
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<tr>
<td>BB</td>
<td>Brazil Bank</td>
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<tr>
<td>BED</td>
<td>Brasil Ecodiesel</td>
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<tr>
<td>BNB</td>
<td>Northeast Bank (Banco do Nordeste)</td>
</tr>
<tr>
<td>BNDES</td>
<td>National Bank of Economic and Social Development (Banco Nacional de Desenvolvimento Econômico e Social)</td>
</tr>
<tr>
<td>BPC</td>
<td>Continuous Cash Benefit Programme (Benefício de Prestação Continuada)</td>
</tr>
<tr>
<td>BPNP</td>
<td>Brazilian Production and Use of Biodiesel National Programme</td>
</tr>
<tr>
<td>BRENCO</td>
<td>Brazil Renewable Energy Company</td>
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<tr>
<td>CAFTA</td>
<td>Central America Free Trade Agreement</td>
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<tr>
<td>CEB</td>
<td>Clean Energy Brazil</td>
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<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CIRAD</td>
<td>Centre for International Cooperation on Agricultural Research for Development (Centre de coopération internationale en recherche agronomique pour le développement)</td>
</tr>
<tr>
<td>CNAA</td>
<td>National Sugar and Alcohol Company</td>
</tr>
<tr>
<td>CNPE</td>
<td>National Energy Policy Council (Conselho Nacional de Política Energética)</td>
</tr>
<tr>
<td>COFINS</td>
<td>Contribution for the Social Security Financing (Contribuição para o Financiamento da Seguridade Social)</td>
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<tr>
<td>COPPE/ UFRJ</td>
<td>Alberto Luiz Coimbra Institute of Post-Graduation and Engineering Research of the Rio de Janeiro Federal University (Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia / Universidade Federal do Rio de Janeiro)</td>
</tr>
<tr>
<td>CW</td>
<td>Centre-West</td>
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<tr>
<td>DED</td>
<td>German Development Service (Deutsche Entwicklungsdienst)</td>
</tr>
<tr>
<td>DNOCS</td>
<td>National Department of Works Against Drought (Departamento Nacional de Obras Contra a Seca)</td>
</tr>
<tr>
<td>EMATER</td>
<td>Rural Extension Service and Technical Assistance Corporation (Empresa de Assistência Técnica e Extensão Rural)</td>
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<tr>
<td>EMBRAPA</td>
<td>Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária)</td>
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<tr>
<td>ESALQ/USP</td>
<td>School of Agriculture Luiz de Queiroz at the S. Paulo University (Escola Superior de Agricultura Luiz de Queiroz / Universidade de São Paulo)</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>FAPESP</td>
<td>The State of São Paulo Research Foundation (Fundação de Amparo à Pesquisa do Estado de São Paulo)</td>
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<tr>
<td>FASE</td>
<td>Federation of Organs for the Educational and Social Assistance (Federação de Órgãos para Assistência Social e Educacional)</td>
</tr>
<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
</tr>
<tr>
<td>FETAG</td>
<td>Rural Workers Federation (Federação dos Trabalhadores e Trabalhadoras na Agricultura)</td>
</tr>
<tr>
<td>FETRAECE</td>
<td>Rural Workers Federation of the State of Ceará (Federação dos Trabalhadores e Trabalhadoras na Agricultura do Estado do Ceará)</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GEG</td>
<td>Greenhouse Effect Gases</td>
</tr>
<tr>
<td>GTZ</td>
<td>German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit)</td>
</tr>
<tr>
<td>IBGE</td>
<td>Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>ICMS</td>
<td>Transport and Merchandises Circulation Tax (Imposto sobre operações relativas à circulação de mercadorias e sobre prestações de serviços de transporte interestadual, intermunicipal e de comunicação)</td>
</tr>
<tr>
<td>INMETRO</td>
<td>National Institute of Metrology, Standardization and Industrial Quality (Instituto Nacional de Metrologia, Normalização e Qualidade Industrial)</td>
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<tr>
<td>INPE</td>
<td>Brazilian National Institute for Space Research (Instituto Brasileiro de Pesquisas Espaciais)</td>
</tr>
<tr>
<td>IPI</td>
<td>Industrial Products Tax (Imposto sobre Produtos Industrializados)</td>
</tr>
<tr>
<td>IPO</td>
<td>Initial Public Offering</td>
</tr>
<tr>
<td>ISPN</td>
<td>Society, Population and Nature Institute (Instituto Sociedade, População e Natureza)</td>
</tr>
<tr>
<td>ITERPA</td>
<td>Pará Land Institute (Instituto de Terras do Pará)</td>
</tr>
<tr>
<td>JBC</td>
<td>Japanese Bank of International Cooperation</td>
</tr>
<tr>
<td>MAPA</td>
<td>Ministry of Agriculture, Cattle Farming and Supply (Ministério da Agricultura, Pecuária e Abastecimento)</td>
</tr>
<tr>
<td>MCT</td>
<td>Ministry of Sciences and Technology (Ministério de Ciência e Tecnologia)</td>
</tr>
<tr>
<td>MDA</td>
<td>Ministry of the Agrarian Development (Ministério do Desenvolvimento Agrário)</td>
</tr>
<tr>
<td>MMA</td>
<td>Environmental Ministry (Ministério do Meio Ambiente)</td>
</tr>
<tr>
<td>MPA</td>
<td>Movement of Small Farmers (Movimento dos Pequenos Agricultores)</td>
</tr>
<tr>
<td>MST</td>
<td>Landless Movement (Movimento dos Trabalhadores Rurais Sem Terra)</td>
</tr>
<tr>
<td>N</td>
<td>North</td>
</tr>
<tr>
<td>NE</td>
<td>Northeast</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>PAC</td>
<td>Programme of Growth Acceleration (Programa de Aceleração do Crecimento)</td>
</tr>
<tr>
<td>PASEP</td>
<td>Formation Programme of the Public Server Wealth (Programa de Formação do Patrimônio do Servidor Público)</td>
</tr>
<tr>
<td>PETI</td>
<td>Child Labour Eradication Programme (Programa de Erradicação de Trabalho Infantil)</td>
</tr>
<tr>
<td>PIS</td>
<td>Programme of Social Integration (Programa de Integração Social)</td>
</tr>
<tr>
<td>PNAD</td>
<td>National Sample Research of Households (Pesquisa Nacional por Amostra de Domicílios)</td>
</tr>
<tr>
<td>PROAGRO</td>
<td>Programme for Guarantee of Agriculture Activity (Programa de Garantia de Atividade Agropecuária)</td>
</tr>
<tr>
<td>PRODEIC</td>
<td>Industrial and Commercial Development Programme (Programa de Desenvolvimento Industrial e Comercial)</td>
</tr>
<tr>
<td>PRONAF</td>
<td>Programme for Strengthening of Family Agriculture (Programa Nacional de Fortalecimento da Agricultura Familiar)</td>
</tr>
<tr>
<td>REFAP</td>
<td>Alberto Pasqualini Refinery S.A.</td>
</tr>
<tr>
<td>S</td>
<td>South</td>
</tr>
<tr>
<td>SDA</td>
<td>Agricultural Development Secretary’s Office (Secretaria do Desenvolvimento Agrário)</td>
</tr>
<tr>
<td>SEBRAE</td>
<td>Brazilian Service for Micro and Small Firms’ Support (Serviço Brasileiro de Apoio às Micro e Pequenas Empresas)</td>
</tr>
<tr>
<td>SINDICOM</td>
<td>National Trade Union of the Distributors of Fuels sold and Lubricants (Sindicato Nacional das Distribuidoras de Combustíveis e Lubrificantes)</td>
</tr>
<tr>
<td>SIP</td>
<td>Integrated Production System (Sistemas Integrados de Produção Agropecuária)</td>
</tr>
<tr>
<td>SRB</td>
<td>Brazilian Rural Society (Sociedade Rural Brasileira)</td>
</tr>
<tr>
<td>STTR</td>
<td>Rural Workers’ Trade Union (Sindicato do Trabalhadores e Trabalhadoras Rurais)</td>
</tr>
<tr>
<td>TAC</td>
<td>Agreement for Adjustment of Behaviour</td>
</tr>
<tr>
<td>UBRABIO</td>
<td>Brazilian Union of Biodiesel (União Brasileira do Biodiesel)</td>
</tr>
<tr>
<td>UFLA</td>
<td>Federal University of Lavras</td>
</tr>
<tr>
<td>UFPEL</td>
<td>University of Pelotas</td>
</tr>
<tr>
<td>UNICA</td>
<td>Sugarcane Industry Union (União da Indústria de Cana-de-Açúcar)</td>
</tr>
<tr>
<td>WWF</td>
<td>World Wildlife Fund</td>
</tr>
<tr>
<td>ZEE</td>
<td>Ecological Economic Zoning (Zoneamento Ecológico-Econômico)</td>
</tr>
</tbody>
</table>
In June 2008, Oxfam International (OI) launched a global study called “Another inconvenient truth: how biofuel policies are deepening poverty and accelerating climate change”. The main objective of this document was to contribute to the public debate on the implications of different measures being taken by rich-country governments, particularly the United States and the European Union, in favor of the production of fuels from agricultural inputs. Oxfam warns that, as opposed to what the rulers of these nations are saying, these policies do not constitute any “salvation” for the climate crisis or the petroleum crisis. Much on the contrary, they are contributing to a third crisis, that of the prices of food products. In developing countries, fuels produced from biomass could, under certain circumstances, offer alternatives for sustainable development. However, the economic, social and environmental costs involved can be severe and decision-makers should take a very cautious stance in designing and implementing policies for this purpose.

Considering that Brazil is a major actor in the international scenario in the area of agrofuels, particularly ethanol, it was seen that its specificities should be better known and taken into account for preparing the above-mentioned global study. Therefore, Oxfam International in Brazil commissioned a research project to researchers John Wilkinson and Selena Herrera, from the CPDA of UFRRJ, to have a more in-depth understanding of the general situation of both ethanol from sugarcane and of biodiesel in Brazil. In addition, it was suggested that case studies on concrete experiences driven by the support provided by governmental policies should be carried out. And so was done. The researchers visited and analyzed three areas where initiatives

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1 For more information see: http://www.oxfam.org/en/policy/another-inconvenient-truth
2 Graduate Program in Social Sciences in Development, Agriculture and Society of the Federal Rural University of Rio de Janeiro (CPDA/UFRRJ).
were launched to produce agrofuel based on family agriculture which rely on the support of public authorities, namely: a project for producing biodiesel from palm oil in Brazil’s North region (state of Pará) and from castor bean in its Northeast region (state of Ceará) and a genuine ethanol production experience in its South region (state of Rio Grande do Sul). The latter initiative was designed not only to integrate food and energy production but also to bring energy production and consumption closer together, so as to ensure energy and food autonomy to the communities involved in the project.

Because of its the wealth of data and keen analysis, the study by John Wilkinson and Selena Herrera provided major inputs for the above-mentioned global document prepared by Oxfam International. Given these facts, we decided to translate the text - originally written in English - into Portuguese and publish it in both languages, so as to share and disseminate the information contained in it publicly. It should be highlighted that the contents of the document are of the exclusive responsibility of the researchers and, therefore, they do not express, necessarily, Oxfam’s position, but rather technical and personal opinions based on the vast professional experience of its authors.

We hope that this publication will contribute to expanding the debate on agrofuel production in Brazil by providing information and analyses that can be used as a benchmark by all men and women interested in this topic.

Good reading!

Oxfam International in Brazil
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Introduction

This study of Brazilian agrofuels deals separately with ethanol and biodiesel. In spite of overlaps which will be discussed in the text and which are likely to increase with time ethanol and biodiesel are governed by very different dynamics. The former is derived from large sugarcane plantations still heavily dependent on, often casual, harvest wage-labourers. Some two-thirds of sugar cane production is concentrated in the State of São Paulo (SP). Ethanol was first used in the 1920s but was promoted in a major way as a light-vehicle fuel through the Federal Government Proalcool programme in the 1970s in response to the explosion of petroleum prices. With declining oils prices in the 1980s and rising world sugar prices consumer confidence was broken as producers shifted from ethanol to sugar for export. Ethanol has re-emerged dramatically in response to the recent rise in oil fuel prices, this time as a private deregulated initiative supported by the startling growth in the flex-fuel car market which allows consumer fuel purchasing choice. While still primarily oriented to the domestic market the future is seen to lie with the transformation of ethanol into a global commodity with Brazil as the leading player.

The emerging biodiesel market, on the other hand, is a government created and regulated market which was launched as recently as 2004. As we will describe in the main body of the text, it is a highly elaborated and original case of “market construction”. Legally enforced regulation on the mixture of biodiesel (a subordinate feature also, it should be added, of the ethanol market) will ensure a progressively expanding market providing a predictable long-term framework for investments. Access to this market is via auctions organized by the ANP. In addition, participation in these auctions depends on the acquisition of a Social Seal provided by the Ministry for Agrarian Development to those firms which demonstrate that a given percentage of their raw material or crude oil has been contracted with family farms in agreement with the rural trade unions. In stark contrast with ethanol, the Biodiesel Programme is explicitly designed as an initiative giving priority to social inclusion. It is seen as an opportunity for income and employment creation within the family-farming sector as a whole. It is also designed as an instrument for regional development with the aim of using raw materials traditional to each region or bioma. Differently from ethanol, therefore, which is exclusively produced from sugarcane in Brazil (although manioc was initially experimented), biodiesel is designed to be produced from a variety of raw materials (including also animal fat, and used cooking oils) in multi-purpose bio-refineries. Ideally it is hoped that the family farming sector will advance to the production of crude oil as a key value-adding activity, although as we will see this is far from evident in practice. Initially biodiesel is directed to the domestic market although investments are underway premised on the consolidation of exports.

The Biodiesel programme is still in its infancy and very different futures are possible. To a certain extent it can be seen as a compensatory policy given that ethanol is unashamedly recognised as the domain of large-scale farming and large-scale, increasingly transnational, capital. On the other hand, it is not
impossible that novel features of the biodiesel programme, such as the stipulation that a (regionally varying) percentage of raw material should come from family farmers, be seen as policies viable also for the sugarcane sector. In practice, however, there are strong indications that the biodiesel programme itself may become absorbed within the logic of the dominant agribusiness sector. Soy-oil is already the principal feedstock nationally and very large-scale oil palm plantations dominate in the Northern region.

Our report will be divided into three sections: the first two dealing respectively with ethanol and biodiesel and the final section with a series of three regional case studies. The first two sections involve a detailed analysis of each sector’s dynamic with a specific focus on social, gender, food security and environmental implications. In addition to a review of secondary data, journalistic information, technical reports, public policy and academic publications, we conducted extensive interviews with a wide range of relevant actors.

Through the case-studies our report examines the development of the biodiesel programme in the Northeast (Ceará) and the North (Pará) with a view to evaluating the programme’s potential for consolidating the participation of the family farming sector and establishing the basis for local and regional development. Both of these approaches impose clear criteria for the biodiesel programme which go beyond the degree to which it accomplishes its supply goals.

The State of Ceará has a high density of family farmers in the semi-arid region for whom the biodiesel programme in principal offers an important opportunity for improved income and employment conditions. More important, however, has been the degree of institutional mobilization to promote the biodiesel programme. Ceará has seen important investments in refining by both Petrobras and the leading private biodiesel firm Brasil Ecodiesel. In addition, the programme has received very strong backing from the State Government. Decisive for our choice of the State of Ceará was the level of mobilization and coordination of the different, relevant actors for the success of the programme.

In the Northern region, the State of Pará was chosen because this State has become the focus of palm oil production which globally is the principal component of the biodiesel programme and has been defined as the initial privileged raw material for this region.

While biodiesel has been conceived from its initial formulation as a programme geared to the family farm, it has been widely accepted that scale economies preclude such an approach in the case of ethanol from sugarcane. The choice of the State of Rio Grande do Sul for our third case-study is based on the number of projects challenging this logic and promoting ethanol from sugarcane in integrated energy and food family production systems.
Ethanol

A brief history

Brazil, as we have seen, has a long tradition with ethanol dating back to the 1920s and during the 2WW ethanol was mixed with gasoline in light vehicles, but it is with the Pro-Alcohol programme launched by Geisel in 1975, still in the period of the military dictatorship, that the dynamic of current ethanol production in Brazil begins. The motive was the petroleum price hike and the difficulty of ensuring supplies following on the embargo by leading Middle-Eastern producers at a time when some 80% of Brazil’s requirements were supplied by imports. The Programme was heavily dependent on State intervention in a still very regulated economy. The aim, in this first period of the programme was to stimulate the addition of 20-25% of anhydrous ethanol to gasoline. In a second phase the goal became that of producing hydrous ethanol for use in light vehicles specially adapted for this purpose. Ethanol prices were fixed at 65% of gasoline prices (themselves also controlled), gasoline stations were obliged to supply ethanol and a range of subsidies ensured that all actors benefited from the production, distribution and consumption of ethanol. The automobile industry responded rapidly, progressively resolving a range of technical problems and by the middle 1980s some 90% of sales were for cars running on ethanol. In the second half of this decade, however, a combination of factors led to the collapse of the programme. Petroleum prices fell sharply, the price of sugar on the world market became attractive, and the economic crisis in Brazil made it increasingly difficult to sustain the huge subsidies that the programme required (more than US$10 billion over the decade). Sugarcane became diverted to exports precisely at the moment when car sales were at their strongest leading to shortages and price hikes undermining the attractiveness of the ethanol option. Consumer deception led to a collapse in ethanol car sales and by the end of the decade production of ethanol driven cars declined sharply and was discontinued in the 1990s.

Sugarcane production expanded sharply in response to the incentives of the Pro-Alcohol programme generating strong criticism focusing on land concentration, the expulsion of small farmers, the substitution of food crops, the treatment of farm labour and the undermining of local communities by large-scale monoculture. Opposition also singled out the negative environmental consequences of sugarcane expansion – increased use of chemical inputs, the burning techniques prior to harvest and the pollution of water sources from sub-products (vinhoto). All these issues re-emerge in the light of the current expansion of ethanol production to which we now turn.

In the new millennium, petroleum prices again experienced explosive increases. Now however the search for alternatives to petroleum became generalised acquiring normative force in the context of the Kyoto Protocol agreements. The automobile industry for its part introduced a major innovation in the
form of the flex-fuel vehicle which allows complete liberty for the consumer to opt for either ethanol or gasoline not now at the point of car purchase but at the petrol-station. This measure rapidly restored consumer confidence and although the flex car was only introduced in 2003 it now accounts for some 80% of car purchases and is expected to reach 90% by 2010 (UNICA, 2008). While the domestic market currently absorbs 85% of ethanol production, the fundamental attraction today is the perspective of a global ethanol market as governments increasingly adopt Kyoto inspired renewable energy goals. There is consensus that in such a market, Brazil would reign supreme at least until the introduction of second generation technology associated with the competitive use of cellulose raw materials. This latter is not due to come on steam before 2015 and even then Brazil may well be able to maintain its competitiveness incorporating cellulose technology to increase even further the productivity of its sugarcane.

In sharp contrast to the Pro-Alcohol Programme, the current surge in ethanol production has been led by the private sector in a framework of unregulated market pricing. An international lobby led by Brazil and the US is currently campaigning for the establishment of norms and standards which would allow ethanol to be transformed into a global commodity. The Brazilian sugarcane sector is further buoyed by the attractiveness of world sugar-prices as strong growth in developing countries increases the demand for this commodity. Brazil now exports some two-thirds of its sugar production. In the light of these stimulants an unprecedented wave of investments has been directed at the Brazilian sugarcane sector. São Paulo remains the centre of future expansion, but new investment programmes now look to the advantages of the savannah regions of Minas Gerais, Goiás, and the two Mato Grosso. Traditional, North-eastern sugar capital (Alagoas, Pernambuco) is now shifting investments to these regions while new areas in the Northeast (Rio Grande do Norte, Bahia) and the North (Tocantins) are also being opened up. Over US$30 billion is expected to be invested over the next five years with the novelty being the importance of foreign direct investment not only in acquisitions but in integrated new green field plants. The sugarcane sector is still relatively fragmented (350 plants although leading players will each have a number of plants. Cosan, the leader, exceptionally has 18 plants) but is undergoing rapid concentration as non-traditional domestic capital (the Brazilian transnational construction company Odebrecht) and a wide variety of foreign capitals (traders, petroleum, investments funds) begin to move into the sector. Sugarcane production currently occupies almost 8 million hectares and it is calculated that the investments in the pipeline will lead to the incorporation of a further 3 million hectares.

This extraordinary expansion of the sugarcane sector, now responsible for a turnover of some US$20 billion, has transformed it into the most dynamic component of Brazil’s agribusiness, although the soy complex is still the leading segment, with some US$30 billion gross earnings. In the State of São Paulo, responsible for over 60% of national production, the sugarcane sector accounts for 45% of the State’s agribusiness. It is not surprising, therefore, that the expectations levelled at the Proalcohol programme are now being renewed in the light of this extraordinary expansion of sugarcane. While earlier criticism was essentially domestic and directed at a very traditional sector marked by immunity from exposure, discussions today on labour and environmental conditions involve above all transnational capital and the development of a global ethanol market whose standards will certainly include an explicit commitment to acceptable labour and environmental objectives.
Profile of the sugarcane complex

Brazil, the world’s leading sugarcane producer and exporter, has currently some 350 sugarcane processing plants, 230 of which are dual purpose mills and distilleries with over a hundred exclusively for ethanol production. In the 2007-8 harvest, 487 million tons of sugarcane were produced on 7.8 million hectares (see Table below). Initially concentrated in the Northeast of the country, production is now overwhelmingly in the Centre-South, with the State of São Paulo accounting for over 60% of overall production. Productivity has increased steadily reaching from 80 to over 100 tons per hectare depending on the region. Processing must occur quickly after harvesting if sugar content is not to be lost imposing a limit to the distance between plantations and processing plants. Most mills as a result depend heavily on their own plantations with independent suppliers accounting for some 30%. It is calculated that there are some 60,000 independent suppliers whose properties on average are less than 150 hectares. These, however, often simply rent out their land to the mill owner many are not farmers in their own right. The milling and distillery sectors are undergoing processes of concentration with the smaller plants being bought out.

Table 1. Brazilian production of sugarcane, sugar and ethanol (2007/2008)

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Sugarcane Production (million tonnes)</th>
<th>% of Total</th>
<th>Sugar Production (million tonnes)</th>
<th>Ethanol Production (billion litres)</th>
</tr>
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<tbody>
<tr>
<td>Southeast</td>
<td>335.9</td>
<td>69.0</td>
<td>21.5</td>
<td>15.2</td>
</tr>
<tr>
<td>São Paulo</td>
<td>295.0</td>
<td>60.6</td>
<td>19.1</td>
<td>13.5</td>
</tr>
<tr>
<td>Minas Gerais</td>
<td>35.6</td>
<td>7.3</td>
<td>2.1</td>
<td>1.8</td>
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<tr>
<td>Centre-West</td>
<td>50.6</td>
<td>10.4</td>
<td>2.1</td>
<td>3.0</td>
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<tr>
<td>Goiás</td>
<td>20.8</td>
<td>4.3</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Mato Grosso</td>
<td>14.9</td>
<td>3.1</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Mato Grosso do Sul</td>
<td>14.8</td>
<td>3.0</td>
<td>0.6</td>
<td>0.9</td>
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<tr>
<td>Northeast</td>
<td>58.7</td>
<td>12.0</td>
<td>4.4</td>
<td>1.9</td>
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<tr>
<td>Alagoas</td>
<td>24.7</td>
<td>5.1</td>
<td>2.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Pernambuco</td>
<td>17.1</td>
<td>3.5</td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>South</td>
<td>40.5</td>
<td>8.3</td>
<td>2.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Pará</td>
<td>40.4</td>
<td>8.3</td>
<td>2.5</td>
<td>1.9</td>
</tr>
<tr>
<td>North</td>
<td>1.3</td>
<td>0.3</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>487.0</td>
<td>100.0</td>
<td>30.6</td>
<td>22.0</td>
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</tbody>
</table>


Traditionally sugarcane has been harvested manually creating an enormous demand for labour during the long harvesting season which extends from five to six months. The harvesting periods in the Northeast and Centre-South do not coincide allowing Brazil to have production throughout the whole year. Most of the labour force is unqualified and migrant coming from the Northeast of the country. Mechanisation has been recently introduced, especially in the Centre-South, where it now accounts for 40% of the harvest. It is estimated that one machine replaces as many as a hundred workers. Manual
harvesting has been subject to persistent criticism both as regards working conditions and environmental implications since it requires the prior burning of the sugarcane to make it easier for cutting. Mechanised harvesting will be obligatory in São Paulo State by 2017 but it is expected that 70% of the harvest will be already mechanised by 2010. While the sugar planters’ association, UNICA, argues that workers received double the federal minimum wage, criticism has focused particularly on the extenuating production targets, double those prevailing twenty years ago. Now, however, sugarcane cutters face the threat of massive unemployment. Mechanisation will also lead to a new employment profile in the sector with increasing demand for more skilled labour. While retraining programmes may permit some level of on the job recycling, this will not provide a solution for the vast majority of sugar cane workers. The rapid expansion of sugarcane in other regions however may offset the impact of mechanisation in the Centre-South. According to UNICA new investments in the Centre-West are planned to be 100% mechanised which will in fact allow for little absorption and few cane-cutters will benefit from the semi-qualified jobs opened up by mechanisation in São Paulo. A lot depends on the rhythm of mechanisation in São Paulo.

The sugarcane sector is one of the few in which domestic technology dominates the whole production cycle. Agricultural and genetic research capacity (including the recent mapping of the sugarcane genome) has allowed for the continuous production of improved varieties and the development of agricultural practices which have lowered the demand for chemical inputs. Brazil also dominates the production of sugar mills and distilleries which are now also being exported. The enthusiasm which the new ethanol market generates in institutions such as the National Development Bank (BNDES), a major financer of new investment projects, derives from the perspective of global competitiveness in a sector where domestic competences dominate all phases of the technological cycle. FAPESP, the São Paulo State research promotion agency is currently investing RS$150 million in ethanol research which includes all aspects of the production cycle. EMBRAPA, the Brazilian national research system has set up a special unit to develop research into bioenergy. Whether this current technological dominance is compatible with the rhythm of foreign direct investment in the sector, which according to Maurilio Biagi Filho, President of the Agroenergy and Biofuels Committee of the Brazilian Rural Society (SRB) will reach a 50% participation in less than ten years, remains to be seen (ANBA, News 27/02/2007). The key to future competitiveness lies in the control of cellulose technology, and although Brazil is active in this area investment in research still lags way behind the US which has already established the goal of basing all ethanol production on cellulose sources by 2016.

Over the years 2007-2012 new investments are projected to total US$33 billion and it is estimated that by 2020 sugarcane production will have doubled. Many new plants are exclusively for ethanol and it may be that this market becomes independent of sugar, particularly if genetic research moves in the direction of dedicated plant traits. At present, however, it is the flexibility in adjusting to the evolution of each market which enhances the attractiveness of the sector. In addition, sugarcane plants are now major suppliers of bio-electricity on the basis of bagasse and straw burnt in high efficiency boilers. According to UNICA, the sugarcane sector currently is able to cover its own demands for electricity and produce a surplus of 1.800 average megawatts equivalent to 3% of Brazil’s demand. It is projected that the sector could increase this production to 15% of Brazil’s energy needs offering an alternative to dependence on
new hydroelectric dams and a complement to existing hydroelectric sources. Bio-electricity is ceasing to be a sub-product for internal use and is being transformed into a co-product on a par with sugar and alcohol and recognised as a component of Brazil’s energy matrix. In addition the production of bio-electricity qualifies the sector for the carbon credits market.

Leading players

The Brazilian sugarcane sector has suffered profound transformations since the beginning of the 1990s when internal market regulation was abolished and international commodity agreements similarly discontinued. The sector is still fragmented with many individual family run mills, but consolidation is underway which together with new investments in the pipeline will substantially transform the sector over the next five to ten years. Specialist companies are now being created to promote consolidation as in the case of Clean Energy Brazil created through an IPO on the Alternative Investment Market of London which we will discuss below. While the size of existing mills varies considerably, Infinity Bio-Energy, a new-style investor argues that optimum size is now between 1-3 million tons of sugarcane. At the moment, some 40 groups control 60% of the market but it is expected that they will be reduced to five or six over the next two decades (UNICA, 2005). Within São Paulo, new investments are shifting to the cattle regions of the State and it is argued that as a result cattle production is increasingly being relocated to the North of the country putting pressure on the tropical forests of the Amazon. Relations between the two sugarcane major producing regions are also changing as the leading groups in the Northeast, from the States of Alagoas and Pernambuco, invest heavily in the Centre-South, particularly in the savannah region of Minas Gerais, the privileged target of new investments. Northeastern groups are also heavily involved in projects in Northern States, especially Tocantins which is aggressively attracting new investment.

Production in São Paulo, using data from 2004, is dominated by the marketing cooperative Copersucar which also has a refinery for final products, port terminal and important research capacity. The Cooperative has 85 associates and 31 mills in São Paulo, Minas Gerais and Paraná States and has a turnover of around US$2.5 billion. Cosan is the largest individual group, with 13 mills run by the traditional Ometto family. In four of these mills and a port terminal it is associated with French group, Tereos. Cosan’s turnover comes to over US$1 billion and accounts for 10% of the market. Crystalsev, with a turnover of some US$800 million is in third place with nine mills and associated with Cargill in other mills and in three port terminals. Fourth place is occupied by Nova América with sales of some US$500 million from two plants. Nova América also has a trading company and a port terminal. Louis Dreyfus Commodities is a major player with three mills in São Paulo one of which is being duplicated, together with a green-field investment project in Mato Grosso do Sul. It currently produces 450,000 tons of sugar and 150,000 cubic metres of alcohol annually.

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1 A recent study has shown that the average national increase in productivity has been from 0.4 to 0.8 per ha which is a big increase but from a very low base (Datagro, in VALOR ECONÔMICO, 30-04-08). On the other hand, the largest cattle raising outfit in the world in the South of Pará with some 550,000 head of cattle claims to have a capacity of 4 per ha. These technical possibilities do not mean, however, that in practice cattle raising is not putting pressure on the Amazon region.
Alliances, mergers and acquisitions are, however, permanently changing the line-up and profile of the leading players. The Santaelisa Vale Company, the product of a merger between the Companhia Energética Santa Elisa and the Companhia Açucareira Vale do Rosário has now Goldman Sachs as its new partner bringing over US$200 million to the new company in exchange for a 15% share participation. This merger now places Santelisa, second in the ranking with a milling capacity of 18 million tons of sugarcane per year. A new company, the National Sugar and Alcohol Company (CNAA), however, has now been created through a merger between the Santaelisa Vale and Global Foods, a Dutch company and Carlyle Riverstone, a US investment fund. The new company aims to process 40 million tons of sugarcane per year reaching a turnover of over US$2 billion. Cargill, which as we have seen has a participation in Crystalev, has also bought up a mill belonging to the Biagi family. Crystalev, for its part, has entered into partnership with Dow Chemical for the installation of a bio-plastics plant with a capacity for 350,000 tons of resin which will be built in the State of Minas Gerais creating the world’s first bioplastics production based on alcohol from sugarcane.

The Brazilian Government’s Programme for Accelerated Growth (PAC) gives some idea of the scale of new investments in the pipeline. According to the PAC, some 77 new ethanol mills producing 23.3 billion litres will come on line by 2010 involving investments to the order of R$17.4 billion. R$4,1 billion of this total is being invested in the construction of 940 kilometres of ethanol ducts which will pipe the fuel from São Paulo, Minas Gerais and the Centre-West States to the ports of São Paulo and Rio de Janeiro. Other estimates (see above) would put the figure much higher. But perhaps the most striking feature of these investments is not the scale but the variety of the investors. In addition to new investments from the traditional Brazilian sugarcane interests, Brazilian groups from other sectors, such as the construction company, Odebrecht, plan to become leading players. This reflects the internationalization of Brazil’s sugar investments in Africa and Central America and the Caribbean which favour Brazilian firms already active in these regions. A number of Brazilian companies particularly in construction, petroleum and minerals have been active for a long time in African countries particularly those which speak Portuguese and also are present in Latin American countries. The global traders are similarly increasing their investments – Cargill, Louis Dreyfus were both mentioned above. In addition, Bunge and ADM have investment plans the latter specifically for sugar. China and India, which lead the new emerging countries, are also investing in Brazil’s ethanol. China has entered into an agreement with the Bahian Government in Brazil’s Northeast for the construction of some twenty plants with the objective of becoming self-sufficient in the production of ethanol and a player in the export market. Two Indian conglomerates, Bajaj Hindusthan and Reliance Industries are already investing in ethanol in Brazil and more are expected in the wake of India’s decision to add 5% ethanol to its gasoline. Perhaps the most interesting aspect of the current investment profile is the strong presence of investment funds often with Brazilians providing the upfront role. A notable example here is the recently formed the Brazil Renewable Energy Company, BRENCO, administered by the ex-president of Petrobras, Reichstut and with participations from Wolfenson (ex-World Bank), Vinod Khosla (Sun Microsystems) and Steve Case (AOL). Brazilian partners include Semler, the CEO of Semco and Zylberstajn ex-president of the National Petroleum Agency (ANP). BRENCO plans to invest US$2 billion in 15 mostly new plants on the understanding that existing advanced technology can increase overall productivity by 40%. The first
fully integrated plant is already being built in the State of Mato Grosso. The harvest will be completely mechanised and the plant will provide two thousand jobs. BRENCO will concentrate exclusively on ethanol and plans for a production of 3.7 billion litres per year from 44 million tons of sugarcane. BRENCOs first four plants and the equipment will be supplied by the leading Brazilian sugarcane sector firm Dedini Indústrias de Base Ltd. A similar initiative is Infinity Bio-Energy created in 2006 with US$350 million. Infinity has already bought three plants from which it aims to produce 5.6 million tons of sugarcane by 2008-2009. As with BRENCO, however, its principal focus is on green-field investments with plans to build six plants in Mato Grosso, Bahia and Espiritu Santo involving investments of over US$1 billion. Total production will provide a capacity for 16 million tons of sugarcane 70% of which will be for ethanol destined for exports. The Brazilian, Sergio Thompson-Flores is at the head of the group which is supported by the investment bank WestLB. Clean Energy Brazil (CEB), which we have mentioned above, was launched on the Alternative Investment market of the London Stock Exchange raising over 100 million pounds sterling. In addition to buying into existing firms CEB plans large-scale investment in States without tradition in ethanol production, particularly Tocantins which has an aggressive policy for attracting investment into this sector. CEBs partners include the trader Czarnikov, the consultancy Temple Capital Partners and the investment bank, Numis Corporation. Merrill Lynch also has a non-executive directorship. Brazilian sector expertise is provided by AGROP controlled by Marcelo Schum Diniz Junqueiro. By 2012, CEB aims to have a processing capacity of 30 million tons of sugarcane. The megainvestor Soros is also heavily committed to investments in ethanol with a mill purchased in Minas Gerais and a plant in construction in Mato Grosso. By 2015 his firm Adecoagro plans to invest some US$800 million with a processing capacity of 11 million tons of sugarcane. Adecoagro is also investing heavily in other commodities (cotton, coffee, soy, rice, corn) in Brazil, Uruguay and Argentina where it is also active in dairy farming. While these new investors typically drawn on global funding, the Brazilian Development Bank (BNDES) is also playing a key role in financing new projects. According to the BNDES some 100 new plants are projected up to 2010 processing on average some 2 million tons of sugarcane per year and increasing ethanol production by 8 billion litres. BNDES invested R$580 million in 2004, increasing to R$1.080 billion in 2005, R$2.020 in 2006 and a projected R$3.200 in 2007.

The emerging ethanol map

In the Federal Government’s PAC programme the focus of new investments was very much concentrated on the São Paulo and Minas Gerais region moving up also into the savannah regions (Cerrado) of Goias and Mato Grosso do Sul. The strategy behind the planned ethanol duct to be constructed by Petrobras is to export this new production capacity through the Centre-South ports of São Paulo and Rio de Janeiro which will be able to export 8.0 million cubic metres of ethanol by 2012. In fact, however, as we have seen both private capital and different State policies are creating a much broader...
dynamic and many regions particularly in the Northeast and the North are becoming important export investment targets with plans for shipping production via the waterways, railways and ports of these regions. We have already mentioned the ambitious projects for Bahia involving Chinese participation in addition to the investments by the Adecoagro Group.

The State of Tocantins has been particularly aggressive in its promotion of investments in ethanol. Along with the States of Maranhão and Piauí it will benefit from investments by the Japanese Bank of International Cooperation (JBIC) to the tune of R$1.3 billion, half for ethanol and half for biodiesel. The ethanol will be for export via the port of Itaqui in Maranhão. More ambitiously, investments of up to US$3.6 billion over five years are planned by Etanalc, a partnership between the Sempra Energy Corporation, one of the largest energy companies in the US, and the German Manferrostaal of the Man group which will be responsible for the construction of, initially, 12 plants. It is estimated that the whole project will involve some 600,000 hectares. The Sempra Group will guarantee purchase of all ethanol production during a period of twenty years.

The Maranhão State which as we have seen will benefit from Japanese investment launched a Biofuels Programme in 2007 aimed at attracting investments to the order of R$10 billion over the next ten years. Based on a study by the ESALQ/USP the aim is for the installation of some 45 new plants producing between 4-7 billion litres/year. According to Governor Jose Reinaldo Tavares “Our objective is to cultivate 1.2 million hectares over the next five years with production costs compatible with those in the rest of the country”. To date the State has three plants in operation processing 2.4 million tons of sugarcane. A key attraction for would be investors is the rail infrastructure put in place by the Vale Company which operates in the State of Para but exports via Maranhão and the port of Itaqui.

Agriculturally the Brazilian Northeast is often seen as combining a decadent coastal plantation region with drought ridden subsistence production in the semi-arid interior. Alongside these realities, however, a very different Northeast has emerged since the 1990s. Globally competitive irrigated fruticulture poles exporting to the very demanding European and US markets have emerged in a number of Northeastern States. In addition, huge regions of the Northeast share the savannah conditions of the Centre-West and have become part of the ever expanding grains and especially soybean frontier. This has important implications for the future of the biodiesel programme as we will see below. It is in this region also that the bulk of the projected ethanol investments are located. Important investments are being made in port facilities and already the States of Maranhão and Piauí provide conditions for large shipping. From the Northeast, the European market is almost a week closer, not only cutting costs but an important factor also in the overall energy balance of Brazilian ethanol production.

The Lula government has identified the ethanol market with the Centre-South and Centre-West regions and has argued that not only is there no sugarcane produced in the Amazon region but that the land there is inappropriate for sugarcane. This is contested by many of the State governments in the North of the country which are also busily attracting ethanol investments. Here it should be noted that there is an important distinction to be made between the legally defined Amazon region, which is an administrative concept for planning and investment purposes and the Amazon bioma, defined ecologically in terms of the tropical forest. In relation to the latter, there is consensus that ethanol
investments should not involve forest clearance. We have seen above, however, that the issue is more complex since the occupation of cattle raising lands by sugarcane in the Centre-South of the country has been identified with the advance of cattle into the tropical forest region. The State Governments in the North argue that the Amazon region is itself made up of very different ecological conditions. More importantly they identify some 90 million hectares of already “degraded land”, the subject of forest clearance in earlier decades. It is argued that in these areas sugarcane production may well be appropriate, depending on zoning criteria, and that as a semi-perennial sugarcane would serve to recuperate these lands. The State of Pará, in addition to becoming the oil palm capital of Brazil on the basis of large-scale plantations as we will see below, is also vigorously campaigning for ethanol investments. Acre has a mill in operation for 3 million tons of sugarcane which will be exported to Peru and Bolivia. Roraima for its part has two projects under consideration. Even in the State of Amazonas itself the Governor defends ethanol investments to the extent that they are limited to “degraded lands”. In Figueirôdo, a hundred kilometres from Manaus, the capital of the State of Amazonas, a sugar plantation established by Coca Cola in the 1980s to provide sweetener for its guaraná soft drink is testimony to the “viability” of sugarcane production in the heart of the tropical forest. As the representative of WWF in charge of the organisation’s Agriculture and Environment Programme argues the issue of sugarcane in the Amazon region is not one of aptitude but is rather a question of logistics and market access. We will return to this issue below.

Brazilian ethanol foreign direct investment (FDI)

Both the Government and private interests are vigorously promoting ethanol as a global commodity. The ex-Agricultural Minister and agribusiness leader, Roberto Rodrigues, is leading an international lobby to this effect and the sugarcane business association in the Centre-South of the country, UNICA, has established representations in the US, Europe and Asia to promote the global ethanol market and encourage production in other countries. It is argued that in contrast to the petroleum cartel sugarcane is produced in over one hundred countries. The promotion of ethanol in other countries is motivated by a variety of investment and market interests but it is also politically important for Brazil not to be identified with an emerging ethanol oligopoly.

There are two main focuses of Brazilian ethanol FDI – Central America and the Caribbean as a platform for access to the protected US market and Africa where Brazil already has a substantial presence in the lusophone countries. Investments are already underway and others at the project stage to develop reprocessing facilities in Central America which will allow Brazil to benefit from the Caribbean Basin Initiative with the US and the Caribbean Free Trade Agreement (CAFTA) with the aim of avoiding the US$0.54 per gallon import tax on Brazilian ethanol. Cargill has investments in the region which have already provoked the wrath of US farmers. Infinity Bioenergy which have discussed above is currently investing in the Dominican Republic. It has bought up a local mill, is building a dehydration plant and has plans for a distillery based on local production. Agreements between Brazil and the Dominican Republic are in place to adapt local varieties of sugarcane for ethanol production. Jamaica and El Salvador
are two other countries in this region which have received investments to dehydrate Brazilian ethanol for re-export to the US.

The sugarcane worker

It is claimed that the Brazilian sugarcane sector provides direct and indirect employment for over a million people. In a National Sample Research of Households (PNAD), the Brazilian Statistics Institute (IBGE) identified 500,000 workers directly employed in sugarcane production. Mechanization of harvesting, which is advancing rapidly in São Paulo and is planned for the new investments will fundamentally change the employment profile although the rhythm of expansion of new projects will offset somewhat the unemployment being created in established sugarcane areas. Although the sugarcane association, UNICA, argues that wages - on average twice the minimum rate - are high for agricultural labour, working conditions and remuneration have been the focus of continued conflict. Many workers are still hired informally through intermediaries know as “cats” who often charge exorbitantly for the seasonal trip to the cane fields. In addition working and living conditions have been a continuous source of denunciation. Although inhuman working conditions have traditionally been identified with sugarcane cutting, current conditions are said to be even more rigorous than in the past. Today it is argued that only young workers up to at most forty are in conditions to resist the increased work rhythm and deaths have been attributed to the demands for increased productivity. While average sugarcane productivity has increased from under 50 tons per ha in the middle 1970s to over 80 tons today, and in many case up to a 100 tons in São Paulo, according to Marina Mendes, “since 1996 the payment per metre cut has remained the same: R$0.10. In general it takes nine hours to cut two hundred metres” (MENDES, 2007). In 2007, the cane-cutters entered into their first general strike since 1986 demanding a threefold increase in the basic rate, meals, rest periods, work safety, better transport and social and medical assistance. According to Guilherme Maciel, a member of the national coordination of the Movement of Small Farmers (MPA): “The majority of the plantations offer very precarious conditions for the workers who have no guaranteed rights. Almost the same as slave labour. They wear themselves out with work and when they are no longer able to continue they leave without any rights. The contract model they are subjected to does not provide any labour rights. After six months they are unemployed with no insurance” (MENDES, 2007).

The data from the PNAD, analysed by O. V. Balsadi, point to many improvements which have been associated also with the pressure exercised by the trade union movement and by a more efficient public monitoring system. Among the improvements identified are: a decline in infant labour, decreased informality, real wage increases, increased benefits and better school qualifications. The sugarcane sector has now one of the lowest levels of informality in agriculture with important benefits in terms of retirement and access to health. Between 1992-2005 real wages increased for all categories with “temporary rural” workers receiving an increase of 37.2%. Working conditions, however, are seen to have worsened. Informatics now allows for individualised control of workers by productivity and docility. To earn more than the basic rate cane-cutters now have to cut from 10-12 tons per day as against only 3 tons at the

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3 It seems to have been confined in practice to a series of plants in the State of São Paulo.
beginning of the 1970s, based on the situation in São Paulo (BALSADI, 10/04/2007). While real wages may have increased payment per ton of cut cane has declined.

Nor is it evident that the situation is better in the areas of new investment. There have been repeated denunciations of inhuman working conditions in Mato Grosso do Sul both as regards migrant labour from the Northeast and local indigenous workers. Employment of indigenous labour has been seen to lead to a breakdown in the social organization of indigenous communities as the men are absent for long periods and with negative consequences for the food security and the women and children. In addition it has been argued that the Indian villages are being transformed into dormitories as the men leave in the early morning and return late at night. Most notable has been the action taken against BRENGO, whose profile we presented above, by the Public Ministry of Labour after an inspection of its plantations in the State of Goiás. Degrading living conditions, use of the “cat” recruiting system, and unsafe working conditions were identified by the monitoring group. The action led to 140 contracts being rescinded. BRENGO and the Public Labour Ministry have now entered into an Agreement for Adjustment of Behaviour (TAC). In addition to an improvement in internal conditions the agreement also involves the provision of public services in the municipalities overburdened by the influx of workers (CAMARGO, 06/03/2008).

Sugarcane, renewable energy and the environment

In addition to being competitive at US$0.32 compared with US$0.75 for US corn and US$1.54 for European beet, sugarcane has a positive renewable/fossil energy balance of 8 to 1 in contrast with all other options which are less than 2. This balance, however, does not take into account distribution and shipping costs. In the context of the Kyoto Protocol the production of ethanol from sugarcane was not considered eligible for carbon credits, but these are available, however, for the production of bioelectricity based on the use of bagasse and straw.

The evidence is not conclusive as yet on the indirect effects of the expansion of sugarcane production. Technically Brazil is calculated to have 91 million hectares of arable land not as yet cultivated. The current proposed increase in sugarcane production would only amount to 0.8% of available arable land. In fact, however, if the current rate of investment continues and if in addition a global ethanol market is consolidated it is clear that much more than 3 million hectares will be required. Even within this scenario, according to EMBRAPA, of the 91 million hectares available for cultivation 25 million are appropriate for sugarcane.

Investments, however, are not based only on technical zoning criteria but take into account a variety of factors among which: incentives, land prices, infrastructure, logistics and regulations. Given the existing patterns of expansion it is clear that sugarcane is now moving onto land in São Paulo and the Centre-West which has been dedicated to other activities. In São Paulo, sugarcane has encroached on orange plantations, on dairy farming (which is relocating to the South of the country) and especially on cattle farming in the west of the State. In the Centre-West region it is argued that sugarcane is ousting soy
production. In both cases it is considered that these activities are shifting northwards putting pressure on the tropical forest. Occupation of new land in the Amazon region demands that some 80% of the property is maintained as forest whereas in other regions such as the State of Bahia this can be as little as 20%. The threat of cattle-raising and soybean production in the Amazon region has provoked strong opposition movements particularly in Europe which have led to the adoption of certification schemes without which access to this market is increasingly difficult. In addition, as we have seen there are some 90 million hectares in the Amazon region which have long been deforested. This is particularly the case in Pará which now sports the world’s largest ranch with some 500,000 cattle, run by a leading Brazilian financial group. Currently the debate over the expansion of ethanol hinges on the obligatory or indicative character of proposed zoning regulation, polarising respectively the Ministries of Environment and Agriculture and currently being debated in the Congress. Once zoning is defined for a particular product this normally means that credit and crop insurance will only be provided if the crop is planted in the area zoned as apt. But this does not prevent the crop being planted in non zoned areas. So the issue of whether in this case zoning will imply that sugarcane can only be planted in zoned areas is a key question given the ability of these firms to raise their own financing.

Official policy for the Pantanal, the huge swampy region in the centre of Brazil which feeds into the Amazon, is also to prohibit investments which threaten its eco-system, though intra-regional distinctions can soften this policy. The same has not been true, however, for the Centre-West savannah region (Cerrado), which has been the object of sustained investments since its soils and climate were adapted to large-scale grains and oils production in the 1970s. There is very little concern with the preservation of this biome’s flora and fauna and it is now one of the principal targets of ethanol investments. Cardoso da Silva (2007) has examined the environmental context in which ethanol expansion is taking place adopting a scenario for the year 2025 in which there will be 22 million hectares under production with 615 distilleries producing 104 billion litres/year. He identifies the twelve principal areas in which new investments are taking place, excluding the Amazon and the Pantanal and analyses their environmental conditions. He finds that seven of these regions have already been modified more than their legal limits and only one region has what he describes as a reasonable state of formal conservation. Of the 844,684 square kilometres critical for ethanol 300,613 square kilometres are key areas for biodiversity. Cardoso da Silva concludes that the following objectives should be adopted. There should be expansion only in areas which have already suffered alteration. All illegal properties should be eliminated (those with less than the legally stipulated reserved areas). There should be a goal of “zero extinction” with the development of biodiversity corridors. Regional funds should be established to finance these measures. On the above

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4 Announced last year as an answer to international criticism of sugarcane expansion towards the Amazon forest, Ecological Economic Zoning (ZEE) was proposed as the basis for a national sugarcane production policy that would be socially fair and economically sustainable. However, according to the newspaper Valor Econômico, the ZEE scheduled for publication in August, 2008, focuses exclusively on identifying the regions where production would be cost effective. Other aspects which are not taken into account include: the expulsion of other cultures toward the forest because of the pressure from sugarcane; the risk of agricultural specialization in some states; the overuse of water resources; the lack of land regulation in proposed areas; and the redefinition of worker relations within the sector. ZEE’s objectives are: to support the BNDES credit policies for the sector (some R$ 6.5 billion for contracted and/or approved operations); to promote mechanization and avoid the practice of crop burning in future productive areas; and to distance sugarcane plantations from the Amazon forest. Public incentives for production in the Legal Amazon region identify some regions of the States of Tocantins and Mato Grosso, where sugarcane can occupy up to 5 million of the 21.2 million hectares of pasture (VALOR ECONÔMICO, News 28-07-08; TAUTZ, News 04-08-08).
scenario ethanol investments will be to the order of US$5 billion annually whereas the costs of adopting these measures come to US$360 million per year or less than 8% of total investments.

The study “Vegetable Coverage Maps of Brazilian Biomes”, undertaken by the Environmental Ministry (MMA), indicates that some 2.5 million km² of trees have been cut down – equivalent to 30% of the national territory. “Everybody just talks about Amazon, due to the high coverage by the press, an other biomes end up being neglected”, said Bráulio Dias, the MMA Biodiversity Conservation Director. According to the report, the Atlantic Bush represents the most devastated vegetation of the country, with 70.95% of its area already cut down; the Pampas region in the South comes next with 60% of its area eliminated; the Caatinga has lost some 37% of its vegetation; and, finally the Amazon and the Pantanal biomes have each suffered less than 15% devastation. In the Cerrado (savannah) region, “40% of the degradation has been caused by humans from the 1960’s to the present at a rate of about 1% per year, while Amazon this rate is 0.5%”, explains Dias (CORREIO BRAZILIENSE, News 31-3-08). The deforestation rate is led by São Paulo State (86,000 ha), followed by Minas Gerais State (25,000 ha), Goiás State (13,000 ha), Mato Grosso State (12,000 ha) and Mato Grosso do Sul State (6,000 ha) (FOLHA DE S. PAULO, News a 12-4-08).

The national stimulus of ethanol production has increased the areas dedicated to sugarcane. In the whole Centre-South region, this increase represents about 18% or 926,000 ha, totalising 6 millions of cultivated hectares (FOLHA DE S. PAULO, News 2-10-07). In Brazil, sugarcane crops occupy 7 million ha in 2007 and are expected to reach almost 17 millions until 2025, according to Datagro Consultancy (VALOR ECONÔMICO, News 6-3-08). “What satellite images are showing is that more than a half of the sugarcane advance in São Paulo has occurred in pasture areas, mainly in the Northwest of the State. In this region, the area of cultivated land has increased sharply due to the installation of new plants”, explains Bernardo Rudorff, the coordinator of Canasat, an Inpe (Spatial Researches National Institute) project that maps the cultivated area by means of satellite images (FOLHA DE S. PAULO, News 2-10-07). In the Centre-West, there are 50 million ha of degraded pastures that could be used for agroenergy expansion (ethanol, biodiesel, forestry for energy), avoiding the occupation of the Cerrado area. For this reason, José Ricardo Severo, of CAN’s (National Agriculture Confederation) sugarcane national committee, believes that sugarcane does not threaten the Cerrado biome and that cattle and beans can provide land for the sugarcane sector to reach 15 millions ha until 2015 (FOLHA DE S. PAULO, News b 12-4-08).

According to a study realized by ISPN (Society, Population and Nature Institute) employing MMA vegetation coverage maps 60.5% of the deforestation of areas considered as a priority for biodiversity conservation in the Cerrado biome has occurred in São Paulo State – the largest sugar and ethanol producer (FOLHA DE S. PAULO, News a 12-4-08). Due to its central localization, the Cerrado serves as an integration zone for the different Brazilian biomes. Occupying 24% of the national territory, it is responsible for 70% of the drainage of São Francisco, Paraná and Tocantins rivers. This biome is estimated to contain some 10,000 vegetable species, of which 4,400 are endemic. These constitute a precious genetic material for the improvement and development of plants resistant to long drought periods and sudden temperature changes, which will be essential in the adaptation to climatic change (CORREIO BRAZILIENSE, News 3-11-07).
For the harvest of 2007, sugarcane crops occupied 5.8 million ha of the Cerrado and 16,033 ha of the Amazon, according to the IBGE data. In the three States of Goiás, Minas Gerais and Mato Grosso do Sul there are 58 sugarcane plants, whereas in the Amazon States there are as yet only three. According to Nilo D’Avila, ISPN public policy coordinator, the advance of ethanol will not directly reach the Amazon biome, but it can collaborate to its deforestation. High rain incidence in the forest has been considered by the agricultural sector as a factor unfavourable to sugarcane production. This region, however, is in fact being occupied by cattle farmers who have sold their land in the Centre-West to sugarcane or soy producers. Furthermore, Pará State in the Amazon region has been declared free of foot and mouth (with vaccination) which represents a strong stimulus to the cattle sector (FOLHA DE S. PAULO, News c 12-4-08). “Cattle are leaving States such as São Paulo and Rio Grande do Sul and migrating to the Amazon. Pasture conversation into sugarcane crops for agrofuels in these States will also increase the flow to the Amazon”, reports Philip Fearnside, INPA (Amazon Researches National Institute) researcher (ISTO É, News 9-2-08).

Luiz Fernando Laranja, agriculture and environment coordinator of WWF-Brazil, confirms that “the problem, is definitely not in the impracticability of agriculture. What restrains sugarcane advance in the Amazon region are simply marketing and logistical issues. If these are resolved, I have any doubt that the region will become an alternative for sugar and ethanol production” (O Estado DE S. PAULO, News 7-10-07). “I think that increase of production towards the North is a natural consequence”, said Francisco Barreto, president of Bionasa Combustível Natural S.A., a biodiesel company that has just built an industrial complex of biodiesel production in Porangatu, in the interior of Goiás (CANAL O JORNAL DA BIONERGIA, News 26-3-08).
Sugarcane and food security, family farming and local development

The global impact of ethanol production on food prices and food security for many developing countries especially those dependent on imports has become increasingly evident. Many countries in Latin America and especially Brazil, however, have privileged access to natural resources (FAO/CEPAL, 2007). Cultivable lands in Brazil which can be brought into production without encroaching on the Amazon or the Pantanal are calculated to be in the order of 90 million hectares. Nevertheless, we have already seen that the expansion of sugarcane, as in the case of soy or cattle, is redefining existing land use. In São Paulo, the activity currently most affected is cattle raising, but the expansion of sugarcane has also displaced dairy farming, orange groves and other crops. While not necessarily responsible for the direct substitution of food crops, sugarcane is responsible for a fundamental relocation of agricultural production with basic foods being pushed out of the São Paulo region, increasing the distance between production and consumption. At the same time, large-scale monoculture has a corrosive impact on local economies and communities. In other regions of the country, sugarcane expansion, as has been the case also with soy and cattle, is uprooting local small-scale producers who become transformed into temporary labour often living in precarious conditions on the outskirts of local towns.

Traditionally it was obligatory for sugar mills to acquire a proportion of their sugarcane from independent suppliers. This is no longer the case, but some 30% of sugarcane is still supplied by third parties in the State of São Paulo. In many cases, we are dealing with small and medium landowners who simply rent out their land to the sugar-mill. There is no reason, however, why measures to guarantee that a percentage of the harvest come from small-farmer suppliers should not be re-introduced. As we have already mentioned and as we will see in more detail below such a system is now in place for the production of biodiesel.

A more ambitious approach is that currently being adopted in a number of projects in the South of the country where ethanol and biodiesel are being produced in integrated food and energy agricultural systems by small farmers organized into cooperatives which are responsible for the processing of sugarcane and oil crops. The Cooperbio Cooperative supplies ethanol directly to Petrobras, whereas the Coopere and Ceral Cooperatives are producing ethanol for the needs of the local community. In these cases the production of agrofuels complements rather than substitutes food (meat, dairy and crops) production. In the case of Cooperbio, which covers 63 municipalities and involves 20,000 small farmers, ethanol production is decentralised in 10 micro-distilleries. The ethanol is then transported to a central rectifier with a capacity for 5,000 litres/day which guarantees the standard quality required by the national petroleum agency (ANP). In addition to sugarcane, manioc and sweet potato are also being tested as feed-stocks. Technology is being developed in partnership with Universities in the region and local metallurgical firms. The importance of this initiative is that it demonstrates the possibility of small farmer systems supplying ethanol directly to Petrobras. Particularly interesting is the Cooperanca Cooperative. Here a medium-sized sugar-mill with twenty years activity in the region is modifying its
production system, promoting decentralised micro-distilleries. This allows small groups of farmers to make greater use of sub-products increasing farm productivity and lowering costs (RAMIS, 2007).

These experiences challenge the dominant model of ethanol production which is premised on the superiority of scale and specialisation within the strategy of developing a global commodity market. To the extent that these projects demonstrate their viability they will provide an alternative model based on decentralised biofuel production and consumption in integrated energy and food farming systems, which rely on the advantages of agglomeration and cooperative organisation rather than individual scale. While it is unlikely that the dominant model will be reversed it is clear from these experiences in the South that the issue of social inclusion is as valid for the ethanol sector as it is for biodiesel to which we now turn.
Biodiesel

A brief history

Historically, during petroleum shortages, vegetable oils and their derivatives have been proposed as alternatives to petroleum diesel fuel. Since 1930, different approaches have been proposed by Brazilian universities and research institutes, including the use of crude vegetable oils (pure or in blends) or their derivatives, such as hydrocarbons obtained by thermal-catalytic cracking and fatty acid methyl or ethyl esters (nowadays known as “biodiesel”) produced by alcoholysis. With the oil shock of the seventies a new perspective for the use of non conventional fuels was opened up. In 1975, the Brazilian government created the “Vegetal Oil Production Plan for Energy Uses” (PRÓ-ÓLEO) and in 1980, Expedito Parente filed the world’s first biodiesel. The PRÓ-ÓLEO plan was not successful, due above all to a lack of technology. Recently, external dependence on imported diesel fuel and the petroleum price explosion have increased discussion in Brazil on the use of alternatives to diesel fuel, biodiesel being the main alternative for a large petroleum diesel substitution program. In 2003, the Brazilian government, by decree, created the Brazilian Production and Use of Biodiesel National Programme (BPNP). This program proposed adding biodiesel to the Brazilian Energy Matrix through blending 2% of biodiesel (known as B2) by 2008, and 5% (B5) by 2013, to all the diesel commercialized in the country. The National Energy Policy Council (CNPE) will supervise a gradual increase in these percentages over the next years and in March 2008 authorized the obligatory use of B3 (3% of biodiesel in the diesel) as from the first July of 2008.

This BPNP contains three important features: (1) the production of biodiesel from different oil sources from the diverse regions of the country; (2) the promotion social inclusion through employment creation and the participation of family farming; and (3) the support of a new source of oil supply with competitive prices and appropriate quality. From a social perspective, the biodiesel represents a very important opportunity for social inclusion in the poorest regions of the country. In addition the blend of biodiesel and diesel has important environmental advantages, reducing dioxide carbon emissions and other toxic elements.

The institutional framework of the programme was created in 2003 by presidential decree and was regulated by the law 11.097/2004. To promote social inclusion through the programme, the government created a Social Fuel Seal, granted to biodiesel plants. The Seal guarantees preferential treatment to industrial producers who purchase raw materials from family farms, providing special financing terms and tax breaks, in exchange for supplying the farmers with technical assistance, seeds and a guaranteed price.

Biofuel trading has been regulated by the National Oil Agency (ANP) through auctions. However, once the market is consolidated, it is expected that the agency will no longer continue its regulating role via auctions. In order to stimulate the companies to adopt family farm supplies in accordance
with the regional quotas model of production the first seven auctions were only open to companies with the social certificate or which had initiated the certification procedure in Ministry of the Agrarian Development (MDA). The eighth and the ninth auctions were organised by Petrobras and the Alberto Pasqualini Refinery (Refap S.A.) to complete the biodiesel stocks which supply the obligatory blend of 2% of biodiesel in diesel consumption in force since the first January, 2008. The next 2 auctions were the eighth and ninth from ANP to cover national biodiesel supply for July, August and September 2008. All the biofuel is bought by the state owned oil company – Petrobras, by Refap which is controlled by Petrobras and by Repsol/YPF. These companies sell the biodiesel to distributor companies, which have to store the biodiesel. The blending with diesel is carried out in the tanker trucks which transport the Bx (a blend with x% of biodiesel) to the petrol station. To stimulate the market, “Petrobras sells the biodiesel to the distributors at the same price as the diesel”, explains Alísio Mendes Vaz, the vice president of the National Trade Union of the Distributors of Fuels sold and Lubricants (Sindicom).

Box 2 – Biodiesel auctions

Depending on the volume of biodiesel needed to supply the national market, ANP announces auctions to purchase production from biodiesel firms. Nevertheless, the eighth and ninth were organised by Petrobras and Refap S.A., at the beginning of the year, to complete the biodiesel stocks obtained by ANP to the compulsory B2’s market – since January 2008.

These last two auctions differ substantially from the previous ones. Before, companies bid successive prices via Internet, with no limits on their number and the one offering the lowest price was the winner. In the new process, companies must be present and bids are limited to three for each, without knowing the values offered by the competitors. The quantity of biodiesel sold was limited to 80% of the plant’s capacity. The delivery timescale for the biodiesel sold was reduced by a half, from 6 to 3 months, diminishing the producer’s vulnerability to the oscillations of commodity markets.

The auction is divided into 2 stages. In the first stage, all the participating companies hand in closed envelopes with up to three different prices and volume tenders based on a maximum reference price suggested by the ANP. For the next step, the lowest tenders are chosen up to a limit of 30% more than the auction’s required volume. In this new round, companies can maintain or reduce the tender’s value but not the biodiesel volume. The lowest prices will be selected until the auction’s required volume is completed. The surplus of 30% with a higher price will then be declassified.

8th and 9th ANP’s auctions:

The Government purchased 330 millions litres of biodiesel, the volume required for the third quarter of 2008. The auctions required altogether 887 million involving 24 producer plants whereas, in the seventh auction, only 12 companies had participated. The reference price suggested by ANP was R$ 2.804 per litre for both auctions and the final average price was R$ 2.69 per litre, including federal taxes on biodiesel (PIS/PASEP and COFINS) but without the state taxes (ICMS) and freight costs.

Source: Data from the ANP site and BiodieselBr.com.
Biodiesel is the denomination for fuels produced from renewable biomass (vegetal oil and animal fat) to be used in diesel motors. In Brazil, only biodiesel from transesterification, a chemical reaction of triglycerides, is recognised as biodiesel (PARENTE, 2003). In Brazil, transesterification is important, because it enables the use of ethanol from sugar cane. The use of ethanol, however, is less efficient than the use of methanol for a number of reasons. For example, methanol reaction time is 25% faster than the same reaction using another catalyst (PARENTE, 2003). Nevertheless, the use of ethanol is another opportunity to use local resources and decrease the external dependence of the country.

Box 3 – Social and environmental certification for agrofuels

The Brazilian government has identified five types of criticisms of agrofuels: 1) they do not reduce GEGs’ emissions; 2) they cause deforestation; 3) their production involves high petroleum consumption; 4) they sometimes entail slave working conditions; and 5) they involve competition for land between agrofuels and food. INMETRO (National Institute of Metrology, Standardization and Industrial Quality) is promoting a certification process — voluntary and internationally recognised — that guarantees adherence to social and environmental criteria by agrofuel production systems together with the intrinsic quality of the product.

Called the Brazilian Programme for Biofuel Certification, it is currently being elaborated for the sugarcane value chain, in cooperation with Embrapa. The certificate will be based on technical criteria that should initially respond to two of the five international criticisms: ethanol production without slave labour or with negative environmental impact. Other criteria to be employed include: (INMETRO, 23-03-07):

- minimum productivity of 6-7 thousand of litres of ethanol, raising until 14 thousand in 2025;
- renewable versus fossil energy ratio of 8 (mechanized harvest) or 9.2, increasing to 11-12 with partial straw recovery (harvest without burning);
- production costs and competitiveness: a current price of US$ 0.28 per litre of alcohol with the goal of reaching US$ 0.20 per litre.

For the question of the environment, Embrapa – which has the ISO 9001:2000 certification for its environmental department (Embrapa Meio Ambiente) – has a partnership through its Labex network with the French Centre for International Cooperation on Agronomic Research for Development (CIRAD) to elaborate an international biofuels “eco-certification” seal, whose first phase will be announced on September. The first raw material to receive this seal will be palm-oil.

One of the certification instruments for sugarcane is the Ecological and Economical Zoning (ZEE), which should indicate areas, which are appropriate for production, areas where the government wants sugarcane to be cultivated or areas where it will be prohibited. The Amazon Basin and the Pantanal will be preserved and priority will be given to pasture, with areas of intensive bean production being excluded. A first study has identified 30-40 million of hectares, mainly existing pastureland, which is recommended for sugarcane in the Centre-west, Southeast and Northeast regions.

In Brazil, there are a large variety of plants that can be used for biodiesel production, such as peanuts, jatropha, soy, palm, castor and others. The most important alternatives are soy, oil palm, because of its high productivity; and the castor bean, because of its resistance to drought—an important characteristic for the northeast region of the country. About a third of soy is produced in properties of 50 ha or under mostly in the south and it maybe that this strata participates in the supply of soy oil in Mato Grosso do Sul. The soy lobby in the biodiesel market, however, is clearly based on the large scale producers.

**Box 4 - Castor-oil beans versus soybeans**

The castor-oil plant was the initial species selected for the Northeast but it involves a complex biodiesel production process and results in a fuel that does not correspond to the stipulated national properties. According to the Resolution No 7/2008 of the ANP, castor-oil biodiesel does not respond to the specifications due to its high viscosity. The castor oil’s viscosity ranges between 20 and 30 mm per second, while the limits established by the ANP are between 3 and 6 mm/second and the final biodiesel has to compete with a diesel viscosity of some 3.1 mm/second. In practice, the energy from the castor-oil is inappropriate for diesel motors (GAZETA MERCANTIL, News 14-7-08). Economically the use of the castor-oil plant seems also to be unviable due to its high price on the international market.

The Ministry of Mines and Energy (MME)’s data indicate a soybean participation of 70.2% in January 2008 in the national biodiesel production and only 57% in June of the same year (BIODIESELBR, News 03-09-08). Considering only the B2 level, predicted biodiesel consumption for Brazil in 2008 is around 850 millions of litres. Its production requires the processing of 4.25 millions of tons of soy beans, equivalent to 7.3% of the soy bean crop predicted for 2008, some 1.5 million hectares (GAZETA MERCANTIL, News 28-3-08). However, on the Chicago Stock Exchange, soybean’s price experienced an average increase of 90% in 12 months due to a high worldwide demand for food and agrofuels, to low levels of reserves – in some cases – and to intense financial speculation in international markets since the USA sub-prime crisis at the end of 2007 (CORREIO BRAZILIENSE, News 24-3-08). With this increase in price, the competitiveness of castor-oil comes closer to that of soybeans (EMBRAPA, News 17-07-08).

“We want and need to build economically viable alternatives to prevent dependence on soybeans. We are in favour of diversification and we know that we can make lots of progress in this area. What was done for soy over the last 30 years must now be done for the development of jatropha, sunflower and palm”, declared Sérgio Beltrão, Brazilian Biodiesel Union (Ubrabio) executive director (GAZETA DO POVO, News 25-2-08).

The most important aspect that must be taken account is the production of oil per hectare (table 2).
The oil market, however, is connected to other markets which are highly volatile and whose value chains have become interdependent, making the management of new biodiesel projects and the relation between suppliers and industries very complex (figure 1).

Figure 1. Biodiesel chain and its connected markets.

Source: Adaptation from CARVALHO et al., 2007.

Brasil Ecodiesel (BED), one of the most important biodiesel companies has suffered the consequences of competition by other markets for castor-oil: 60% of the family farmers hired in the Northeast region took advantage of the increased prices of the beans and sold their production to a buyer who paid more, ignoring the contracts with the BED (REVISTA EXAME, News 10-07-08). Furthermore, biodiesel companies such as BED have had to cope with a biodiesel price higher than that of the main raw material, the soybean. The biodiesel public auctions gradually increased the price from R$ 1.863/L in november 2007 to R$ 2.69 per litre in march 2008, while the refined soy oil price was around R$ 1.83 per litre in may 2007 and 3.23 R$/L soy in april 2008 (data from CONAB). Such situations compromise the viability of firms producing exclusively biodiesel and encourage the participation of big companies already working in the oil market.

Table 2. Potential biodiesel production of some oily seed species

<table>
<thead>
<tr>
<th>Specie</th>
<th>Oil Content (%)</th>
<th>Harvesting Months</th>
<th>Oil Productivity (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Palm (Elaeis guineensis Jacq.)</td>
<td>26</td>
<td>12</td>
<td>3.0-6.0</td>
</tr>
<tr>
<td>Sunflower (Helianthus annuus L.)</td>
<td>38-48</td>
<td>3</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Canola (Brassica campestris L.)</td>
<td>40-48</td>
<td>3</td>
<td>0.5-0.9</td>
</tr>
<tr>
<td>Castor (Ricinus communis L.)</td>
<td>43-45</td>
<td>3</td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>Peanuts (Arachis hypogaea L.)</td>
<td>40-50</td>
<td>3</td>
<td>0.6-0.8</td>
</tr>
<tr>
<td>Soy (Glycine max (L) Merril)</td>
<td>17</td>
<td>3</td>
<td>0.2-0.6</td>
</tr>
</tbody>
</table>

Source: MACEDO et al., 2005.
The Brazilian Production and Use of Biodiesel National Programme (BPNP) - The Social Fuel Seal

Authorization for the use of biodiesel, a system of widespread distribution, the differential tax regime recognizing the importance of oilseed production by family agriculture units - particularly in the North, Northeast and the semi-arid regions - and the introduction of the “Social Fuel” seal are all regulatory instruments designed to promote social inclusion throughout the new fuel’s production and value chain.

The Social Fuel Seal, awarded by the Ministry of Agrarian Development (MDA), establishes the conditions for industrial producers of biodiesel to obtain tax benefits and credit. In order to receive the seal, an industrial producer must purchase feedstock from family farmers and enter into a legally binding agreement with them to establish specific price guarantees together with the provision of technical assistance and training. The tax rules include differential rates depending on the oilseeds production region and whether they are produced by large agribusiness concerns or family farmers. In the case of the production of biodiesel derived from oilseeds cultivated by the family farming in the North, Northeast and Semi-arid region, for example, manufacturers will be exempted from taxes. Biodiesel feedstocks and the fuel itself are exempted from the Industrial Products Tax (IPI).

Through the Social Seal, the government has stipulated minimum quantities of raw materials that must be produced from family farming and from medium/large-scale agriculture (table 3).

Table 3. Participation of family farming in raw-material supplies per region of the country

<table>
<thead>
<tr>
<th>Region</th>
<th>Family Agriculture (%)</th>
<th>Medium/Large-scale Agriculture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Northeast</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Centre-West</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Southeast</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>South</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>


The National Agroenergy Plan of 2005 proposes that the Northern region of Brazil should be responsible for 10% of total biodiesel production with palm oil as its main raw-material. The northeast region would be responsible for 15% using the castor oil, a plant aimed at promoting social inclusion since it can be integrated into traditional family farming production systems. In the Centre and the

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5 The Decree nº. 6.458, of 14th may 2008, grants the maximum benefit reduction in the PIS/PASEP and COFINS rates “for the biodiesel from raw materials produced in the Northern, Northeast and Semi-arid regions, acquired from family farmers included in the PRONAF.” The former decree only benefitted castor oil and palm.
South regions, the main raw material would be soy oil associated with other products such as animal fat, sunflower, and canola.

The proposed model includes an association between a biodiesel producer company, family farmers supplying raw material and the regional public power or the federal authorities. The company offers technical assistance for the planting and a guarantee that the production will be bought by the company. The families cultivate the oilseeds and are eligible for credit to cover operational costs. The regional authorities provide financial assistances with low interest taxes. The families and the companies must negotiate a contract to cover this commercial agreement.

Figure 2 – Actors involved in the National Biodiesel Programme (BPNP)

Ideally it is hoped that the family farming sector will advance to the production of crude oil as a key value-adding activity, although as we will see this is far from evident in practice. Technologically advancing into oil extraction should present no problem. The issue of standards only comes into consideration for the production of biodiesel. Where farmers are well organised it should therefore be possible to advance into oil extraction. This depends, however, also on the strategies of the biodiesel firms, which at present are not clear. Petrobras is supporting such a move but is also developing technology for the production of biodiesel directly from the raw material, which would eliminate this stage. One of the limitations in the Northeast is the pulverisation of producers and the very limited areas dedicated to oil seeds which means that extraction is only viable in those areas with a critical density of production.

Initially biodiesel is directed to the domestic market although investments are underway premised on the consolidation of exports. Four firms – BSbios, Oleoplan, ADM and Agrenco – which have their production based on soybean, have now been authorised to export (Biodieselbr Magazine nº. 6, Aug/Sept 2008). The new investments in the North in oil palm are also said to have exports as their focus.
Rural employment

The Social Seal is a precondition for the biodiesel company’s participation in the national auctions, regulated by the National Oil Agency. The objective is to oblige the biodiesel industries to purchase their raw materials from family farmers, at least at the beginning of the BPNP. By the end of 2007, approximately 90 thousand families from 21 Brazilian states had been included in the value chain. According to the MDA (O Estado DE S. PAULO, News 3-9-07), the leading region is the Northeast, with 51% followed by the South with 34% and the Centre-West with 9%. According to Arnoldo Campos, national coordinator of the biodiesel programme, the inclusion of family farming in the programme has ground to a halt and it will be difficult to attain its initial aim of 200 thousand of families. “The most important now” he said, “is to consolidate the current 100 thousand, which means around 250 thousand people considering 2.5 persons per family”, (FOLHA DE S.PAULO, news 16-08-08). Efforts to involve family farmers also come from State government programmes (see next paragraph).

Table 4. Family farmers’ expected participation with B2 and B5

<table>
<thead>
<tr>
<th>Year</th>
<th>Bx</th>
<th>Biodiesel (millions of L)</th>
<th>Nº Family farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>B2</td>
<td>840</td>
<td>205,000</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td>1.140</td>
<td>244,668</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>1.547</td>
<td>292,011</td>
</tr>
<tr>
<td>2010</td>
<td>B5</td>
<td>2.100</td>
<td>348,515</td>
</tr>
</tbody>
</table>


Public support for agriculture

Public banks (BNDES, BB, BNB, BASA) offer financial support for the production of biodiesel raw materials through government’s programmes and insurance schemes: the Programme for Strengthening of Family Agriculture (PRONAF), the Family Farm Insurance Programme (Seguro da Agricultura Familiar, in Portuguese), Crop Guarantee Programme (Garantia-Safra, in Portuguese), Programme for Guarantee of Agriculture Activity (PROAGRO), etc. The PRONAF, managed by the Ministry of Agrarian Development (MDA), is the most important programme for covering the farmer’s operational costs.

In order to promote renewable energies, family farmers which are classified as C, D or E PRONAF’s group can apply for a loan to invest in solar, wind and biomass energy systems, in biofuel mini-plants, and sugar cane production to produce ethanol (AGÊNCIA Estado, News 27-6-07). In June 2007, the MDA announced a line of credit called PRONAF ECO Environmental Sustainability, specifically to help family farmers participate in renewable energy production chains (BIODIESELBR, News 14-1-08).
AGROFUELS IN BRAZIL: WHAT IS THE OUTLOOK FOR ITS FARMING SECTOR?

Box 5 – Women’s participation on the BPNP

Interview with Antonia Duarte, “Graça”, state coordinator of the Rural Worker Women’s movement of the FETRAECE, in the State of Ceará (18-2-08):

“In the very language of the Federal Government’s text divulging the programme we can see that the issue of women’s participation is lacking. When it speaks of family farming it is referring to the male worker. From the way it is being publicised everything suggests that women are not included as such in the programme because the contract is written up in the name of the man. It is all directed at the man: he signs the contracts, he receives the seeds, and the technical assistance… In one way or another women will benefit but only indirectly. Women are always left in the background.”

“There are organized groups of women producers – of manioc flour (tapioca etc) in Milagres, of medicinal plants in Missão Velha, and of handicraft from corn straw in Juazeiro do Norte. These are groups which the Fetrace accompanices, groups which have emerged from the initiative of the communities themselves. But there are others as well. It is these groups which are more interesting. As a result levels of participation and income have improved. The union movement which has been very masculine oriented until now begins to look at these women with more respect.”

Project involving castor oil in Minas Gerais State

The municipality of Conceição da Barra de Minas is host to one of the State’s pioneering projects. In an area of some 20 hectares castor oil is being produced for the Biodiesel programme by 20 families all headed by women. For 80% of these families their principal source of income is the Family Grant Programme of the Federal Government (Bolsa Família) which provides very low income families with monthly grants of from R$18 to 112.00. “These women must now have an income of between two or three minimum salaries” informs Pedro Neto, professor of the Department of Engineering at the Federal University of Lavras (UFLA).

The seeds were provided free by this University which also assists the project. SEBRAE-MG has taken on the training in business management, while the Municipal Government has ceded the land and provides transport to take the women from the town to the farm plot. The University itself should absorb the group’s first harvest. The castor plant will be sold still with its shell and each kilo is values at R$0.60 (MUNICIPALITY OF CONCEIÇÃO DA BARRA DE MINAS, News 12-03-08).

State’s government also supports the biodiesel value chain with specific programmes (table 5).
Table 5. Examples of State biodiesel programmes

<table>
<thead>
<tr>
<th>Region</th>
<th>State</th>
<th>Chain’s stage</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>Rio Grande do Norte</td>
<td>Agricultural</td>
<td>Plantation of: 15,000 ha of cotton and 13,000 ha of sunflower.</td>
</tr>
<tr>
<td></td>
<td>Ceará</td>
<td>Agricultural &amp; Industrial</td>
<td>See the Case Study.</td>
</tr>
<tr>
<td>N</td>
<td>Pará</td>
<td>Industrial</td>
<td>BNDES: Biodiesel Investment Financial Support Programme – financing till 90% of Social Seal projects and 80% of the others. Financed stages: agricultural, crude oil production, storage, logistic, by-products production and acquisition of machines and equipments that use biodiesel.</td>
</tr>
<tr>
<td>S</td>
<td>Rio Grande do Sul</td>
<td>Agricultural &amp; Industrial</td>
<td>Agreement among the University of Pelotas (UFPEL), the Rural Workers Federation (PETAG) and the trade unions of 10 municipalities. Creation of the Cooperative System of Vegetable Oil Production for Biodiesel – South (Siscoop-bio) responsible for the farmer’s organization. Investments from the Ministry of Sciences and Technology (MCT): R$ 2 million (R$ 600 thousand for the biodiesel plant with an initial capacity of 100 thousand litres per month; R$ 800 thousand for 10 oil extraction plants; and R$ 600 thousand for other costs).</td>
</tr>
</tbody>
</table>

Source: www.biodieselbr.com (March 2008) and HERRERA (2008).

The Government provides cash transfer programmes aimed at the lowest income groups (table 6). According to the Brazilian Statistics and Geography Institute (IBGE, 2006), the main programmes are the Bolsa-Família (Family Grant) Programme, the Continuous Cash Benefit Programme (BPC) and the Child Labour Eradication Programme (PETI). The Northeast is the most favoured region (35.9% of the sampled households) by the three programmes, followed by the North (24.6%), the Centre-West (18%), the South (10.4%) and the Southeast (10.3%). Except for the South where numbers remain stable, these percentages increased from 2004 to 2006.

Table 6. Expenditures in selected cash transfer programmes, in Brazil – 2005

<table>
<thead>
<tr>
<th>Programme</th>
<th>Families/Persons</th>
<th>R$/year</th>
<th>US$/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolsa-Família</td>
<td>8,700,451 families</td>
<td>6,592,630,104</td>
<td>2,746,929,210</td>
</tr>
<tr>
<td>PETI</td>
<td>931,000 persons</td>
<td>450,000,000</td>
<td>187,500,000</td>
</tr>
<tr>
<td>BPC</td>
<td>1,211,761 persons</td>
<td>4,384,828,296</td>
<td>1,827,011,790</td>
</tr>
</tbody>
</table>

Notes: R$ values as of December 2005, US$ exchange rate of 2.4.
Source: Estimates from Boletim Estatistico da Previdência Social, v. 10 n. 12, and Ministry of Social Development; In: MEDEIROS et al., 2006.

The same study shows that, for all five regions, but especially in the Northeast and North, households with income from the Bolsa-Família are more numerous than those benefited by other Federal programmes.
At the same time, average per capita household incomes are smaller in the Northeast (R$ 361), which has the highest percentage of households receiving cash transfers (table 7).

Table 7. Average per capita monthly income for households, depending on governmental cash transfers and social programmes by region – 2006

<table>
<thead>
<tr>
<th>Programme</th>
<th>Average per capita monthly household income (R$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brazil</td>
</tr>
<tr>
<td></td>
<td>Regions</td>
</tr>
<tr>
<td></td>
<td>North</td>
</tr>
<tr>
<td>Bolsa-Família</td>
<td>149</td>
</tr>
<tr>
<td>BPC</td>
<td>302</td>
</tr>
<tr>
<td>PETI</td>
<td>147</td>
</tr>
<tr>
<td>Others</td>
<td>198</td>
</tr>
<tr>
<td>Anyone</td>
<td>669</td>
</tr>
<tr>
<td>Total*</td>
<td>601</td>
</tr>
</tbody>
</table>

Notes: The same household may have received cash transfers from more than one social programme.
* Includes information on households without a social programme receipt.

The BPNP aims to improve living conditions for family farmers in the Northeast and Semiarid regions (table 8). Until May 2008, the government stimulated the castor-oil production in the Northeast as the vegetable species that granted the Social Seal. However, a simple comparison between tables 7 and 8 shows that, for the system I, the castor-oil revenue does not exceed the average per capita income received from social programmes, considering a two-hectare plantation. In the case of a semi-commercial producer (system II), castor-oil does begin to represent a solution.

Table 8. Family farmer’s income, depending on castor-oil and bean productivities and the productive system, in the Ceará State (Northeast region)

<table>
<thead>
<tr>
<th>System</th>
<th>Castor-oil productivity</th>
<th>Production costs (R$/ha.year)</th>
<th>Bean productivity</th>
<th>Net revenue* (R$/ha.year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System I</td>
<td>400 kg/ha</td>
<td>370</td>
<td>300 kg/ha</td>
<td>50 – 100</td>
</tr>
<tr>
<td>System II</td>
<td>750 kg/ha</td>
<td>493</td>
<td>600 kg/ha</td>
<td>436 – 40</td>
</tr>
</tbody>
</table>

* Without the state’s grant of R$ 150/ha till 3 ha of castor-oil crop for each family.
Note: The system n° 1 is characterized by a subsistence’s agriculture with small experience on oily seeds plantations and technique weakness, where the only sold production is the surplus. To avoid subsidies, system I should produce at least 700 kg/ha with intercropping and have access to rural grants and to crop’s guarantee programme. The second system is composed by semi-commercial producers that have some access to equipments and inputs and receive PRONAF’s financial assistance. In compensation they are not consolidated and the sell of their production is not regular.
Source: Carvalho’s lecture in COPPE/UFRJ on 4 April 2008.
Private support

Private support for agriculture is ensured in the context of adhesion to the Social Fuel Seal. The BPNP obliges biodiesel companies with the Social Seal to guarantee free technical assistance, training and implements. Other companies, such as SuperVerde in Ceará State, have also adopted this relationship with family farmers for other purposes, in this case oil exports.

In the industrial field, the BPNP provided a stimulus to the biodiesel plant equipment construction companies. Dedini, the largest equipment firm, also involved in the construction of ethanol refineries as we have seen above, accounts for 35% of Brazil’s biodiesel plants. During 2007 it received 60 proposals.

Box 6 – Cash transfer programmes in Brazil

**Bolsa-Família Programme**

In 2003, the government of Luiz Ignacio Lula da Silva launched a comprehensive programme to stimulate growth with social progress. On the social side, the centrepiece was a sweeping reform of Brazil’s social safety net, in the form of the Bolsa-Família Programme (Decree nº 5.209, of 17 September 2004 - Regulates a Law-010.836-2004), which integrated four cash transfer programs (Bolsa-Escola – Ministry of Education; Bolsa-Alimentação – Ministry of Health; Cartão-Alimentação – Fome Zero; and Auxílio-Gas – Ministry of Mines and Energy) into a single programme under the umbrella of a new Ministry of Social Development. Bolsa-Família provides financial aid to the “moderately poor” (families with a per capita monthly income between US$17 and US$34) and “extremely poor” (families with a per capita income of less than US$17 per month) Brazilian families, conditioning these transfers on child school attendance, use of health cards and other social services. This money is given preferentially to the female head of the household, through so-called Citizen Cards which are mailed to the family. This card operates like a debit card and is issued by the Caixa Econômica Federal, a government-owned savings bank (the second largest bank in the country). In January 2005, Bolsa-Família covered 6.6 million families and accounted for about a quarter of Brazil’s social safety net spending. The social investment represented 1.1% of total government expenditure and 0.2% of Brazil’s GDP (LINDERT, 2005).

**Continuous Cash Benefit Programme (BPC)**

The Continuous Cash Benefit Programme (BPC, Benefício de Prestação Continuada) is an unconditional cash transfer to the elderly (individuals over 65 years of age) or to extremely poor individuals with disabilities, whose household per capita income is less than one quarter of the minimum wage. It has been in effect in Brazil since 1993. The value of the transfer is equivalent to a monthly minimum wage (Medeiros et al., 2006).

**Child Labour Eradication Programme (PETI, Portuguese acronym)**

The Child Labour Eradication Programme (PETI, Programa de Erradicação do Trabalho Infantil) provides financial aid to families whose children practice typical urban or rural activities by conditioning transfers on school attendance by the children, and other social services (IBGE, 2006).
for projects, 10 of which will be producing biodiesel in 2008. One such project involves the delivery of a complete plant to Bionasa, which has received some R$ 125 million from the Trading Emissions PLC, a British company.

Foreign company participation in the biodiesel chain involving large-scale capital has led to investments of some R$ 1.2 billion during 2007 (table 9). Petrobras has inaugurated three biodiesel plants in 2008 – in the States of Minas Gerais, Bahia and Ceará – at a total cost of R$ 300 million (GAZETA MERCANTIL, news 29-07-08). The BNDES (Economic and Social Development National Bank) has financed ten biodiesel production projects with R$ 466.1 millions out of a total cost of R$ 602.5 millions. These plants will have a capacity of some 1.1 billion litres (BIODIESELBR, News 14-1-2008).

**Box 7 – Examples of biodiesel plant costs**

**Petrobras’s plant:**
- Localization: Candeias (State of Bahia)
- Production: 57 million litres of biodiesel per year
- Investments: R$ 101 million or US$ 60.55 million (R$ 1,668/US)
- Employments in the building site: 600
- Direct employment: 65
- Indirect employment: 35 thousand
- Contracted family farmers: 25,639 from 215 municipalities in Bahia and 3,283 from 49 municipalities in Sergipe.

Source: CORREIO DA BAHIA, News 15-1-08; GAZETA MERCANTIL, news 29-07-08.

**Agrenco’s plants:**
- Localization: Alto Araguaia (State of Mato Grosso), Caarapó (State of Mato Grosso do Sul), Marialva (State of Paraná)
- Production: 198 million, 90 million and 110 million of litres of biodiesel per year, respectively, with European and North American standards; residues; vegetable oils; and electricity.
- Investments: US$ 190 millions for the three plants

Source: AGÊNCIA Estado, News 11-3-08.
Table 9. Foreign investments in the Brazilian biodiesel and ethanol chain

<table>
<thead>
<tr>
<th>Firm (Country)</th>
<th>Land acquisition</th>
<th>Raw material acquisition</th>
<th>Industrial Processing</th>
<th>Marketing</th>
<th>Infrastructure</th>
<th>Financing</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>E</td>
<td>B</td>
<td>E</td>
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<td>Abengoa (Sp)</td>
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<tr>
<td>Adecoagro</td>
<td>X</td>
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<tr>
<td>ADM (USA)</td>
<td>X</td>
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<td>X</td>
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<td>Agrenco (Holl)</td>
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<tr>
<td>Amyris Crystalsv Biofuels</td>
<td>X(1)</td>
<td>X</td>
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<td>Basf (Germ)</td>
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<td>Bioauto (Braz-Sp)</td>
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<tr>
<td>BrasilAgro (Arg, Braz, USA)</td>
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<td>Brenco (Braz-USA)</td>
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<td>Beyond Petroleum (UK)</td>
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<tr>
<td>Beyond Petroleum (UK) / Tropical Bioenergia (Braz)</td>
<td>X</td>
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<td>Cargill (USA)</td>
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<td>Comanche (USA)</td>
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<td>Dow AgroSciences (USA)</td>
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<td>DuPont</td>
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<td>EIB</td>
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<td>El Tejar (Arg)</td>
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<td>EVONIK (Germ)</td>
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<td>Global Foods (USA)</td>
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<tr>
<td>Goldman Sachs (USA) / Crystalsv (Braz)</td>
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<td>Goldman Sachs (USA) / Santelisa Vale (Braz)</td>
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<td>ICQ (It)</td>
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<td>LDC Bioenergia (Fr)</td>
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<tr>
<td>Multigrain AG (Braz-USA-Jp)</td>
<td>X</td>
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<td>Noble (Jp)</td>
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<td>Petrobras (Braz) / Mitsui (Jp)</td>
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<td>Shell (UK/Holl)</td>
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<td>Superverde (EU/Braz)</td>
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<tr>
<td>Terasol Energy (USA/Braz/Ind)</td>
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<tr>
<td>Tereos (Fr) / Guarani (Braz)</td>
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</tbody>
</table>

1) The raw material is sugarcane. (2) Marketing of carbon credits and biodiesel. E: ethanol; B: biodiesel; R.M.: raw material; I.P.: industrial processing; EIB: European Investment Bank; Arg: Argentina; Braz: Brazil; EUs: European Union; Fr: France; Germ: Germany; Holl: Holland; Ind: India; It: Italy; Jp: Japan; Sp: Spain; UK: United Kingdom; USA: United States of America.

Source: Different newspapers (Valor Ecômico, O Estado de S.Paulo, Gazeta Mercantil, BP, etc.).
Private sector: leading players

According to Edson Silva, the ANP supplies supervisor, there are 52 plants authorized by the ANP, with a biodiesel production capacity of 2,780 billions of litres per year and a further 38 authorizations expected to produce more 686 million litres (AGÊNCIA BRASIL, News 18-3-08).

The Centre-West Region (CW) has the largest number of companies with the Social Fuel Seal, and the largest biodiesel production capacity. From figure 3 we can conclude that the CW is the region that contributes most in terms of family farming, in spite of the federal government’s aim to prioritise the North and the Northeastern regions.

Figure 3. Companies with Social Fuel Seal

![Graph showing companies with Social Fuel Seal by Brazil's regions.]

Source: ANP's data (March 2008).

Figure 4. Capacity authorized by ANP

![Graph showing biodiesel production capacity by region at different times.]

Source: ANP's data (March 2008).
Mato Grosso in the Centre-West is the State which has received the most biodiesel industries (2 times more than the next state, which is S. Paulo). In 9 months, from June 2007 to March 2008 the number of industries has increased from 6 to 18. 83% of these companies have a capacity of less than 50 thousand m$^3$/year. In the country as a whole, 63% produce less than 50 thousand m$^3$/year, 23% have a capacity of between 50 and 110 thousand of m$^3$/year, and 13% can produce up to 110 thousand of m$^3$/year. The industries in this last group are to be found in São Paulo, Mato Grosso, Rio Grande do Sul and Goiás, successively. São Paulo has the largest plant (Biocapital) and will also receive the second largest (Naturoil), this year, as a result of Spanish investment. Agreco, in Mato Grosso, will be the third largest industry.

The leading companies are Brasil Ecodiesel (BED) and Granol, whose production totals 621 and 335 thousand of m$^3$/year respectively. Their market policy is to establish plants in different regions. BED is in the North (Tocantins), in the Northeast (Ceará, Bahia, Maranhão, Piauí) and in the South (Rio Grande do Sul). Granol is found in the South (Rio Grande do Sul), in the Centre-West (Goiás) and in the Southeast (São Paulo).

The large companies benefit from foreign financing through shares or in the form of direct investment. Brasil Ecodiesel, Biocapital and Agreco were the first three companies with shares on the stock exchange. Furthermore, BED began its activity with the financial participation of the Deutsch Bank; Naturoil receives capital from Italy; Agreco is a multinational company with its head office in Holland; Biocapital participates with shares on the international market; and ADM (Archer Daniels Midland Company), the fourth biggest plant, is American and one of the largest agricultural processors in the world. Bionasa, soon to be in operation in the State of Goiás, has received the largest investment from a foreign company (British) in the biodiesel area (FATOR BRASIL, News 11-9-07). According to Thomas Haeberle, business unit director in Building Blocks, the chemical sector of the group, “Brazil is the most attractive biodiesel market in South America, making it the best location for a manufacturing unit” (BiodieselBr Magazine, nº 2, Dec. 07/ Jan. 08). The reasons are explained in the table 10.

Table 10. Advantages and disadvantages for foreign investments in Brazil

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil has productive agricultural areas with favourable climate.</td>
<td>Nevertheless, Brazil has road transport problems and a lack of efficient port infrastructure.</td>
</tr>
<tr>
<td>The BPNP employs the Social Fuel Seal, which promotes inclusion and promotes the development of the small farming sector.</td>
<td>Small farmers have low skills and do not receive the necessary support to ensure successful results.</td>
</tr>
<tr>
<td>The Social Seal supplies financial assistance to compensate some of the biodiesel production taxes.</td>
<td>Brazilian taxes are heavy and financial assistance is restricted to some raw materials and regions.</td>
</tr>
</tbody>
</table>


The North region has small biodiesel production plants (less than 50 thousand m$^3$/year) and the Northeast, medium ones (between 50 and 110 thousand of m$^3$/year). The pattern is not so clear for the other regions, except for the Centre-West, where there are no medium plants and 3 times more small
plants than big ones (up to 110 thousand of m³/year). With 15 plants Mato Grosso accounts for 45% of the country’s industries with less than 50 thousand m³/year. 10 of these 15 can produce only 10 thousand m³/year or less, of which 5 are managed by cooperatives (data of March 2008).

Mato Grosso is an example for the participation of cooperatives in the biodiesel value chain. Some small cooperative plants have been installed with ANP authorization; others are awaiting approval. Nevertheless, a large plant, of 110,000 m³ per year, has been installed by the Cuiabá Biofuels Cooperative (Cooperbio) with some 260 members costing R$ 30 million, of which R$24 million came from the BNDES. ANP approval will classify it as among the largest plants in the country, like ADM and Fiagril. However, its objective is not the biodiesel market. In order to reduce diesel costs, the cooperative aims to produce its own fuel. Mato Grosso has the largest production area of cotton, sunflower and soy in the country. “With biodiesel produced from soy oil, we will save 25% fuel costs; with biodiesel from cotton, the saving is around 40%”, according to João Luiz Ribas Pessa, the Cooperative’s president. Biodiesel from sunflower produced in Centre-West costs 50% less than diesel bought in Mato Grosso’s stations (BiodieselBr Magazine, nº 2, Dec.07/Jan.08).

The cooperatives are responsible for 6% of national GDP and 35% of the agricultural GDP. Since they produce the raw materials, which represent 60-80% of biodiesel costs, the cooperatives have a privileged place in the biodiesel value chain. At the same time, the production for own consumption allows exemption from fuel sale taxes (PIS/PASEP and COFINS). ANP also contemplates the exemption for biodiesel production carried out by the cooperatives, which is still obligatory (BiodieselBr Magazine, nº 2, Dec.07/Jan.08).

According to Arnoldo Campos, MDA general coordinator of value and income aggregation, “management training is the biggest challenge for the inclusion of cooperatives in biodiesel industrial processing”. Without a professional management, bank institutions are unlikely to provide financing (BiodieselBr Magazine, nº 2, Dec.07/Jan.08).

To confront these problems, the government has been implanting Biodiesel Poles throughout the country to stimulate durable relationships between the different actors of the biodiesel value chain. The poles – 30 up until now – are organized through Working Groups, formed by biodiesel companies, trade union representatives, financial agents, technical assistance companies, research institutions, cooperatives and, sometimes, universities, municipalities and others public and private organizations. Arnoldo Campos maintains that “these poles can become the embryo for the development of cooperatives in the biodiesel sector. Where there is an industry, there needs to be a raw material supply system in place” (BiodieselBr Magazine, nº 2, Dec. 07/Jan. 08).

Social movements and some NGOs claim that the poles can also stimulate a decentralization in the production and the consumption of energy, promoting the use of residues and industrial sub-products by the local farmers and the reduction of fuel transportation costs together with their environmental impacts (see the study case of Rio Grande do Sul).
Environmental impacts

Governmental impacts

The BPNP has a Social Fuel Seal but not an environmental one. Abramovay (2007) argues that agronomical practices for the promotion of integrated energy and food production systems should provide the basis for a general system of environmental certification for biodiesel production, which, it is thought, would have positive market impacts for all the actors of the value chain.

In the environmental area, the government’s lack of control represents the biggest threat to sustainable development. The study, “Agrarian Reform and Environmental Management: Matches and Misunderstandings”, published in April 2007 by Flávia Araújo, indicated that MST settlements lack environmental controls in spite of their territorial importance. Until 2006, only 6.8% of settlements established prior to 2003 had an environmental licence. A large part of these has been degraded due to deforestation for the cultivation of crops or were already degraded prior to the arrival of the settlers. “Federal, state and municipal institutions, which are responsible for environmental activities, do not carry out their functions either through problems of bureaucracy, or ideological quarrels” reported the Jornal do Brasil newspaper in April 2007. On the other hand, according to the above study, the farms in the settlements give priority to their immediate subsistence needs to the detriment of environmental preservation.

Agricultural impacts

Human activities represent the biggest threat to biodiversity conservation. One of the common agricultural practices, which needs to be eliminated, is the eradication of vegetation by means of burning, very frequent in the Semiarid region. After the valuable wood has been withdrawn the remaining vegetation is burned and the land is cultivated during a few years. The soil’s productivity progressively declines until the land becomes “tired”, as the region’s farmers say, due to heavy soil erosion. As a result, family income is diminished, biodiversity is reduced; atmospheric pollution is aggravated and the fragility of the agroecosystem increases; noxious fumes production.

Box 8 – Environmental impacts on the Caatinga biome

Lands with the highest risk of desertification due to environmental degradation, are concentrated in the Brazilian semiarid region and, more exactly, in the Caatinga biome (MMA, 2006). 60% of this area is considered to have already been transformed by human activity and another 30% is heading in this direction, which makes this biome one of the most degraded by human activity in Brazil. In the last 15 years, approximately 40,000 km² of Caatinga have been transformed into a desert (FERREIRA et al., 2006). Hundreds of hectares in the Caatinga are still being cut down every year to supply the population with energy and to make way for the planting of crops.
AGROFUELS IN BRAZIL: WHAT IS THE OUTLOOK FOR ITS FARMING SECTOR?

According to Donzelli (UNICA, 2005), erosion is the main reason for agricultural land degradation. In castor-oil planted areas soil losses are about 41.5 t/ha.year\(^{-1}\) with water losses reaching 12%; meanwhile for soy cultivation, soil losses are 20.1 t/ha.year\(^{-1}\) with water losses of 6.9% (Maria, 2001; In: ADS, 2006; Donzelli, In: UNICA, 2005). Not only for castor-oil cultivation but also for other vegetable species introduced into family farming, agricultural practices must be analysed to decide the correct exploration of soil and water resources and their insertion into traditional productive systems (Carvalho, 2006).

The family farmer’s use of alternative productive systems that stimulate conservationist practices is essential to improving environmental levels in the semiarid region. The strengthening of agri-silviculture and pasture systems, the suppression of burning, planting using level curves, direct sowing, the preservation of soil humidity’s around the plant, emergency irrigation, crop rotation, use of cultures that bring nitrogen to the soil, integrated pest control and biological pest control are indispensable measures for the sustainable development of production in the semiarid region.

For the biodiesel value chain, Embrapa estimates that soil recovery for oil seed production will cost some R$ 40,000 millions (Berma, 2007).

**Box 9 – Grains in the Amazon biome**

Grain crops in the Amazon region – soy included – can be an alternative for the recuperation of degraded areas. Embrapa has developed a technology that integrates crops (grains), cattle and reforestation, called the Integrated Production System (SIP). Its implementation follows three stages: in the first year, farmers intercrop grains and the trees that will compose the reforestation; in the second year, grains are planted again; and in the third year, the grains can be replaced with pasture because the trees will tall enough to avoid the risk of being destroyed by the cattle. Agricultural land, in this way, becomes pasture and can receive cattle again, which can enjoy the shade of trees and raise their productivity. This form of land recovery requires high investments in fertilization and land correction. Experiments are being conducted on farms in the North region of the country (Folha de S. Paulo, News 3-2-08).

**Industrial impact**

During the manufacture of biodiesel via the transesterification of oils from plants such as rape, soy and palm, 100 kg of glycerol (also known as glycerin) is produced for every 1 tonne of biodiesel. As it has about 85% purity, it also contains small quantities of salts, methanol, residual esterification catalyst and free oil acids (Biodiesel Br, News 9-10-07). This glycerin was quite useful when the number of biodiesel plants was low, and it was possible to be sold increasing, thereby, the yield of the manufacturing plant. However, currently and more so in the near future (with so many biodiesel manufacturing plants under construction), society is unable to absorb the tons of glycerine (glycerol) produced in this process. As a consequence, prices of its various components have dramatically declined to a point that glycerin has become a residue (in the 90’s prices declined more than 50%). In Europe, the production of glycerol has
triplled within the last 10 years to 600 thousand metric tonnes per year (THE GLYCEROL CHALLENGE, 2008). Nova Petroquímica (ex-Suzano Petroquímica bought by Petrobras) predicted that until 2013 glycerol production will reach, in Brazil, 250 thousand tons considering government’s goal to add biodiesel to diesel (GAZETA MERCANTIL, News 7-3-08).

Nowadays glycerol is used, in its almost pure form (99% purity), in medical, pharmaceutical and personal care preparations, foods, beverages, resins, among other markets. Given that glycerine markets are being saturated, a biodiesel plant can choose between reducing the quantity produced, transforming it into co-products or incinerating it (USDA, News 20-9-07).

A new biodiesel production technology that does not generate undesirable residues has been developed and patented by the German company Westfalia Separator and is being installed in some Brazilian plants, as Fiagril. The new method - named Alcoholic Neutralization - improves the vegetable oil’s pre-treatment and contributes to a reduction of raw material and to a sub-products income until R$ 2.4 millions per year for a plant capacity of 120 thousand of tons, equivalent to 1.5% of raw material’s cost employed during this period (CARBONO BRASIL, News 27-6-07).

Residues can also become co-products, like methane, plastic resin, animal feed or textile materials. The Federal university of Pernambuco has identified bacteria extracted from bovine manure that are fed on glycerine and produce methane employed as fuel (BIODIESELBR, News 27-3-08). The Nova Petroquimica is perhaps the first company in the world doing plastic resin from biodiesel residual glycerine, replacing some petroleum raw material (GAZETA MERCANTIL, News 7-3-08). Kerr, Dozier and Iowa State University colleague Kristjan Bregendahl studied whether crude glycerin could be used to supplement the feed of laying hens, broilers and swine. They found that crude glycerin provided a supply of caloric energy that equalled or exceeded the caloric energy available in corn grain. Dr. Lin and his colleagues of Iowa State University are trying to turn the resulting glycerol into a substance called 1,3 propanediol, or PDO, the base material for a substance used in upholstery, carpets, clothing and other applications (USDA, News 20-9-07). There are others examples from numerous research centres.

Emission’s impacts

Bioenergy crops offset their greenhouse-gas contributions in three key ways: by removing carbon dioxide from the air and storing it in crop roots and soil as organic carbon; by producing by-products like protein for animal feed, which saves on energy to make feed by other means; and by displacement, whereby replacing a fossil fuel with a biobased one “recycling” rather than adding more carbon dioxide to the atmosphere (USDA, News 8-6-07).

The Brazilian biodiesel program, BPNP, may not reduce carbon dioxide emissions if logistics require transporting biodiesel’s thousands of km throughout the country. Furthermore small quantities of biodiesel (up to 5%) mixed to diesel do not contribute much to emissions’ reduction, according to some studies (VIEIRA, 2006). In this way German research indicates that, from a given percent of diesel’s substitution by biodiesel, other gas’s mitigation policies will be more efficient than the BPNP (FRONDEL; PETERS, 2006; In: BERMANN, 2007).
Case studies

Case 1. Family agriculture of the state of Ceará (Northeast): castor oil culture

Case 2. Palm culture by the family farmers of the State of Pará (North)

Case 3. Sugarcane and ethanol cooperatives of the State of Rio Grande do Sul (South)
1. The state of Ceará in the Northeast

Ceará is not the largest producer of oil crops, particularly castor-oil, appropriate for the biodiesel programme in the Northeast. Bahia produces some 85% of the region’s castor-oil in addition to being a large-scale producer of cotton and soy. Ceará is notable, however, for the degree of mobilization around the biodiesel programme and in addition, it has a large concentration of family farmers in the semi-arid region. Both from the point of view of the target public, therefore, and the involvement of public and private actors it provides an excellent opportunity to evaluate the potential of this programme for offering new opportunities of income and employment for the small farmer sector and for providing the basis for strategies of local development. It should be emphasized, however, that the programme is still at a very initial stage making any assessment necessarily very provisional.
Table 11. Biodiesel programme’s investments in the State of Ceará

<table>
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<th>Chain’s stage</th>
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| Agricultural* | - Credits for small farmers:  
|               | 1) R$ 150/ha to castor-oil’s lands until a maximum of 3 ha; and  
|               | 2) R$ 0.14/kg + government’s minimum price (by the state government).  
|               | - Castor-oil seeds for family farmers and 50% of the chalky for the soil correction (by the Agricultural Development Secretary’s Office – SDA).  
|               | - R$ 0.50/kg of sunflower + the credits form small farmers + 50% of the chalky (by the state government).  
|               | - Quixadá mayoralty: free tractor’s hours for oily seeds.  
| Industrial    | R$ 12 million to construct 20 castor-oil mini-overwhelming involving 2 or 3 thousand of families each (by the federal government). |

* The investments will totalize R$ 20.1 millions until 2010, of which 88% will come from the State Government and the rest from Petrobras. The challenge is to reach 45 thousand of hectares of oily seeds – 40 for castor-oil plant and 5 for sunflower – that will produce 14,400 tones of castor-oil biodiesel and 3,375 tones of sunflower biodiesel, and generate 14,520 employments – 0.33 per hectare used. Until the end of the last year, there were registered in the State 21,919 farmers, which represent together 35,445 hectares. To attend to the BED, Petrobras and the other five medium biodiesel plants supply, there would be necessary at least 300 thousand of hectares of oily seeds, according to SDA. This area would be reached in at least three years, depending on the BPNP’s success.

Source: www.biodieselbr.com (March 2008) and HERRERA (2008).

In the context of the Northeast, and particularly its semi-arid region, the biodiesel programme is often presented as a possible solution to the collapse of the traditional cotton-cattle-subsistence crop economy, where cotton provided a cash crop for the small-farmer sector. Since then, however, there have been major transformations in the rural sector. Many agrarian reform settlements were created and have now become consolidated. At the same time, NGOs, rural unions and social movements have been active in the promotion of alternative strategies for the family-farming sector. These strategies have focused on new farming practices based on agroecological principles and organic production, often articulated with alternative niche, quality markets such as fair trade. The biodiesel programme, therefore, does not emerge within a vacuum but must negotiate with these actors many of whom are reticent or hostile to its objectives. Nevertheless, Ceará still bears the marks of its traditional agrarian structure with some 470,000 landless farmers planting under share-cropping arrangements on large cattle ranches.

This latter reality perhaps best explains why production of castor oil plant did not take off in spite of the early implantation of the Brasil Ecodiesel plant in 2005, the promise of the Petrobras plant for 2008 and the incentives provided by the State Government. Drought as always was a central factor, exacerbated by the difficulties of incorporating castor oil plant into the sharecropping system (landowner opposition because of risks to cattle and initial opposition by the programme’s organizers to the inclusion of corn in the intercropping system with castor oil plant). The vulnerability and pulverization of production within the sharecropping system was partially offset by the agrarian reform sector, which in Ceará comprises some 18,000 families in the Federal settlements and some 400 settlements under the responsibility of the State Government. The hope was that some 40,000 ha of castor oil plant would be planted in 2007 but the reality was little more than 5,000 has. It became clear that market style incentives on their own were
insufficient and would have to give way to the systemic construction of a new agroindustrial production chain, where technical, organizational, logistical and marketing features were equally decisive. For this to be possible many different agents would have to be mobilized and spaces created for their effective articulation.

**Box 10 – Alternatives strategies for the family-farming sector**

In Ceará State, the ESPLAR NGO has for ten years developed and supported organic farming projects for some 500 family farmers. The Association of Cultural and Educational Development (ADEC) of Tauá processes organic cotton and markets cotton through Fair Trade through Veja Fair Trade, Alter Eco and Justatrama. The price received by the farmer is higher than in the traditional market (R$ 24.90/kg instead R$ 20). ActionAid is discussing the use of cotton seed and sesame to produce oil. Another option is the sunflower plant, which produces oil, seeds, animal feed and apiculture. “To plant the castor-oil plant for them (for Petrobras) means more pesticides, putting our health at risk and polluting everything. You can cultivate castor-oil plant in an organic way, but in smaller quantities but this is not what they want”, said a cotton producer who works for ESPLAR in the Middle Stream Community (CE).

To overcome the difficulty of granting technical assistance to all the farmers, Brasil Ecodiesel (BED) has signed a public-private agreement between MDA, Birmann Foundation, GTZ, DED and Contag for the development of a collective training project. Called ATER Coletiva (Assistência Técnica e Extensão Rural Coletiva) this project aims to assist farmers better by promoting forms of association and family farmer participation schemes for all farmers included in a radius of 6 km who have contracts within the BPNP. “When work is more and more grouped together everything goes better, even people’s knowledge. Before we only knew how to work alone. Now we realise someone who goes it alone goes nowhere”, declared Neto, a farmer who is also the president of the communal association.

If castor oil plant were to be incorporated into the traditional production systems of the semi-arid region technical solutions would have to be found to the risks of intoxication to cattle, to the problems of productivity when intercropping with corn, to the toxicity of dehusking the castor oil plant seed.

According to FETRAECE, about 470 thousand Ceará families live on land that belongs to others. In the semi-arid region, the farming arrangement is that the farmer keeps the small-scale production and the forage crop goes to the landowner’s cattle. Castor-oil is often not authorized because of its toxicity. “Here (in Monsenhor Tabosa) if you want to plant corn, beans and castor-oil, the landlord does not mind. But don’t think about planting only beans and castor-oil because he wants the corn straw for his cattle as a forage crop”, declared Neto, a castor-oil producer from Monsenhor Tabosa. Furthermore, “corn straw (for the animals) costs more than the R$ 150/ha”, incentive given by the government, said Francimar, a councillor of the Choró rural workers’ trade union (STTR – Sindicato do Trabalhadores e Trabalhadoras Rurais).

For new solutions to become adopted and diffused priority would have to be given to technical assistance and extension services in a State where the public system had been allowed to crumble. Average
agricultural productivity was way below break-even point demanding the development, production and diffusion of new seeds. Given the objective of offering new opportunities for income and employment generation and a stimulus to local/regional development the programme would have to go beyond the simple supply of raw material and develop value-adding strategies. In addition, therefore, to the large-scale biodiesel plants of BED and Petrobras, small-scale plants for local production and consumption and primary processing plants to transform the seed into crude oil for subsequent supply to the biodiesel plants would be necessary. For this to be possible, however, qualitatively new levels of organization would be required and new capacities created, including those of organization, administration and basic business management.

Box 11 – Family farming organization

Stephan Görtz, a biodiesel consultant, thinks that the lack of family farmer organization in castor-oil grain production and marketing means that subsistence agricultural techniques will continue to predominate. In addition, Görtz argues that production groups, referring to the groups created within the MDA’s strategy of regional poles, increase the reliability of production and reduce the middleman’s action. “Without cooperative development, the biodiesel programme will not improve small producer livelihoods. Nobody can live off monoculture, alone, on five or ten hectares”, said Carlos Zveibil Neto, Ponte di Ferro director.

The aim of these production poles is to bring together the different actors in the value chain, from farmers right up to the biodiesel companies. Sometimes this interaction can compensate for the weakness of the public technical assistance service, Emater (Empresa de Assistência Técnica e Extensão Rural), thanks to the compulsory company assistance implanted by the BPNP. “The support received here comes from Brasil Ecodiesel because Ematerce (Ceará’s Emater) does not work”, according to Neto, a castor-oil plant producer from Monsenhor Tabosa, in Ceará State. Monsenhor Tabosa is one of the six most productive castor-oil plant municipalities of Ceará. “It was known as the castor-oil plant capital”, said the producer. This rural zone, however, still does not have electric energy, a demand still being negotiated by the community association.

The challenges are daunting given the historical precariousness of family farming in the Northeast but two decades and more of rural social movements, ONG activity and trade union organisation have given rise to a new generation of rural leaders, with women playing a particularly predominant role, often having the agrarian reform settlements as their base of support. For its part, the State Government has established a R$150 per hectare subsidy for up to three hectares and R$ 0.14 per kg in addition to the public minimum price. In close articulation with the Federal Ministry of Agrarian Development and other Federal bodies such as DNOCs, an organization created to counter the effects of the drought, now responsible for public irrigation projects in the Northeast, and of course Petrobras with its biodiesel plant in Quixadá which will require 160,000 litres of oil per day, have organised a production chain, with family farming as its principal source of supply. Among the most important measures have been: reactivation of the rural extension service through an agreement with Petrobras, guaranteed purchase of all production, free provision of seeds and the production of (shorter cycle) seeds by family farmers.
within the irrigated perimeters of DNOCs, extension of credit and insurance to areas outside the official zoning regions, permission for intercropping with corn where experiments have justified this system, provision of dehusking equipment, and the implantation of up to 20 primary processing plants (there are already five).

Such a mobilization involves the articulation of a multiplicity of actors with often very different interests and subject to very different organizational dynamics. In addition, important leadership components in social movements, the rural unions and influential ONGs are sceptical or openly hostile to the biodiesel programme which is seen as contrary to strategies based on agroecology, organic and sustainable production systems. Nevertheless, a large measure of overall agreement has been reached, ranging from Petrobras, to the Landless Movement (MST) and Forums have been created at State and local levels (Working Groups) which have been able to establish the parameters of broad-based collective action. These working groups have reinforced the strategy of promoting biodiesel within the perspective of establishing development poles based on the adoption of castor oil plant production by a critical mass of family farmers. In addition to being a precondition for guaranteeing a minimum supply base for the Petrobras biodiesel plant, the promotion of development poles also make possible value-added strategies for primary processing.

Brasil Ecodiesel (BED) also participates in these forums although it would seem to have developed a parallel strategy relying on its own extension services. At present, castor oil plant bought by BED is transported to its plant in Itaquara, Bahia and it is not clear whether the Crateús plant (which by judicial decision must now be relocated away from the river) will process castor oil plant in the future or continue as at present to use soy oil. BED has also planted some 11,000 ha of castor oil plant along plantation lines and there are other medium-to-large producers in the State. Once new more productive and adapted seeds are available other medium and large-scale producers may be attracted to castor oil plant production.

Figure 6. A family farmer (on the left) that produces castor oil plants (on the middle). On the right, there is an example of intercropping of castor oil plant with corn and gourd. The pictures were taken in the Ceará State
Ceará is a striking example of a complex mobilisation involving a wide range of heterogeneous actors who nevertheless have established the conditions for coherent systemic action aimed at the promotion of a biodiesel production chain. The programme is currently heavily subsidised and dependent on political wills, which may change before results are consolidated. While efforts are directed at ambitious results in the short term – increasing for instance production from 5,000 to 50,000 hectares from 2007 to 2008 – it is likely that consolidation will require a considerable number of years. In addition to those who oppose the Biodiesel programme because they defend alternative strategies for family farming in the Northeast recent research (CARVALHO et al., 2007) has called in question the capacity of the programme to fundamentally change income and employment perspectives, given the low productivity and the reduced areas available to family farming, whose production systems are largely subordinated to the large cattle ranches whose lands they rent. Currently, greater potential for response is being shown by the agrarian reform settlements which reinforces the view that the agrarian structure remains a key barrier to the consolidation of viable family farm production systems in Brazil’s semi-arid region.

2. Oil palm in the state of Pará, North of Brazil

Mojú and Tailândia, municipalities some two hours from the State capital Belém, have become the centre for oil palm production. Agropalma began its plantation in 1982 and now has some 32,000 hectares in production. Another large-scale investment is that of Biopalma, Canadian capital, with plans for 40,000 hectares. Agropalma, became a show-case for the introduction of oil palm to the Amazon region because it has developed a family farm model of contract production for some 186 families with a total area of 1,800 hectares. The rural unions in the region are particularly active and are negotiating to ensure that new investments do not involve the purchase of land already occupied by family farmers, as in the case of renters and sharecroppers on cattle land. Nevertheless, as large-scale plantations advance, it is feared that the future of many small farmers will be that of wage-labourers on the plantations, living precariously on the outskirts of the towns. Moves are afoot to recognize the palm crop as eligible for reforestry status which would legitimize its planting in the Amazon region allowing access to green credits and investment funds. Biopalma has already anticipated such a development designating itself as a reforestry operation.

Not all actors in the region, however, support the development of oil palm or see it as an opportunity for the family farm sector. FASE, a key NGO active in rural development and long present in the region argues that the crop is not native to the region and that priority should be given to the many endogenous sources of oil. In addition, it argues that the development of high value markets (pharmaceuticals, cosmetics, food industry) provide a more viable and sustainable alternative for family farming communities, than the oil palm plantations currently being introduced into the region.

Pará is a State in what is called of called “Legal Amazonia,” an administrative region that covers 60% of the national territory. Pará itself is a huge State one third of the Brazilian Amazon region, 16.7% of the country’s territory. The State has only 7 million inhabitants – an average of 5 persons per square kilometre. Its economy is based on mineral extraction, and, to a lesser extent, on agriculture, livestock farming and industry. Pará accounts for 1.9% of Brazil’s GDP or roughly US$ 16 billion (in 2006) and is an area of major social, economic and environmental tensions.
Agropalma Group began its palm oil (obtained from the pulp of the fruit through cooking, shelling and pressing) and palm kernel oil (obtained through pressing, once the shells have been broken and separated from the core) production and extraction activities in 1982. Palmdiesel, as Agropalma’s biodiesel is named, is produced from the fatty acids extracted from the palm oil refining process – and is regarded as a sustainable process.

The Agropalma Group directly employs more than 2,800 people who live in agro communities provided by the Group, complete with water, electricity and sewage infrastructure. A further 10,000 people, who live in communities near the plantations, are indirectly both economically and socially dependent on the results and the related services generated. The Agropalma Group also engages 186 family farmers who plant some 1,800 hectares for which the company assumes responsibility for technical support and the purchase of all the production at Rotterdam Stock Exchange oil prices. This partnership was launched in 2001 with the Project of the Colonists of Arauáí, involving the planting of 1,500 hectares. The farmers live on lands granted by the Federal Government and have each 10 ha of palm plantations and 2 ha for others crops. A further 300 hectares have been planted in the Calmaria settlement – with a total of 500 ha being projected. This long degraded area forms a continuous plantation and is being worked in lots of 6 hectares per family. According to Agropalma’s site, some 15,000 hectares will be planted in the municipalities of Tailândia, Moju, Acará and Tomé-açu over the next 7 years by independent farmers and producers. In future projects, Agropalma makes clear that it will not provide the level of assistance which characterised the Arauai project, suggesting that this experience may well be exceptional and unlikely to be reproduced in future projects.

**Figure 7. Palm culture by the family farming**

*Photograph: S. Herrera*
AGROFUELS IN BRAZIL: WHAT IS THE OUTLOOK FOR ITS FARMING SECTOR?

The Project of the Colonists of Arauá grew out of a joint initiative by the Mojú municipal council and Agropalma. To achieve their objectives, both sought funding from the Programme for the Strengthening of Family Farming (PRONAF), through the Amazonian Bank (BASA) to make it viable for families to respond to the proposal. In addition to the BASA loan each family was given a 25 hectare plot with legal ownership rights - thanks to a negotiation between the company and the Pará Land Institute (ITERPA). The families also received agricultural machinery and equipment, palm seedlings and technical assistance directly from Agropalma. In addition, the company pledged to purchase all the small farmers’ production and to provide an agricultural operations team, vehicles for transporting fertilizer, raw materials, tools and personal safety equipment. The municipal council, in its turn, promised to select and settle the families and also provide infrastructure support – both by choosing the area and the topography and providing demarcation. By 2006, the company had invested US$ 1.2 million in the project. As the palm trees take roughly three years to start yielding fruit, BASA granted a monthly stipend of one minimum wage (some US$130) for the support of each family and the purchase of palm farming material. The loan was payable with 4% interest a year, within a seven-year grace period compared with an annual interest rate of 64.4% charged for loans to individuals in 2005. “Part of the earnings of each family is retained by BASA and will be used to pay off the financing”, explained Marcello Brito, the commercial director.

“This is a crop ideally suited to family farming”, says Seculino, a farmer who works for Agropalma.

The project became an attractive employment option for small family farmers in this poorly developed region. By transforming family farmers into suppliers for the palm oil production chain, farmers, it is argued, have begun to play an active role in the local economy, whereas previously they had focused only on subsistence farming. As palm oil farmers, these families are presented as the agents of a sustainable socio-environmental development process characterized by growth in income generation and ecosystem conservation. Thus, an example of perennial crop production that generates ongoing monthly income is argued to have come true in the Amazon region, reducing rural migration and strengthening the community. Another favourable aspect identified, is the conservation of land and natural resources by the local population, mainly by the farmers’ families. The degraded land now occupied by palm allows for its recovery through a higher rate of rain infiltration, which diminishes soil erosion and renews the soil system, in addition to capturing carbon.

In 2005, fifty family farmers in Mojú harvested their first crop and began earning an average monthly income of US$320, with a possibility of doubling this in 2006. After the seventh year (2008), the expected annual income should reach some US$8,500 per family. Before taking part in this project, average monthly family income did not exceed US$26 made on sales of flour fruit and charcoal, while, according to 2005 data, the average monthly income in Brazil equalled US$231.14 and the equivalent for the rural population amounted to US$108.30. In addition these activities contributed to forest degradation. Families now have a source of permanent work due to the crop’s perennial nature, in which production is maintained on the same site. Moreover, the palms do not require daily care and the planted area can be shared with other crops (FISCHER et al., 2006).
The Dendê (Oil palm) Family Farming Project led the Mojú farmers to establish the Arauáí Community Development Association where monthly meetings are held attended by the association members, Agropalma technicians and representatives of the parties involved with the project. Difficulties, improvements and partnerships in aid of the community are discussed at these meetings, giving rise to action plans that have already led to road building, the establishment of a school and the institution of public transport. The appearance of this association is considered one of the project’s main results, because it strengthens the community’s social capital and its capacity to interact with the government. In the words of Edmilson Ferreira de Barros, president of the Arauáí Community Development Association, “we didn’t have development before – we deforested a lot and reaped little. Now we don’t cut down the forest” (FISCHER et al., 2006).

The palm producers who work for Agropalma can be classified into two groups: wage-earners working the company’s lands and family farmers who sell their production to the company. In spite of the apparent success of the experiences, each group has its problems.

With regard to financing, family farmers have to face a six months period at the beginning of the fourth year of plantation without the bank support when production still does not provide a financial return sufficient to maintain the family. “The farmer becomes desperate”, says Carlos Alberto Dias, “Balsa”, Mojú STTR director of agricultural policy. “The overall income is excellent, but the projects for credit must be improved”, reported Balsa, suggesting an increase in the period of BASA’s financing from 36 to 42 months.

For its part, the STTR argues for the need to diversify crops on the family-farm lands. Basing itself on properties of 25 hectares which is equivalent to the region’s basic module, the recommendation is to plant a maximum of 6 hectares of palm to ensure that the Legal Reserve of forest land is maintained and that there is sufficient land for cultivating other crops. Intercropping with palm is also under evaluation. Finally, the president of the Mojú STTR insisted on the crucial necessity of preparing and training farmers to administer their own enterprises. In any event, the family farm sector will have to confront more business oriented investors coming into the region from other areas and other countries.

During the 80’s and 90’s, the state government awarded lands to companies who were planning to invest in oil palm. Today, union action is making it difficult to sell land which is also used by family farmers as renters and sharecroppers. Nevertheless companies are now buying up family farms whose members then migrate to the nearby towns where many become wage earners for the company which bought their lands. This is already happening in Mojú, the focus for investments attracted by vast deforested areas, cheap labour, favourable soil and climate conditions (it rains the whole year) and logistics. New enterprises are arriving, such as Biopalma da Amazônia, which has installed 40,000 ha of oil palm, three oil processing units and a biodiesel production unit. Petrobras has shown interest in setting up a refinery; and a number of South producers, are also considering investments in the region according to the Mojú STTR.

A very different strategy for the consolidation of family farming in the region is that of cultivating native oils for high value markets in pharmaceuticals, cosmetics, fine chemicals and the food industry. This is a strategy which, as we have seen earlier, important NGOs in the region such as FASE support.
Natura, one of Brazil’s leading cosmetic firms, is stimulating the cultivation of the native plant murumuru by family farmers and is offering R$ 1.5 per kg of almond. International firms, such as Body Shop and Aveda, have also been active in similar initiatives in other regions of the Amazon. According to the Mojú STTR president “In the countryside, those who do not participate in one or other of the projects is surviving in precarious conditions”.

Box 12 – Palm culture for family farmers
- Harvest every 10-15 days, during 2 days;
- Harvest mechanization is not viable because each bunch must be selected;
- Oil loses its quality after the 15th day;
- 10 ha per family with 2 children plus 2 ha for other cultures;
- Fertilization twice a year;
- Land cleaning;
- Net income at full production: R$ 1,200 per month;
- After 20 years payment of land credit the family gains ownership;
- High initial investment (land clearing plus imported and expensive seedlings).

3. Integrating food and agroenergy in the family farm sector in the South

While biodiesel has been conceived from its initial formulation as a programme geared to the family farm it has been widely accepted that scale economies preclude such an approach in the case of ethanol from sugarcane. A number of projects in the South are challenging this logic and promoting ethanol from sugarcane (and also experimenting with manioc and a sweet variety of sorghum) in integrated energy and food family production systems. Biodiesel is also being planned within the same approach, again experimenting with various sources, particularly tree crops (jatropha and tung).

Decentralised plants with a capacity of 600-1,000 litres/day can produce alcohol and/or cachaca. Demerara sugar and other co-products can also be produced with both sets of activities relying on the same wood/steam heating system. Family farms in this region typically have ten or twenty hectares and within the terms of the project only two hectares can be dedicated to sugarcane both to prevent competition with food crops and excessive demands on labour. Experiments are being developed to test a variety of inter cropping systems both with tree crops and short cycle food crops. The project, which we will discuss in more detail below, requires collective action in the form of associations of producers to jointly manage the processing operations and cooperate in farming activities.
The project is conceived as a radical challenge to the dominant agribusiness model within which the family farm sector is often integrated as a contracted supplier. Within this perspective the combined food and energy production systems are seen as strategies for increasing the autonomy of the less favoured family farm sector, an important feature of which includes the production of ethanol for local consumption. These projects are still at an early stage of development and so definitive conclusions cannot be drawn as to their feasibility. Nevertheless, as can be seen from the description below, they may well offer a complementary strategy for ethanol production in the family-farming context in other regions of the country. Regulatory adjustments permitting direct sales to the members of a producer cooperative thereby promoting decentralised distribution circuits increase the attractiveness of such a strategy.

Cooperativism in the South has a long traditional and in the wake of the crisis of the large-scale commodity-based cooperatives in this region there has been a surge in the creation of smaller more locally focused cooperatives and associations. In the North-western region of Rio Grande do Sul State there are some 72 such cooperatives and 278 producer associations. Cooperbio is one such Cooperative operating since 2005 in an area which covers some 63 municipalities and where there are 57,149 properties with less than 50 hectares, almost half of which has less than 10 hectares. Some 8 other cooperatives are involved with Cooperbio in an initiative to promote integrated fuel and food production systems. Cooperbio sees itself as working with the least privileged segment of family farmers and aims at increasing this sector’s self-sufficiency in the face of exclusionary strategies on the part of agribusiness. While currently dairy is providing a decisive source of income for this sector, Cooperbio’s leaders predicts that there will be a sharp process of concentration and exclusion in the coming years.

Cooperbio’s leadership belongs to the Small Farmers’ Movement (MPA) whose interests are directly represented in the Ministry of Agrarian Development. Its energy strategy involved both ethanol and biodiesel, with in each case Petrobras as its principal partner and financer. The ethanol initiative is currently at a more advanced stage.

In the case of ethanol the idea is to implant 9 micro distilleries, each one supported by a producer association. It is estimated that some 20 hectares of sugar cane are needed to feed each plant. To ensure that the food supply is not prejudiced each producer is allowed to plant only two hectares. Labour considerations, particularly in relation to harvesting have also influenced the establishment of this ceiling. Harvesting is particularly arduous because prior burning is not allowed which makes the sugar cane more difficult to cut. Harvesting and planting will often be conducted on the exchange of days of service. A mobile milling machine which can be attached to a tractor extracts the sugar for subsequent processing. All the members of the producer organization receive training to operate the distillery and related activities. The distillery in question, with a capacity for 600-1000 litres, has been designed by a rural extension technician from the neighbouring State of Santa Catarina. In addition to alcohol, the machinery is adapted to produce cachaca and there are adjacent facilities for the production of demerara sugar and other co-products. The 9 micro-distilleries will be supported by a centralised rectifying plant with a capacity for 5-15,000 litres/day which will adapt the ethanol to the requirements of the National Energy Agency making it available for sale to Petrobras.
The micro distilleries are currently being implanted. One producer group, which has recently installed a distillery, has been producing Demerara sugar and other co-products for three years. After initial problems relating to the unevenness of demand the sugar is not sold to the government in the context of its programme for social inclusion (the family grant programme). The oven that heats both sugar and alcohol production is fed by wood and the Cooperbio project includes provision for wood production within the integrated fuel and food farming system. The marketing options for alcohol are various. Once the rectifier is in operation alcohol can be sold into the main ethanol distribution system but price factors may make this option less attractive than other outlets. These include the direct use of alcohol in the vehicles of the members of the producer association. Such a market could also be expanded through the creation of a consumer cooperative as part of Cooperbio. Rectified alcohol could also be sold directly to the “white line” or generic distributors.

There is also a plan for the production of biodiesel which in a similar fashion would combine decentralised oil-extraction plants with a centralised refining facility allowing the biodiesel to enter the official distribution network. The idea, here, would be to promote multi-purpose crops (sunflower) and especially tree crops (jatropha and tung) in combined food and fuel production systems. A prototype drying, selecting and storage plant has been developed which runs on solar energy and can dry up to one ton a day in an indirect heating system which preserves the nutrients of the grains. Decentralising oil-extraction would mean richer solid residues for application on the farm. On the other hand, large scale production of biodiesel through the country will lead to an overproduction of such solids which may drastically lower prices and undercut local prices. Similar experiences for biodiesel and/or ethanol are being conducted by one or two other cooperatives in the region.

Box 13 – The participation of family farming in the Centre-West (state of Goiás)

A master degree thesis defended in 2008* at the University of S. Paulo has analysed the participation of family farming in Biodiesel Programme in the State of Goiás. The study compares the incomes generated by producers in activities under contract to the biodiesel company with traditional activities. On participating in the BPNP, the area dedicated to traditional crops (soy, cotton, corn, beans and milk) declined 77% from an average of 68 hectares to 39 hectares, with 42 hectares now being used for the production of biodiesel.

Among the family farmers, the castor oil producers – about 30% of those interviewed – are still less remunerated and economically more fragile than the traditional well-organized and economically consolidated soy producers. The regional net incomes ranges from R$ 243 to more than R$ 4,504 for 15.6% of the farmers, and up to R$ 58,715 for the rest. Average incomes have grown 20.16%, from R$ 362.26/ha to R$ 435.29/ha, before and after the BPNP.

In the case of Cooperbio we are dealing with quite an ambitious project involving investments at individual farmer, producer association and cooperative levels. Petrobras is reported to be investing some R$45 million with a further R$25 million coming from the Cooperative. PRONAF provides credit lines both for the producer associations and the individual farmer. With nine micro distilleries, one per producer association of 10-20 members, the project could initially directly benefit 180 families. In addition the rectifier plant will involve contracted labour and generate further demand for suppliers of raw material. If it becomes viable to market the agrofuels in the region this could represent an important gain in income retained in the locality with various indirect benefits and beneficiaries. It is still too early to evaluate the feasibility and replicability of this experience but it is clear that success depends on a considerable level of organisation and capacity for collective action.
Conclusions and recommendations

There is a stark contrast between the ethanol and biodiesel programmes in Brazil. The former has one basic input – sugar-cane – which is produced on a large-scale in the Centre-South and Centre-West, in great measure independently of Government controls. It is price competitive with petroleum at around US$30 a barrel, is highly efficient in energy input/output ratios (1/8), and depending on the life cycle criteria used is neutral on carbon emissions. It has been most vulnerable to criticism for the effects of its monoculture farming system, the working conditions for wage-labour and the continued pollution from crop burning. While there has been some substitution of crops, Brazil’s enormous availability of land, particularly used land, reduces the direct threat of ethanol production for food supplies. The issue of greatest contention, perhaps, relates to the indirect effects of the huge projected expansion of sugar-cane ethanol production, particularly the relocation of soy production and cattle raising from the Centre-South to new frontier lands releasing carbon emissions and putting pressure on sensitive biomes.

Biodiesel, on the other hand, is based on a wide range of raw material inputs, is a regionally dispersed activity, and has been directly created and promoted by public policy which affects all aspects of its functioning. Its final consumer price is subsidised and its raw materials have not shown themselves to be price competitive. Energy efficiency (with the exception of oil palm which is only produced in the North) is low and the programme increasingly depends on soy, which is seen, along with cattle raising, as the principle cause of new land use and therefore gas emissions. In contrast with ethanol, it has been designed with a view to promoting regional development and social inclusion. There has been in particular a sustained effort to make biodiesel a viable option for the semi-arid North-eastern region.

Within the objective of making agrofuels work for the poor a range of policy proposals would seem to be in order. In the case of ethanol, it is important that the proposed zoning regulation be given teeth, both in its prohibitions and its incentives which should include adhesion to zoning as a pre-condition for access to credit for both working capital and investment. Legislation on mechanisation of the harvest and the elimination of crop-burning should be speeded up in traditional areas of production and made obligatory for new investments. Adhesion to acceptable labour standards should be rigorously imposed and monitored and priority should be given to on the job retraining programmes. While scale is a necessary component of a supply system aimed at replacing and/or complementing gasoline in the national and global markets, policies should also promote its decentralised production for local consumption. In this context, integrated food and fuel production systems using equipment and machinery compatible with associated small farming should be promoted.

Biodiesel currently faces a more fundamental challenge with regard to its economic viability. It may be argued that with time and particularly investment in research and technology viable levels of
productivity may be achieved in castor oil and tree crops such as Tung and Jatropha integrated into family farming systems. Nevertheless in the critical regions of the Northeast high levels of political motivation and mobilisation have been inversely related to results. Such initiatives have exposed, and research has corroborated, the need for more structural measures to reinforce access to primary assets, fundamentally land. The majority of farmers in this region still have insufficient or inappropriate form of access to land. Individually their production is generally too low to have a positive effect on income and their fragmentation undermines efforts at logistical efficiency and value added initiatives. It is not surprising, therefore, that many of the best organised farmers in the region look to alternative strategies, such as agroecology and niche markets. In the North, the inclusion of family farming in oil palm production would seem not to be reproducible, and current investments point to the predominance of large-scale plantations. In the Centre-West research has suggested that it is the more consolidated family farmer producing soybeans rather than the small farmer producing castor oil who is benefiting from the programme. If soy comes to confirm itself as the preferential raw material for biodiesel, however, it will be the large farmer and the dominant agribusiness channels which will certainly take over the programme - if, that is, the ethanol sector does not encroach itself on biodiesel markets.

The Brazilian biodiesel programme has been exemplary in its efforts to engage family farming and has created a range of innovative instruments for the designing of markets with a view to social inclusion. While it does not appear able to offer a general solution to income generation for the family farm sector, the combined measures and initiatives which we have described in the case of the Ceará case study, complemented with advances in research on the strengthening of family farming systems may contribute in an important way to reinforcing the family farm base of local development in regions which manage to consolidate a critical mass both in productive and organizational terms. In this sense the Biodiesel programme can be seen as one among a series of initiatives which are contributing to the consolidation of the family farming sector in Brazil.
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