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NOTE

Policy Department A
Economic and Scientific Policy

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THE IMPACTS OF BIOFUELS ON THE ENVIRONMENT AND ON FOOD SECURITY IN BRAZIL

AGRICULTURE / ENVIRONMENT

April 2008

EN

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Directorate General Internal Policies of the Union

Policy Department B: Structural and Cohesion Policies

Policy Department A: Economic and Scientific Policy

AGRICULTURE AND RURAL DEVELOPMENT

THE IMPACTS OF BIOFUELS ON THE ENVIRONMENT AND ON FOOD SECURITY IN BRAZIL

NOTE

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Author:

Mr Leo Peskett[1]
Overseas Development Institute

Responsible Official:

Mr Albert Massot Marti
Policy Department Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: ipoldepb@europarl.europa.eu

Mrs Yanne Goossens
Policy Department A: Economic and Scientific Policy
European Parliament
B-1047 Brussels
E-mail: yanne.goossens@europarl.europa.eu

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[1] Drafted by: Steve Wiggins, Guy Edward & Jodie Keane — Research Fellow, Research Associate and Research OfficerContact: *s.wiggins@odi.org.uk*

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NOTE

Content:

This note analyzes the impacts of biofuels on the environment and on food security in Brazil. The Brazilian biofuels industry is a world leader and currently 40% of vehicle come from ethanol from cane. Since 1990 over 42 M Ha of Brazilian forest have been lost but it cannot be on account of biofuel. In other hand, there is little evidence that biofuels cause hunger: prices of most food in Brazil have been falling compared to the general price since 1994. In addition, the biofuel industry provides jobs to 800.000 persons at wages above the average in farming.

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Key points:

- Brazil has more than 30 years experience of large-scale production of biofuel: currently 40% of vehicle fuel come from ethanol.
- Most biofuels come from 3M ha of sugar cane, less than 5% of the total cropped area. Since 1990 over 42M ha of forest have been lost: it cannot be on account of biofuel.
- Mono-cropped sugar cane can reduce biodiversity, degrade soil, and pollute soil and water; but it is not clear that sugar is any worse than most other crops. Biofuels probably reduce greenhouse gas emissions compared to fossil fuels — so long as forest is not cleared to grow feedstock.
- Despite Brazil being a rapidly-growing middle income country, because of high levels of inequality, at least 23% of the population are poor, and at least 7% are under-nourished. There is little evidence that biofuels cause hunger: prices of most food in Brazil have been falling compared to the general price level since 1994. In addition, the biofuel industry provides jobs to 800,000 persons at wages above the average in farming.

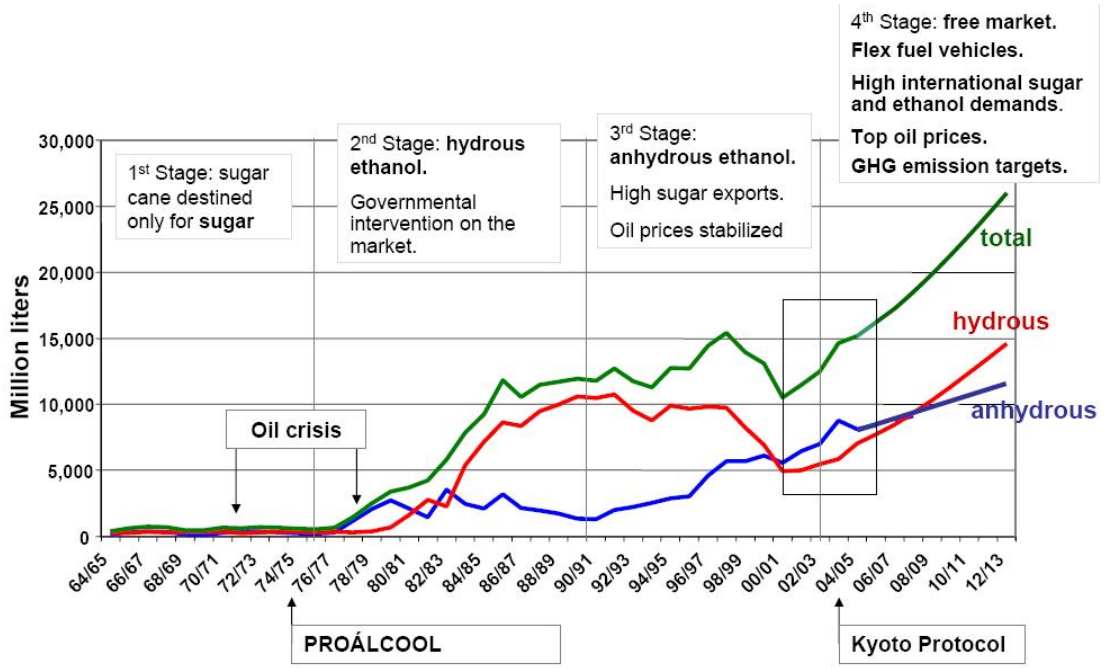
Background: biofuels development and policy in Brazil

Brazil introduced legislation for blending ethanol with gasoline as long as ago as the early 1930s, but it was the oil price shock of 1973 that led to major developments as government began the *Proalcool* — National Alcohol — programme in 1974. Designed to reduce dependency on foreign oil, *Proalcool* used subsidies and tax breaks to encourage farmers to plant more sugar cane, industrialists to invest in distilleries, and car manufacturers to design their vehicles suitable to run on ethanol blends.

As world oil prices fell in real terms in the 1980s, biofuels production stagnated, only to revive strongly in the 1990s as oil prices once again moved upwards and greenhouse gas (GHG) emissions became a concern. See Figure 1.

With more than three-decades of large-scale ethanol production, the Brazilian biofuels industry is a world leader, able to produce ethanol from cane at a cost equivalent to US$35 a barrel of gasoline. All automobile fuels contain ethanol, mainly as 25% or 100%. Some 40% of Brazilian vehicles run on pure or 100% ethanol (also known as anhydrous ethanol).

Figure 1: Timeline of Bio ethanol Production and Development in Brazil



Source: Ministry of Agriculture, Livestock and Food Supply (2006)

There are now plans to blend 5% biodiesel, from soy beans and palm oil, into diesel fuel by 2013, and 20% by 2020. Processors who source from (small-scale) family farms can earn a 'Social Fuel Stamp' conferring tax exemptions and access to low-cost loans.

Land use and biofuels

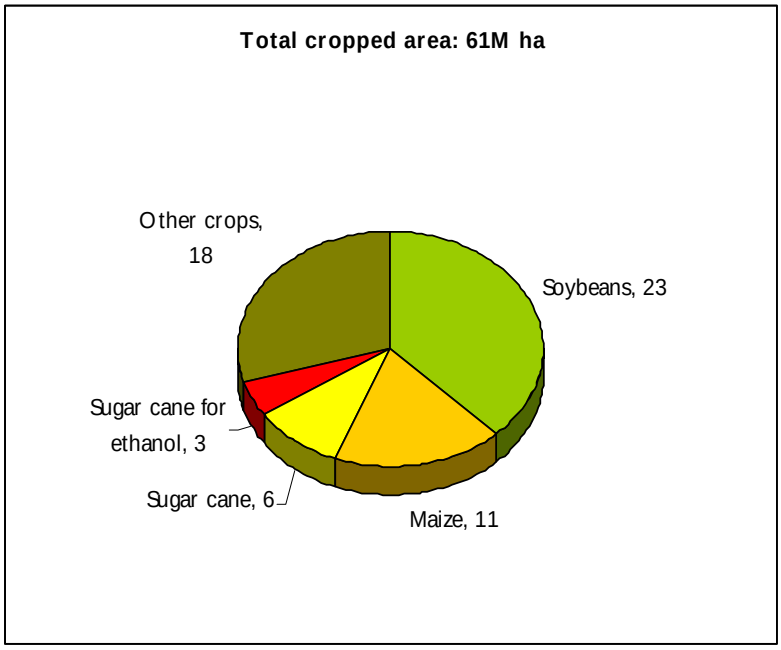
Brazil has 850M hectares (ha) of land, of which as much as 340M ha may potentially be arable. In 2007, 61M ha were under crops and 200M ha under pasture. Of the cropped area, around 10% was in sugar cane of which a little more than half was being used to make ethanol.

The land used to grow cane is located in the Centre-South and North-East, far from the Amazon forests. Plans to expand sugar cane farms to 10M ha in the next ten years are expected to occupy land in the same areas, but this may well displace soy beans that may expand into the Cerrado and the fringes of the forests, and this in turn may push cattle ranches deeper into the forest, thus indirectly leading to clearance in both the Cerrado and the Amazon (Sawyer 2007).

That said, the areas under crops are small compared to those under pasture and forest. Between 1990 and 2005, the area under arable and permanent crops increased by 9M ha; yet the area under forest fell by 42M ha (FAOSTAT data)[2]. Clearly crop farming can only be a minor contributor to forest clearance.

[2] In 2005 the total area under forest was reported as 478M ha.

Figure 2: Crop land in Brazil, 2007



Source: ICONE 2007

Environmental impacts of biofuels

Biodiversity

Direct effects of sugarcane production on mammals, birds, amphibians and invertebrates are thought to be low to intermediate (Embrapa 2003, cited in Macedo 2005), although there are concerns over expansion of production into the Pantanal wetlands region and in Maranhão state, which includes areas of the Amazon rainforest. Sugarcane may be grown on steep slopes, in riparian areas or in wetlands, which can be important havens of biodiversity (Early & Early 2006).

Biodiversity is also reduced by the replacement of mixed farming systems by monoculture systems, which make up the majority of soy and cane farming systems (Sawyer 2008).

Water quantity and quality

Sugarcane crops in Brazil are mainly rainfed, but irrigation is increasing (Smeets et al. 2006). Processing of sugarcane and conversion to ethanol also use large quantities of water (Gabeira 2007, in Sawyer 2008), even if water efficiency is improving. (Dufey 2007; Worldwatch 2006).

Pollution occurs through both organic pollutants from ethanol production and agrochemicals from sugarcane production. Vinasse — the organic residue from the distillation of cane syrup — has high biological and chemical oxygen demand, and can lead to eutrophication of rivers, resulting in fish kills during each harvest. This is particularly the case in the North East where pumping and the costs of land for storage and treatment are prohibitive. Legislation has been passed to mitigate these negative impacts, but there are concerns that the legislation and its enforcement are weak (Faaij 2006).

Sugarcane uses fewer pesticides than crops such as corn, coffee and soybean and similar levels of herbicides to soya beans (Macedo 2005). Mineral fertiliser use is also low because of the use of vinasse as an agri-fertiliser.

Soil quality and erosion

Soil loss rates from cane fuel at 12.4 ton/ha are less than those from other crops such as maize and soy beans at 24.5 ton/ha (Donzelli 2005). Irrigation and the application of vinasse as an agri-fertiliser can increase soil loss, as well as lead to leaching of nutrients and agrochemical residues from the soil, exacerbating water pollution and reducing soil fertility.

Intensive harvesting can compact the soil — affecting structure, biodiversity, and leading to water-logging, deplete soil nutrients and organic matter, and affect capacity to retain water. Erosion is most severe after harvesting, so frequency of harvesting and replanting matter as well (Worldwatch 2006). Most cane farmers now use no-till practices, which reduce erosion and improve soil quality, but can increase weed pressure resulting in trade-offs with a higher use of herbicides.

Greenhouse gas emissions

Greenhouse gas (GHG) emissions from biofuel production result from and from land use. Commercial Brazilian ethanol has a better GHG balance and energy balance compared to fossil fuels or other biofuels. The IEA (2004) estimates that these are 92% lower than emissions from standard fuels, partly owing to efficiency in production in which the waste bagasse is used to supply energy for bioethanol, sugar and other industrial processes.

The CO_2 savings for Soya Oil in Brazil are about 32% compared to fossil fuels. Transportation of soybeans to processing plants, however, has a large effect on GHG emissions balances. The greater distances soybeans travel prior to conversion results in GHG savings of approximately half the value of soy derived biodiesel from the US (Greenergy 2007).

Much depends on land use change, and especially conversion of forest: these account for 75% of national GHG emissions (Macedo 2005); deforestation of one hectare of tropical forest may cause emission of 900 tonnes CO_2 (IPCC, 1996).

Food security

Although Brazil is a middle income country, wealth is highly unequally distributed — the Gini coefficient[3] stands at 0.57, one of the highest in the world — and many Brazilians are poor and undernourished. The proportion of the total population currently under nourished has been estimated at 13M, that is around 7% of the total population of 187M. The food insecure form part of the estimated 35M poor in Brazil,[4] 23% of the population, half of whom live in rural areas, and 60% of whom are concentrated in the North-East.

Does the production of biofuels make poverty and hunger worse or better? By using land to grow cane for ethanol, biofuels could push up food prices.[5] But there is no evidence that food prices have increased more than the general price level since the mid-1990s. Currently they are

[3] The Gini-coeffient is obtained by dividing the area between the Lorenz curve of the income distribution and the uniform (perfect) distribution line by the area under the uniform distribution line. It is expressed as a value between 0 and 1 where 0 corresponds to perfect income equality.

[4] By national poverty lines: the World Bank reckons that 33% of the population live on less than US$1 a day.

[5] But then again, there is no evidence that land saved from producing cane for ethanol would be used to grow food crops.

rising fast, but that is related to the general rise in world commodity prices and not to domestic ethanol production.

If there is hunger in Brazil it arises from distribution, not shortage: the FAO reports that in 2003 the food balance was equivalent to more than 3,100 Kcal a day for every person in the country — far and above the minimum amounts needed to assure nutrition (c 2,300 Kcal).
Furthermore, as many as 800,000 people are employed in the sugar and ethanol sector, with full legal entitlements and increasing formalisation of employment. Salaries paid to those working in the sugar industry and ethanol sector are also higher than the average in the Brazilian agricultural sector.

Although it is difficult to know what would happen to food prices and employment in the absence of the biofuel industry, on the evidence collected here it is hard to argue that biofuels cause hunger.

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Appendix: Useful Links

Agência Nacional do Petróleo, Gás Natural e Biocombustíveis ***(ANP)***
http://www.anp.gov.br/

Brazilian Agricultural Research Corporation, EMBRAPA — http://www.embrapa.br/english

Brazilian Reference Centre on Biomass — http://www.cenbio.org.br/in/index.html

Brazilian Institute of Geography & Statistics, IBGE — http://www.ibge.gov.br/english/

Unica – the São Paulo Sugar Cane Agroindustry Union —
http://www.portalunica.com.br/portalunicaenglish/index.php