16

An IPC Issue Brief
October 2005

Specific Environmental Effects of Trade Liberalization: Oilseeds

BY JANE EARLEY, THOMAS EARLEY AND MATTHEW STRAUB

EXECUTIVE SUMMARY

This study analyzes how trade policy changes brought about by the Doha Development Round in the World Trade Organization will affect the environment in countries producing oilseeds, and how these effects might be addressed in advance by policymakers in these countries.

The study describes the WTO negotiation's likely results and its effects on production and trade in soy, palm oil and rapeseed, the major oilseed commodities. It also assesses the effects of biodiesel policies. It describes the major trade and environmental policies at work in the producing countries, and assesses the likelihood of change to national environments should Doha results occur. Finally, it distills and presents the basic conclusions resulting from the analysis in visual form in a matrix relating the trade policy changes to the possible environmental ones.

In the broadest sense, the study concludes that by and large the Doha policy changes will be welcomed in most oilseed producing countries, but will be overshadowed by the more sweeping oilseed market trends that are already underway. Underlying growth in the sector is already strong in comparison to other major crops, and one important new trend is the use of rapeseed, soy and palm oils for biodiesel production. In fact, it becomes clear from the analysis that the impact of the Doha Development Round on oilseed production, consumption and trade will be far less than either long-term demand or biodiesel policies.

The oilseed sector will also continue to be an important driver for environmental changes taking place in palm oil and soy producing countries, particularly those where good management practices and environmental law enforcement ability are challenged by the rapid pace of development spurred by high oilseed prices. These trends, while perhaps enhanced by Doha results, did not begin with them. Instead, Doha-related policy changes could provide producing countries with an opportunity to revisit development policies to benefit both their continued ability to supply world markets and to serve environmental goals with a minimum of further disruption to challenged eco- and social systems. This study provides a useful tool for national policy-makers to evaluate the environmental effects of their decisions as they confront the challenges ahead.

Work on this paper was supported by the UN Foundation.

International
Food & Agricultural Trade
Policy Council

1616 P Street NW, Suite 100 Washington, DC 20036 / USA / TEL 1 202 328 5056 / FAX 1 202 328 5133 / www.agritrade.org
10 rue Berckmans / B-1060 Brussels / Belgium / TEL 32 2 534 9036 / FAX 32 2 534 9882

SECTION 1: INTRODUCTION

This paper assesses the environmental impacts of the WTO Doha Development Round negotiations on agriculture in oilseed-producing countries, and of accompanying shifts in production of oilseed biomass for biodiesel. The oilseeds sector is a particularly inviting one for this purpose, since much work has been done to document historic patterns of supply and demand, and the future growth pattern in this sector is well-known to industry participants.

The sector is comprised of a number of products, but the most important are soybeans, palm fruit, and rapeseed (or canola), which must be processed before the products can be used for animal, human or industrial use. The sector is complex, due to its joint products and the competing oil derived from oilseeds (hereafter referred to as "oil") and protein sources arising from other agricultural sectors and commodity processing industries. Oilseed production and processing occurs all over the world, but important producing and processing countries are the United States, Brazil, Argentina and China for soybeans; Indonesia and Malaysia for palm oil; and China, the European Union and Canada for rapeseed. This study focuses on a subset of those countries. (A fourth major oilseed, sunflower seed, has not been included here because production is more geographically diverse, with no country accounting for more than 15% of world output).

By assimilating and interpreting available records and literature on oilseed trade and its environmental impacts in each of the targeted countries, this study attempts to separate some of the underlying causal effects of associated domestic and international policies. The goal of the analysis is to develop a comprehensive matrix that itemizes and evaluates each of the main effects. Due to some degree of uncertainty regarding both the range of potential responses to changes in the world oilseed economy and the results of the Doha Round of WTO negotiations, the analysis was based on assumptions about the results of trade negotiations and trends in the oilseeds sector.

SECTION 2: ASSUMPTIONS

For the purposes of this study we have focused exclusively on the agriculture negotiations, in which WTO members are engaged in three areas:

- Reduction of domestic supports linked to production
- Elimination of export subsidies, and
- Increased market access

We have assumed a 50% reduction in bound tariffs. Amber box support reduction commitments could reach to 60% of bound levels within the next five years and 80% thereafter from bound levels. The blue box will probably include the US countercyclical payments and some EU payments, but would be capped at 5% of the value of production. Negotiators could agree to reduce the *de minimis* provision from 5% to 2.5%, and will likely subject the sum of amber box, blue box, and *de mimimis* to a cap on total domestic support. Observers expect the agreement to eliminate export subsidies by 2015 and also to discipline export credits and state trading enterprises.

We assume that China and India, two of the major oilseed producing and consuming countries, will benefit from special and differential treatment provisions that will limit the degree to which they must adjust support to agriculture and reduce trade barriers.

SECTION 3: THE OILSEED SECTOR

There is a diverse array of products involved in or competing with the oilseed sector. There are seven major oilseeds: soybeans, rapeseed (canola), cottonseed, peanuts (groundnuts), sunflower seed, copra (from coconuts) and palm kernel. From the perspective of international trade, a handful of commodities and countries dominate. In fact, soy, palm and their derivatives account for 85% of all oilseed sector export volume (Table 1). Today soy and palm account for 63% of world vegetable oil production, while soybean meal alone accounts for two-thirds of world protein meal production.

Table 1: Key World Oilseed Producers and Exporters

Key World Oilseed Statistics
(2002/03 – 2004/05 Average)

Commodity	**Production**	**Exports**
	million metric tons	
Oilseeds		
Soybeans	205	60
United States	76	27
Brazil	56	21
Argentina	33	8
China	17	-20
Rapeseed	38	5
EU-25	12	<1
China	11	<-1
Canada	6	3
Other oilseeds	109	5
Total	352	70
Oilseed meals		
Soybean meal	133	45
United States	34	5
Brazil	23	15
Argentina	20	19
China	21	1
Other oilseed meals	60	12
Total	193	57
Vegetable oils		
Palm oil	29	21
Malaysia	14	12
Indonesia	11	7
Soybean oil	29	9
Other oils	43	8
Total	101	38

Source: Foreign Agricultural Service, USDA

With the proliferation of bilateral and regional free trade agreements, tariff levels can be quite variable. With the exception of China and India, tariffs are quite modest in this sector (Table 2). Complicated and less transparent systems in India and high out-of-quota tariffs in China are expected to remain following the Doha Round under Special and Differential Treatment for developing countries. Relatively low tariff barriers mean that any reduction will have relatively small effects on the location and scale of production or on trade flows. Several studies point in this direction. A study by Promar International for the United Soybean Board concluded that a 50% reduction in remaining trade barriers would result in only a 0.4% increase in world oilseed production and use.[1] A study by Agriculture and Agri-Food Canada came to virtually the same conclusions: world oilseed production would increase 0.2% and prices would rise by 2.1%.[2] Both studies found the greatest effects to be on the oil side, with increases in vegetable oil trade and a strengthening of oil prices relative to meal.

Table 2: Applied Tariffs on Selected Products

	Soybeans	Soybean Meal	Soy Oil, Crude	Soy Oil, Refined	Palm Oil, Crude	Palm Oil, Refined
	------------------------percent------------------------					
Brazil	8	6	10	10-12	10	10
Canada	0	0	4.5	9.5	0	0
China	3	5	9-30.7	9-30.7	9-19.9	9-19.9
EU	0	0	3.2-6.4	5.1-9.6	3.8	5.1-12.8
India	30	15-30	45+	45+	80+	90+
Indonesia	0	0	0	5	0	0
Malaysia	0	0	5	5	0	5
United States	0	~2.5	19.1	19.1	0	0

A 2001, The United States Department of Agriculture (USDA) study examined the production and trade implications of full trade liberalization.[3] For the oilseed sector, it concluded that complete elimination of all agricultural supports and protections worldwide would increase total world production of oil and oilseeds 0.7%. Output would decline 5.3% in developed countries and rise 4.8% in developing countries. World trade volume would go up 11.4%

A separate USDA study that year, using a different model, looked specifically at the oilseed sector and the implications of eliminating all import duties and export taxes – the so-called "zero-for-zero" option.[4] It found that oilseed output would rise by 0.4 – 1.8% in major exporting countries, and that Malaysian palm oil output would rise 4.1%. (Strangely, Indonesian palm oil output was unaffected.) Again, trade in oils would increase more than trade in oilseeds or oilseed meals.

More recently, the Food and Agriculture Organization (FAO) analyzed two different levels of ambition in the Doha Round – one roughly similar to the Uruguay Round cuts, and one with bigger Swiss formula tariff cuts, a 50% expansion in tariff rate quotas (TRQs) and an 80% cut in domestic support.[5] Impacts on oilseeds under the first scenario are limited: trade expansion of 1% for oilseeds and 6% for oils, with price increases of 4.2% and 3.2%, respectively. (Production volume effects were not reported.) The second scenario resulted in a 3% gain in oilseed trade, an 18% gain in oil trade, and price increases of 10% and 8%, respectively. Because the major markets for oilseed meal (dairy, meat) are highly distorted, the study could not predict the potential for liberalization in that sector.

These aggregate changes are similar in magnitude to changes that are occurring already on an annual basis due to rising global demand. For example, world consumption of vegetable oils has grown at an average annual rate of 4.4% since 2000/01, and 4.6% over the past decade. Consumption of oilseed meals has grown at a 3.4% rate since 2000/01, and 4.8% over the decade. In addition, the oilseeds sector is changing rapidly even without changes brought about by multilateral trade agreements. The geography of oilseed production has been shifting in the last decade to South America and Asia. Demand has been shifting as well, changing focus from Europe to Asia. Thus distinguishing the output effects of trade liberalization from those related to the ongoing rapid growth in demand and shifts in supply sources is a challenging task.

3.1 Soybeans

Soybeans and soybean oil are consumed worldwide, but six countries account for about 95% of world soybean production: United States, Brazil, Argentina, China, India, and Paraguay. Production in India and China is almost entirely for domestic consumption, and the remaining four countries account for essentially all exports of soybeans and soybean oil, which accounts for 30% of global production. As a result of cost competitiveness and the tremendous potential for growth in output, the production and processing of soy for export has been rapidly shifting from North to South America. Low land costs and the devaluations of the Argentine and Brazilian currencies have contributed to the large production cost advantage of South American producers compared to North American soy producers.

Since 1996 the US government has increasingly supported its soybean sector through subsidies meant to serve as a financial safety net for producers. These subsidies, which include export assistance, have affected global prices of soy and are believed by some to have contributed to the chronic depression of vegetable oil prices in recent years.[6] And, while tariffs have been relatively low in the soy sector, non-tariff barriers have become more controversial with regards to state trading enterprises and labeling requirements for genetically modified products. The controversy over the use and acceptability of biotechnology has had major ramifications for trade in oilseeds and oil-containing products. Mandatory traceability and labeling regulations by the EU have accounted in part for some of Brazil's increased exports to the EU and for the EU's increase in palm oil imports.

Europe and Asia are the world's largest importers of soybean, either in their raw form or as processed oil and meal products. Because most soybeans are crushed to yield about 80% meal and 20% oil, the soy export market is driven primarily by the demand for meal and less by that for oil. The meal is very high in protein, and a valuable additive for animal feeds. Demand for soybeans has increased by 64% in the past ten years, but change has been most dramatic in China and India where meat and vegetable oil consumption are expanding rapidly. These two countries now account for about one-third of world soybean oil use and the United States for a quarter (Table 3).

Table 3: Soybean Oil Use

	1,000 metric tons				
	1994/95	1999/00	2004/05	10-year growth (percent)	2004/05 share (percent)
United States	5,857	7,283	7,847	34	25
China	2,502	3,024	7,566	202	24
Brazil	2,456	2,937	3,009	23	9
India	555	1,582	2,450	341	8
EU-25	5,172	1,639	2,071	-5	7
Iran	371	624	898	142	3
Mexico	445	791	860	93	3
Japan	678	684	736	9	2
Other	4,424	5,566	6,388	44	20
Total	**19,460**	**24,130**	**31,825**	**64**	**100**

Source: Foreign Agricultural Service, USDA

Environmental Impacts

The major oilseeds are typically grown by farmers who also grow grains and other field crops. Soybeans are a row crop, with mechanized planting in the US in rows about a half-meter wide and seeds about 5 centimeters apart. Planting methods have included closer cropping methods in Brazil and other countries where climatic conditions differ. In most areas, cultivation, fertilizer and pesticide application, and harvesting are mechanized. While soybeans in temperate regions are typically rotated with corn or other crops on an annual basis, they can be rotated biannually in tropical regions where two crops can be produced in one year.

Environmental concerns associated with soy production are generally the same as for other mono-cultured oilseed crops. They include chemical application, soil and water contamination, monocrop expansion into environmentally sensitive areas, leading to loss of wildlife habitat and soil degradation, and genetic modifications that could promote superweeds or other environmental problems.

The use of fertilizers and crop protection chemicals in soy crops is low compared to other field crops, and differs with respect to the kind of cultivation used (tilling vs. no-till) and region of growth (temperate vs. tropical).[7] No-till methods, also called conservation tillage or direct planting, are generally environmentally preferable because they leave more organic matter on the soil surface, reduce erosion and runoff, reduce machinery use and lower the costs of production.

Biotechnology has encouraged no-till farming and soybeans have been one of its prime beneficiaries. Herbicide-resistant soybeans can be planted directly into the ground without tillage of the soil and then sprayed with herbicides, leaving the edible bean plants intact. This reduced input costs for farmers, who do not need to apply the volume and variety of herbicides used with conventionally planted non-resistant varieties. It has also reduced soil erosion and improved soil and water quality. No-till planting methods can also be used with conventional (non-GM) crops in some regions.

The processing of soybeans can also have impacts on the environment – those associated with processing in general and with chemical refineries in particular. These include effluent, energy use, and air pollution, and are associated both with the refining process and transportation. Crushing has relatively small impacts in developed countries where wastewater is typically treated in municipal water treatment systems, but wastewater loadings may be an environmental issue in developing countries. Solvent extraction of soybean oil from the flakes can result in atmospheric emissions of hexane.

Social problems posed by soy culture and processing in developing countries are generally similar to those encountered in many other agricultural development enterprises. They can include exploitation of workers and disruption of indigenous communities, exposure to health hazards caused by agricultural chemicals and machinery, and unsafe working conditions. The scale of soybean production can also exacerbate the rural-urban transition as displaced workers (from small landholdings) cease production and head to cities for employment.

The industry structure in the soy value chain differs from country to country, but in most countries large farms, or cooperatives or small farms unified by efficient transport schemes, can best produce soy to the economies of scale that now characterize the industry. The soybean trade in, transport to, and ownership of crushing facilities, is concentrated in a few large multinationals. Cargill, Bunge, ADM, Louis Dreyfus and Glencore account for more than 75% of global crushing and are highly competitive in all major markets. The multinational compound feed industry, which further processes soy meal for animal feed, is regionally based while refined soy oil for food use is divided between global players and family-owned refining and bottling companies. [8]

In Latin America, soy producers are often financed by crushers who can also provide social benefits that might not otherwise be locally available. The industry also has access to credit from large commercial banks and has used highly developed risk management practices. Rapid price increases in soybeans have yielded new sources of credit availability in many countries.

3.2 Palm industry

Within the oilseed sector, consumption of palm oil has been growing faster than that of soy or rapeseed, primarily because of its lower cost of production. No other oil comes close in terms of growth rate. In addition to low production cost, palm oil is also used as a primary oil in geographical areas where population growth and economic development are rapid (India and China), and it has partially supplanted soy oil in Europe due to the region's opposition to genetic modification of soy.

Palm oil is semi-solid naturally and does not require hydrogenation. It can be separated into liquid and solid fractions, referred to respectively as olein and stearin, and either of these can be traded in their crude or refined forms, as can the oil from palm kernels, the seeds within the palm fruit.

Malaysia and Indonesia account for about 85% of all palm oil production, and most of this is destined for export (though more so in Malaysia (90%) than Indonesia (53%)). Indonesia is expected to overtake Malaysia as the world's largest producer of palm oil between 2012 and 2015, yet its concerns for and commitments to self-sufficiency in domestic oil consumption (mainly for cooking) will ensure a long-term lag in export volume relative to Malaysia. Nigeria is also a large producer with 30% of the world's total plantation area, but normally its entire output is consumed domestically. Expansion of palm oil production has begun in some parts of Africa and Latin America but has not yet reached levels competitive with Southeast Asia.

Most palm oil production is exported and therefore producers are highly exposed to world market prices. Because there are a number of substitutes for palm oil, the market is highly competitive. Markets for byproducts of other oilseeds also influence this market. The main market driver for soybean demand, for example, is soy meal, used primarily for animal feed. Thus, price changes in the feed industry send strong signals to the palm oil industry due to a high cross price elasticity (high prices for animal feed encourage greater production of soy meal and soy oil regardless of oil prices.) The energy market is also taking great interest in the potential for alternative fuels, namely biodiesel and ethanol, implying that oil palm producers may be more directly affected by energy prices, specifically petroleum prices, in coming years.

The majority of palm oil trade is within Asia. Exports from Malaysia and Indonesia are particularly large to India (18% of world imports), China (12%), and Pakistan (17%). The EU also draws heavily on palm oil imports and now accounts for 17% of world imports. Malaysia and Indonesia are expected to gain from trade liberalization initiatives, given their dominance as exporters on the world market. Reductions in oil import tariffs in importing countries would make palm oil cheaper to consumers in those countries and increase demand in the international market.

India, the world's largest importer of vegetable oils and the single largest buyer of palm oils produced by Malaysia and Indonesia, imposes high bound (maximum) tariffs of 300% on most edible oils. The major exception, soybean oil, is subject to bound tariffs of 45%, which has boosted soybean oil imports over palm oil. Palm oil has had to be sold at a discount in order to remain competitive in a highly price sensitive environment and Malaysia has been calling for a more coherent policy in India. Exporters would benefit greatly if India reduced its palm oil tariff ceiling.

In the European Union, palm oil consumption has increased by 140% since 1994/95 to 13% of global usage. Yet the EU has maintained a disparity between tariffs on crude palm oil and those on refined and processed products coming from Malaysia and Indonesia. The EU also continues to offer preferential access to several palm oil producing countries, including Papua New Guinea, Ivory Coast, Nigeria, Ecuador, and Colombia (Table 4).

Table 4: EU Import Tariffs for palm oil products (in %)

Product/Country	Indonesia Malaysia	Papua New Guinea, Ivory Coast, Nigeria, Ecuador, Colombia	Thailand, Brazil
Crude palm oil	3.8%	0.0%	0.0%
Refined palm oil	9.0%	0.0%	3.1%
Stearin	10.9%	0.0%	3.8%

Environmental Impacts

Oil palms are large trees, typically planted in grids on plantations that range from 4 to 729 square kilometers.[9] Creating plantations requires removal of standing vegetation by cutting, mechanical clearing or burning. Grids are often planted with little regard to topography, which sometimes results in planting on steep slopes. Land is prepared for planting by mechanically weeding or treating with herbicides. The trees start to flower in 2-3 years and can produce for as many as 50 years, but new propagation methods are decreasing the time from seedling to maturity and enhancing production, while reducing net life-span. Peak production of most areas planted now is from 8 to 30-year-old trees.

Fertilizer is important to maintain production, and input costs can range from 40 to 60% of total maintenance costs. However, new techniques, such as underplanting of nitrogenous crops, can reduce the need for fertilizer. Until the canopy closes and shuts off light, cash crops can also be planted.

Establishing new palm oil plantations requires significant capital investment, first for the processing facility, second for enough land planted to oil palms to service it, and third for the money tied up in the plantations until they start to produce. Mills typically require at least 10,000 hectares of productive land to be viable. This often creates a symbiotic relationship between large and small producers, in which smaller producers surround large-scale producers that typically invest in crushing mills in order to meet their processing needs. This has been changing with the emergence of smaller and more mobile processing mechanisms. In Malaysia and Indonesia, oil palm plantations are typically established on converted forest land or converted rubber plantations. These occupy a large part of peninsular Malaysia and are increasing in Indonesia due to Malaysian and Chinese foreign investment.

The environmental consequences of producing palm oil have been considered as the loss of environmentally sensitive forest habitat. The growth of the palm oil sector continues to have significant impacts on forest resources in high value tropical forests. Clearing the land for palm oil plantations often involves illegal burning, and policies in some areas have provided perverse incentives for deforestation, rather than replanting abandoned agricultural land.

Recently, producers and some important end users have come together to discuss a set of best practices and quality assurance guidelines that could govern both production and purchasing decisions. In an initial “Roundtable on Sustainable Palm Oil”[10], some specific environmental concerns were identified. These include:

- Forest conversion
- Fire from land clearing, causing extensive air pollution and haze
- Planting considerations (on steep slopes, which are prone to erosion, and on peat soils, which are difficult to cultivate sustainably)
- Biodiversity on forest plantations, which is lower than that of native habitats
- Agronomy and mill management, and
- Lack of enforcement of environmental laws, specifically those outlawing burning of forests to clear land.

3.3 Rapeseed

In general, rapeseed oil is used for industrial purposes because of its toxicity. For human consumption it must be altered to a higher-value oil and protein crop known as canola. Canola meal can be fed to livestock, while use of rapeseed meal as feed is limited to cattle because of its glucosinolate content.[11] Very little rapeseed or canola oil enters world trade, so consumption tends to be concentrated in the countries where the crop is grown. In Europe, the biodiesel market has become one of the main drivers of the rapeseed market, consuming about one third of EU-25 rapeseed oil production. Approximately 80% of biodiesel production comes from rapeseed oil.

Rapeseed and canola are prolific cross-pollinators, and much care is taken to strictly separate food and industrial varieties. Work in Europe on the environmental effects of rapeseed production has focused on the effect of increased production in sequestering carbon emissions.

Like other row crops, the purely environmental effects of rapeseed cultivation are generally acknowledged to include loss of biodiversity due to cultivation, soil degradation and effects of fertilizer and crop protection chemical use. There are several ways to minimize these effects including:

- Minimizing the amount of set-aside land used for rapeseed (biofuels) to maintain biodiversity and encourage natural land regeneration,
- Minimizing the use of artificial fertilizers for biofuels to reduce nitrous oxide produced through excess fertilizer decomposition,
- Using low levels of herbicides and pesticides to keep weeds and pests within acceptable limits, rather than eradicating them completely,
- Interspersing rapeseed cultivated areas with other crops and sowing different parts of the crop for harvesting in different seasons, and
- Retaining uncultivated buffers around rapeseed areas, such as at field edges or around watercourses to maintain plant biodiversity and promote natural regeneration of the land after cultivation.[12]

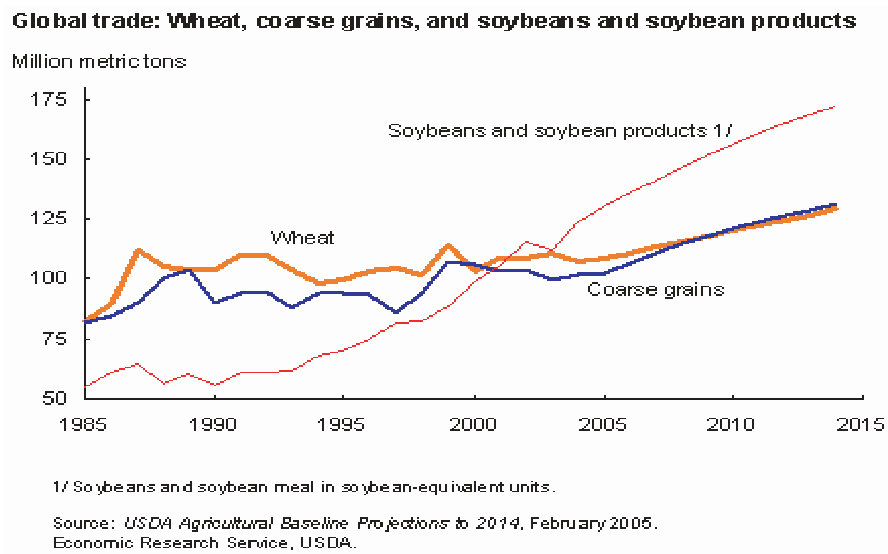
SECTION 4: MAJOR CHANGES TO THE SECTOR

4.1 Underlying growth

Over the last decade world demand for protein meal and vegetable oil grew at annual rates of 3.7% and 4.4%, respectively, according to USDA figures. Oilseed production grows at about the rate of meal demand but obviously varies from year to year due to weather. Looking ahead, a conservative forecast based on past trends might cut these growth rates by a fifth to 3.0% and 3.6% respectively on the theory that the most dramatic impact of China's economic changes is past. That still leaves 6-7 million tons of additional protein meal per year, and 4 million tons of additional vegetable oil per year.

USDA's February 2005 Long-term Baseline projections do not include numbers for total oilseed sector demand growth, but they do include a trade forecast for soybeans and the soybean-equivalent of soybean meal that implies continued strong growth in world demand, as indicated in a chart reproduced as Figure 1 below. (USDA did not publish a projection of soybean oil trade.)

Figure 1:



To produce an extra 6-7 million tons of protein meal each year requires about 10 million tons of oilseeds, and soybeans have typically been about 60% of the total. For oil production and use to grow faster than meal demand, production of palm oil or high oil content seeds like rapeseed and sunflowerseed needs to grow faster than soybean production. Historically it has been palm oil that has shown the fast growth.

Some growth in oilseed output has come from the upward trend in yields, which have grown at 1.2-1.8% per year depending on the oilseed. But growth in demand has been so much more rapid than for other major field crops that planted area has also had to increase. This new acreage is partly due to shifts from other crops and partly to bringing new land into production. Oil World estimates that in the 20 years ending in 2002/03, harvested oilseed area rose by an average of 2.75 million hectares per year.[13] In the following two seasons it rose an average of 10 million hectares per year, far above the historic average rate. For 2005/06, world oilseed area harvested is estimated to be essentially unchanged from a year earlier.

4.2 Biodiesel production

Rising demands for renewable energy must be factored into any discussion of the future of the oilseed sector. During the last quarter of the 20th century, there have been two separate renewable energy initiatives for biofuels. Fuel ethanol has gained a foothold in both the United States and Brazil either blended with gasoline or used as a straight automotive fuel. In the United States the raw material for ethanol production is primarily corn while in Brazil it is sugarcane, and both countries have developed significant production capacity for their respective crops through government support. In Europe, where diesel powered cars are more popular, biodiesel has gained wider acceptance. Europe's demand for biodiesel has been a driving factor in its support for rapeseed production.

In practical terms, the three oils of interest for biodiesel are soy, palm and rape, either because they are cheap or because they are produced in the countries that can afford to subsidize these more expensive fuels. In recent years a number of countries outside of Europe have been supporting research and development programs to find new end-uses for specific oilseeds and derived products. The regular provision of subsidies and/or tax breaks to refiners has been necessary to guarantee the economic viability of bio-diesel production from oil crops, although the fuel price increases that have occurred in 2005 may obviate that need.

The future demand for biodiesel has the potential for reshaping the dynamics of the oilseed industry, with a greater emphasis on vegetable oil as an industry driver. Because of commitments to reduce greenhouse gas emissions under the Kyoto Protocol, and a desire to reduce dependence on imported fossil fuels, several countries have adopted ambitious renewable fuel strategies. Subsidies and tax credits applied to alternative fuels will likely fall into the Green Box category of policy tools under the WTO, in which case they would not be subject to substantial reform. As the price of petroleum rises, the EU in particular will begin to look beyond their limited stocks of oilseeds and other field crops to satisfy growing demand.

The European Union's Biofuels Directive set targets for a minimum share of transport fuels for biofuels: rising from 2% in 2005 to 5.75% by 2010. A subsequent directive in 2004 encouraged the development of a biodiesel industry by allowing member states to "de-tax" (or reduce taxes on) fuels from renewable sources. In early 2004, Rabobank forecast biodiesel consumption at around 4-6 million tons by 2010 in the EU-25. Subsequent world oil price developments suggest the upper end of that range is more likely. In addition to being used to produce biodiesel, vegetable oils are also being blended directly with petrodiesel, used in home heating systems, and burned to produce "green electricity" in Europe.

As a result of its aggressive renewable fuels policy, the EU had total biodiesel production capacity of almost 2.4 million tons in 2004 according to the European Biodiesel Board (UFOP). Actual production in that year is estimated at 1.4 million tons, with Germany accounting for about 60% of the total. Biodiesel production in the EU will expand to a projected 6 million tons in 2010, with rapeseed oil the primary raw material, but with substantial quantities of imported palm and soybean oil being used as well.

The rapid expansion of the biodiesel sector in Europe means that rapeseed oil will be supplemented by soybean oil from the Western Hemisphere and palm oil from Malaysia and Indonesia, both of which can soon enter the equation. Soybean oil is in surplus in Europe because of consumer aversion to genetic modification. Palm oil's position as the world's cheapest oil puts it in a good position to capitalize on Europe's growing appetite for alternative fuels. Recognizing this, the Malaysian government has proposed a policy to promote the conversion of palm oil into biodiesel. Malaysia itself and Asia as a whole are also expected to use palm oil as energy policies and crude oil prices drive industries to favor the use of diesel blends.

There is also likely to be increased production in of rapeseed Europe. The renewable fuels policy has already increased rapeseed production in the EU even though support has been reduced under Common Agricultural Policy (CAP) reforms. Since current production for biodiesel constitutes approximately 2.7 million tons of the total oilseed production of 13.1 million tons, future increases could consume a substantial percentage of total oilseed production. For instance, French production of rapeseed is projected to more than double by 2007. This is ultimately projected to reduce demand for soybean meal, as rapeseed meal is substitutable in animal feed at a rate of 1.5 pounds to 1 pound of soybean meal.[14] Under the current CAP, the arable raw materials needed for biodiesel production may be grown on set-aside land, which would otherwise be taken out of production.[15]

The United States and Brazil are likely to be the next two largest biodiesel markets after Europe. In the United States, the Energy Policy Act of 2005 combines a renewed tax credit with a renewable fuels standard (RFS) to require a percentage of biodiesel in fuel. The bill is expected to expand the use of biodiesel to 7.5 billion gallons.[16] Biodiesel will be a more important factor for Brazil than for the United States because in addition to its domestic use, Brazil will be the main beneficiary of EU import demand for soy for biodiesel, in the form of either beans or oil. Canola oil from Canada may also contribute to this feedstock, since Canada's domestic demand for biodiesel is projected to be low.[17] Canada's Climate Change Action plan targets 500 million litres/year of capacity by 2010.

Malaysia and Indonesia are together expected to provide up to 20% of Europe's supply.[18] Table 5 provides rough estimates of the tonnage of biodiesel production in these countries in 2004 and 2010 (which will be approximately the quantity of vegetable oil required, keeping in mind that a small share of biodiesel is produced from recycled frying oils and animal fats like tallow).

Table 5: World Biodiesel Production (1,000 metric tons)

	2004	2010
European Union	1,400	6,000
United States	125	750
Brazil	25	750
Other	50	250
Total	**1,600**	**7,750**

Estimated world biodiesel production in 2010 is likely to be composed of 4.5 million tons of rapeseed oil, 1.9 million tons of soybean oil, 1.2 million tons of palm oil, and 150,000 tons of other oils. The expansion from 2004 levels will require 9.3 million tons of rapeseed (35% oil content), 9.2 million tons of soybeans (18% oil content) and 5.75 million tons of palm fruit bunches (20% oil content).

These are rough estimates based on secondary sources and are intended only to capture the order of magnitude of the change underway. Much will depend on how energy prices and the world economy evolve over the next few years, and on interactions within the sector, such as rapeseed meal displacing soybean meal.

The key conclusion, however, is that over the next six years, the growth in oil used for fuel will be a significant increment over the historic growth pattern. The growing demand for human consumption and industrial purposes will require an additional 4 million tons of oil production per year, or an extra 24 million tons of oil production over and above the 2004 base consumption of 105 million tons by 2010. Add to that the projected annual demand of 6 million tons of oil for biodiesel and the total requirement for 2010 amounts to about 135 million tons of oil. Meeting this demand will require a 29% increase in production.

4.3 Trade liberalization

Studies of the impact of trade liberalization on oilseeds reviewed in Section 4.1 pointed to rather modest impacts on total oilseed output. Taking the high end of the range, the Doha Round might expand world production by 1.5% over a number of years. By 2009/10 world oilseed production will be about 410 million tons in the absence of biodiesel expansion and trade liberalization. As noted above, biodiesel will require an additional 18.5 million tons of rapeseed and soybeans, or about 1.5 years of normal growth in production, plus 1 million tons of palm oil. Trade liberalization will have a considerably smaller effect – about 6 million tons of oilseeds plus something like 1.2 million tons of palm oil. The two together could push world oilseed production that year to 435 million tons and palm oil production to 42 million tons.

Cross-commodity effects between the soy and palm sectors will occur but it is difficult to separate those stemming from trade liberalization, biodiesel demand, and underlying trends in the sector. As discussed earlier, the high protein content soy sector and high oil content palm sector are already closely linked through the overall dynamics of food demand. Increased oil demand due to biodiesel and trade liberalization would tend to tilt the balance toward palm, and that trend could be strengthened by soy's liabilities: the negative perceptions of trans fatty acids and of biotechnology.

Another background factor adversely affecting soy is the competition for soybean meal in the United States from mid-protein by-products of fuel ethanol production, such as distillers dried grains and corn gluten feed. There are now about 10 million tons of these byproducts being produced annually that will expand considerably over the next few years. However, trade liberalization will enhance the demand for livestock products, and the derived demand for soybean meal and other feedstuffs.

In our subsequent analysis of environmental impacts, we assume that trade liberalization and biodiesel have the incremental resource requirements between now and late in the decade (Table 6).

Table 6: Additional Resource Requirements

	Production 1000 mt	Yield Mt/ha	Hectares 1000 ha
Soybeans			
Biodiesel	9,160	2.47	3,700
Trade liberalization	3,700	2.47	1,500
Rapeseed			
Biodiesel	9,300	1.75	5,315
Trade liberalization	725	1.75	415
Palm oil			
Biodiesel	1,150	3.60	320
Trade liberalization	1,200	3.60	335

4.4 Biotechnology

While some of the biotechnology debate is academic and hypothetical (particularly relating to the environmental effects of varieties yet to be developed and used), some of the positive environmental and economic effects resulting from using the new biotech-derived seeds are evident to producers, who have embraced the technology in most areas where it has been permitted. Successive studies have noted reduced use of pesticides[19] and reduced insect and pest damage,[20] and consequent reduced input costs for agrichemicals. No-till methods account for some of the general improvements in soil condition attributed to biotech crops (enhanced organic content, less erosion and chemical runoff and faster breakdown of herbicides and insecticides), but biotech varieties have also made no-till methods profitable (and therefore advantageous to farmers) in some areas where conventional varieties did not allow for this method of cultivation.[21]

Biotechnology has also permitted increases in yields that have been fairly well-documented.[22] Use of biotechnology-derived crops increased from 2003 to 2004 by 20%, amounting to 13.3 million hectares.[23] However, for countries whose production is export-oriented, biotech production is only economically beneficial if it can be exported. The

EU's regulations, particularly as they have been replicated elsewhere, may make biotech production for export less feasible for many countries.

SECTION 5: A MATRIX APPROACH

The purpose of the matrix approach is to derive the environmental sustainability implications of changes in scale and location of agricultural production that will accompany agricultural trade reform. It does so by illustrating in chart form the environmental repercussions of changes in agricultural production associated with the terms of international trade. In one dimension the matrix lists the relevant causal policy measures, and in the other the environmental indicators that show effect. This matrix approach originates from a paper; "Trade, Agriculture and the Environment" co-authored by John A. Dixon and M. Ann Tutwiler, and makes it possible to indicate the kinds of environmental problems that are likely to arise from explicitly distorting policy measures and the underlying (implicit) policy measures that may contribute to them.[24]

Our matrix, however, differs in some respects from the one used by Dixon and Tutwiler. In its treatment of implicit and explicit distortions the matrix includes,

- explicit domestic policy measures relating to biodiesel. We included this because of the great influence that biodiesel-related policies will have on growth of planting areas in the countries studied, and consequently on environmental indicators.
- a focus on the three major components of the Doha negotiations (market access, domestic support and export subsidies) because focusing on the "boxes" at this time would lack clarity in light of recent WTO Appellate Body rulings and the state of the negotiations.
- direct input subsidies in domestic support.
- the enforcement of environmental regulations/rule of law, which is treated as an implicit distortion rather than an explicit one, and considers undefined property rights.

The treatment of environmental effects,

- combines soil mining and erosion into a "soil erosion/quality" category,
- combines groundwater and surface water contamination into a "water quality" category,
- eliminates a category for "loss of other productive use" because good information sources are lacking, and
- creates a "social impacts" category to take into account not only deleterious human health impacts but also urban migration of rural populations, disruption of indigenous communities, general working conditions and job creation,

A brief description of each category in the matrix follows, together with the question that each poses for oilseed production vis-à-vis the environment of each country.

5.1 Columns - Policy Measures, Explicit and Implicit Distortions

5.1.1 Biodiesel

For reasons that should be obvious at this point, biodiesel has been included as an explicit policy distortion because its development is being driven primarily by government policies that either mandate or subsidize its use. Since the scale of biodiesel's impact is likely to be considerably larger than that of trade liberalization, it is important to keep this in mind as a background factor as one looks at the relative effects of the different components of trade liberalization or implicit distortions.

5.1.2 Market Access

Tariffs and Quotas

Both tariffs and quotas are being negotiated in the Doha Round. Because import tariffs and quotas are market distorting, high tariffs (and low quotas) impeding market access are potentially disruptive to environmental improvements unless they are associated with measures designed to compensate for environmental externalities not included in the prices of a product. In the agriculture context, high import duties are also associated with either protected or value-added products. Protecting production through high tariffs may promote environmentally disruptive production at the expense of market signals. Applying a higher duty for processed products than for unprocessed ones can encourage production of basic raw commodities at the expense of processed ones, which may save on the environmental costs associated with a heavily polluting processing industry but may also cause environmental degradation if it encourages the use of non-sustainable farming practices to maximize volume. As noted in Section 3, the Doha Round is expected to cut high tariffs more than low ones, thus reducing or eliminating tariff escalation, but developing countries will receive special and differential treatment that will most likely result in longer phase-out periods for tariffs and end rates of less than zero. "Sensitive" products may also remain protected. Rates in the oilseed sector are already rather low in comparison to other agricultural commodities, but there is a great gap in some countries between bound and applied rates.

Non-tariff barriers

Non-tariff barriers are relevant to production of all agricultural commodities. In the oilseeds sector, such barriers include traceability and labeling for commodities derived from modern biotechnology, sanitary and phytosanitory (SPS) requirements relating to plant pests and diseases such as soybean rust (US) and government-mandated requirements such as import certificates (China). The SPS and technical barriers to trade (TBT) texts are not expected to be negotiated in the Doha Round, but there may be increased levels of technical assistance given to developing countries in this area. Of the countries studied in this paper, only Indonesia would be expected to qualify. Non-tariff barriers negotiated in Doha will not likely affect the oilseeds sector. Although biotechnology-relevant issues will be dealt with there, it is unlikely that resolving them would lead to greater market access or affect production.

5.1.3 Domestic support measures

Domestic support measures linked to production (Amber Box) have been criticized as distorting price competition, limiting imports and creating oversupply, making exported commodities cheaper in the importing country than domestically produced ones. Supports not linked to production (Green Box) and production-limiting compensation (Blue Box) have also been criticized in the US and EU because of their continued high levels and implicit impact on trade.[25]

The United States and the European Union have maintained high levels of support for their farming sectors, of which the oilseed sector has been a primary beneficiary. The Doha Round is expected to substantially reduce Amber Box payments. Blue Box payments would likely be capped at 5% of the value of production. This would result in a relatively significant change for developed country oilseed producers and might shift production to other crops for which production-related payments are not likewise disciplined, in the absence of market signals to the contrary. Continued strong demand fueled by biodiesel and high prices, for example, could keep oilseeds competitive. Green Box compensation may also offset oilseed disciplines in other categories through support for biodiesel and may even increase production of oilseeds. Blue Box compensation can be harmful to the environment if it keeps marginal or environmentally sensitive land in production.

5.1.4 Export subsidies/taxes

Export subsidies can affect the environment through terms of scale, composition and changes in production technologies.[26] However, eliminating export subsidies is part of the Doha agenda because of their price effect. By subsidizing production in the exporting country, these subsidies reduce the price in the importing country, sometimes below the cost of production. They also increase the use of fixed factors of production, discourage agricultural diversification, result in over-grazing and the extension of farming to marginal land, and lead to intensive use of chemicals (fertilizer and pesticides). By suppressing world prices, they reduce farm incomes in non-subsidized countries and stifle poverty-alleviation efforts in many developing countries.[27] Export subsidies can also affect environmental conditions in a commodity-importing country when they are removed, by spurring rapid growth and investment that is environmentally damaging. Removing them can also cause the relative sizes of different sectors to change because they have insulated certain sectors from market signals. If polluting sectors grow when subsidies are removed, they can cause environmental damage. Removing subsidies can also contribute to changes in production methods that are less costly but more polluting. Export subsidies are expected by be eliminated by the Doha agreement by 2015, but the agreement will begin to rationalize production in response to market signals before then. Competitive producers will benefit, but if market signals act to increase productive capacity, this could be at the expense of the environment in sensitive areas unless corresponding policy measures act to discourage production there.

5.1.5 Externalities

This heading includes policy measures that are external to the cost of producing oilseeds, but highly relevant to national policies that affect the environment. These include, for the purpose of this study, enforcement of environmental regulations and well-defined property rights. Both can add to the cost and risk of production but are not directly included in the cost.

Relevant environmental regulations can include requirements to retire land because of soil erosion, air quality regulations pertaining to airborne dust, regulations prohibiting wetlands loss, requirements for water quality/ impairment from nutrients, regulations governing wildlife habitat loss, environmental liability regimes, etc. Obviously there is great opportunity for variations in enforcement of these regulations between countries, areas within countries, and kinds of producers. It can generally be assumed that environmental performance standards are lower where enforcement of environmental regulations is lax or nonexistent, but there may be exceptions for some areas where private certification schemes can effectively take the place of state intervention. Environmental enforcement is generally more effective with respect to processing industries than production of agricultural commodities.[28]

Undefined property rights and lack of environmental enforcement can also deter investment in a sector and ultimately lead to creation of environmental problems when land is abandoned or otherwise not used productively. It is well-accepted by economic and developmental experts that markets for environmental (and all other) goods fail to work well when property rights are undefined, are poorly defined or cost too much to enforce.[29] Property rights issues arise in the oilseeds sector in countries where agricultural expansion is taking place. As such, they are implicitly distorting and can lead either to an inability to use available resources or to uncontrolled exploitation unregulated by rule of law.

Non-pollution environmental externalities

In this paper, non-pollution externalities are the physical conditions in producing countries that have an effect on their ability to realize gains in terms of market access, etc., from trade reforms focused on agricultural production or processing. These include soil quality, existing biodiversity, and geographical conditions like access to ports. For example, a country may not be able to expand production to take advantage of increased market access if it has no land available. Conversely, it may be possible for producers to further exploit already-degraded, cheap and available land for quick gains enabled by new market access opportunities. Non-pollution spatial externalities like soil erosion and biodiversity loss are therefore implicitly distorting and can act as barriers or incentives to exports. The Doha agenda will not change any of these parameters, but a producing country's policy response to them will be influenced by the Doha results.

Pollution externalities

Like non-pollution spatial externalities, pollution externalities can act in some cases as barriers and in other cases as incentives to unregulated production and exports, depending on the terms of trade. Some examples of pollution externalities relevant to oilseeds production might include chemical residues in soil or water, air pollution caused by surface transportation or polluting processing facilities, or water pollution caused by fertilizer runoff. Policies relevant to pollution externalities might include becoming a signatory to environmental treaties or initiating programs to combat adverse environmental conditions.

5.2 Environmental effects

The rows of the matrix assess effects relative to a set of environmental indicators. Environmental indicators were much discussed in the 1990's. The OECD Ministers adopted a set of environmental indicators in May, 2001. Of the OECD indicators, which include a range of indicators from climate change to fishery resources, several are particularly relevant to environmental conditions prevailing in oilseed producing countries. These include soil erosion/organic content, groundwater contamination, loss of habitat/biodiversity resulting from forest conversion or improper land use, loss of other productive use, and deleterious human health impacts. As relevant as these basic indicators are, each will not be equally relevant to oilseed production in each producing country. The OECD indicators do not include soil health, for instance, which is a key component of sustainable agricultural production.

The World Bank and other development institutions have also used environmental indicators extensively in their evaluations of projects for environmental and social impacts. Most recently the 2005 Environmental Sustainability Index (ESI)[30] ranked countries on criteria that include overall environmental stewardship in several categories. They include not only soil, air and water quality and quantity, but also include environmental governance, reducing ecosystem and population stress, reducing transboundary environmental stress, and a number of other criteria. We include their rankings in the country sections where relevant. The study is interesting not only because it is exhaustive for a variety of indicators, each of which is based on multiple data sets, but also because it attempts to correlate them to both GDP and growth competitiveness, and because it illustrates the complexity and multi-dimensionality of environmental sustainability.

In comparison, this effort uses a much broader and simpler approach to arrive at results that are more indicative than they are definitive. It is based on work undertaken on environmental effects of agriculture, and focuses on:

- changes in land use (expressed here in terms of land area planted to oilseeds),
- air quality (intended to encompass air pollution/haze from forest conversion, particulate and other emissions from processing and harvesting activity, and gross emissions of greenhouse gasses from agriculture)
- water quality (to take in both the kinds of use and scarcity),
- soil factors (expressed as soil erosion and quality), pollution, intended here to capture effluents and the effects of chemical applications,
- loss of habitat and biodiversity, and
- social impacts, intended to reflect both disruption of rural communities and indigenous people, and jobs added to the rural economy.

SECTION 6: COUNTRY MATRIXES

United States, Brazil, Malaysia, Indonesia

Scoring the matrix for each country is challenging for a number of reasons. First, there is limited data on the quantitative linkages between soil, air and water quality and oilseed or palm production and processing, forcing a reliance on subjective assessments of varying degrees of “good” or “bad” in each national environment. Second, adjustments in a nation’s oilseed sector depend on the changes not only in its own policies but in policies in all other countries as well. The four countries profiled are among those expected to see increased demand placed on their oilseed sectors as a result of trade liberalization, and greater demand will probably place more adverse environmental pressure on their resource base. But the environmental impacts are due primarily to policy changes in other countries, not in the countries themselves. This points to the need to remediate, or adjust to these possible environmental impacts in terms of those domestic environmental and trade policies that affect the sector, many of which are detailed in the analysis.

Third, where total planted area cannot readily be expanded, as in the United States, the question becomes whether the environmental effects of soybeans are better or worse than those of competing crops like corn or cotton.

The exception is the last line of the table, land area planted to oilseeds or palm, which just indicates the relative magnitude of changes in the explicit or implicit distortions on planted area. These are generally positive, except in the United States where reductions in domestic support and export subsidies work to reduce planted area.

6.1 United States

The main benefit to the United States soybean sector of agricultural trade liberalization is likely to be some combination of higher market prices and more value added in processing, because the ability to expand planted area is somewhat constrained. The country does have about 15 million hectares idled through its Conservation Reserve Program, but changes resulting from biodiesel or the Doha Round will not be large enough to drive a change in that policy. However, that land is primarily in grass and could be brought back into production if market conditions warranted it. Overall, the combined effects of biodiesel and improved access to foreign markets to outweigh the negative effects on land used for soy of cuts in domestic and export subsidies. Table 7 scores the environmental impacts of oilseed trade liberalization and biodiesel.

Table 7: United States Matrix

	Explicit Distortions/Policy Measures					Implicit Distortions		
Environmental Effects	Bio-diesel	Market Access – Tariffs/ Quotas	Non-tariff Barriers	Domestic Support	Export Subsidies	Externalities (e.g., envtl. enforcement, defined property rights)	Non-pollution Externalities: environmental	Pollution Externalities
Soil Erosion/Quality								
Air Quality	+					-		
Water Quality	-	- -		+	+			-
Loss of Habitat/Biodiversity	-	-		+	+			
Social Impacts	+			-	-			

6.1.1 Economy and Trade

The US has aggressively pursued both bilateral and multilateral trade liberalization over the past three years. It has completed negotiations of over 20 Free Trade Agreements in the past few years, and helped to launch the Doha Development Round in 2001. It continues to support its 2002 proposal to set a goal of total elimination of trade-distorting agricultural subsidies and barriers to market access, but it is also preparing for a Farm Bill in 2007. This, together with recent WTO litigation will set the parameters for US adherence to the Doha results. At present, expectations that federal spending must be curbed to reduce the largest budget deficits in US history will frame the debate. Farm groups expect that growth in federal spending over the next decade will take place in health care, social security and higher interest payments on federal debt, leaving little flexibility for other domestic investments. They also expect that "More than ever before in American history, the provisions of the 2007 Farm Bill will be linked directly to global trade negotiations."[31] However, delay in concluding the negotiations will give farm groups defending present levels of spending more leverage in the farm bill process.

US domestic agricultural policies may have an important effect on world markets even if they are not directly targeted toward trade because of the size of the US market and its production capacity. The US and EU are together criticized by developing countries and others for the high levels of support in domestic farm policies that contribute to adverse effects on developing country agricultural production. The stakes in the 2007 farm bill and the Doha negotiation are therefore high.

Impact of the Cotton Case

US commodity export assistance program development and farm payments in general will be subject in the future to limitations articulated by the WTO Appellate Body in a recent WTO case brought by Brazil that challenged a number of export assistance programs for cotton.[32] The panel agreed with Brazil that some US export guarantee programs are, in effect, export subsidies. Some of the commodity-specific programs will be eliminated. Others will reflect changes in how their payments are classified under WTO rules.

In addition, the case sends a clear signal that US farm programs using countercyclical components are "under close scrutiny and likely to be unacceptable in the future."[33] The case will affect how US farm payments will be treated in the next farm bill. If the United States complies with the ruling, many programs will be changed or eliminated. If it does not comply it will eventually be liable to pay compensation under WTO rules, not only for cotton program payments but also for those to soybean producers.

Market Access

Most oilseed imports either enter the United States duty free or are subject to low tariffs; all tariffs except two are bound. Tariff escalation exists for some processed forms. The tariff on soybean oil is a comparatively high 19.1%, although its practical effects are muted by the duty-free status of competing oils such as canola oil from Canada or palm oil.

Trade liberalization will increase area planted to soybeans as a result of improved US access to other countries' markets. However, the US export assistance and support programs will be cut and this would tend to reduce impact on soybean production, provided all major US field crops are similarly affected. Thus the negative scores for market access impacts on water quality and biodiversity are partially offset by positive scores related to cuts in domestic and export subsidies.

The scale of the various impacts is limited because producing soybeans is more environmentally friendly than producing competing crops like corn or cotton, due to lower input use, nitrogen-fixing character, and prevalence of no-till methods. Soil quality is generally well maintained through conservation measures, so the main environmental concern in most US crop production areas is with the quality of surface and sub-surface water. Nevertheless, an important implicit distortion affecting air quality is US non-participation in the Kyoto Agreement.

Domestic Support

US domestic support for agriculture takes many forms, most provided in the Farm Bill,[34] which includes:

- Direct payments (DPs) on a per unit basis fixed for the life of the Bill. As of the 2002 Farm Bill, this program now includes soybeans and other oilseeds.
- Loan programs providing fixed revenue floors per unit of production. This includes soybeans but at a reduced levels to rebalance corn and soy markets. These programs are notified as “Amber Box” programs. They include the commodity loan program, allowing farmers to default on loans from the Commodity Credit Corporation (CCC) by forfeiting commodities, marketing loan programs that provide income support but not supporting market prices, and loan deficiency payments allowing farmers to sell their crops directly on the market at market prices.
- Countercyclical payments to support incomes. These are “decoupled” payments with rates dependent on current prices, fixed historical acreage and yields. Soybean producers are eligible for this program.
- Insurance programs to protect farmers against revenue losses.

Table 8: Total US Commodity Program outlays (million US dollars)

	2000	2001	2002	2003	2004
Total outlays	32,255	22,105	15,680	17,425	10,575
Soybean-specific	2,840	3,281	3,447	907	595

Despite record budget deficits, US farmers are not likely to see major changes in these programs in the 2007 Farm Bill in the absence of a Doha Round agreement.

Export Subsidies

Export subsidies, including for oilseeds, were scheduled for reduction commitments in the Uruguay Round Agreement on Agriculture with total outlays not to exceed $594 million annually.

Export finance, insurance and guarantees are also part of export assistance. These programs include the

- Export Credit Guarantee Program,
- Intermediate Export Guarantee Program,
- Supplier Credit Guarantee Program
- Facility Guarantee Program.

Export assistance is also available under two other programs. These include the Economic Support Fund, under which funds are made available to purchase US food products for countries based on special economic, political or security needs, and the market Access Program (MAP). The latter uses CCC funds to help to create, expand and maintain foreign markets for US agricultural products.

Food Aid

The US has been the world's largest supplier of food aid, with most aid going to countries in need of emergency assistance to combat famine. Food aid is largely composed of in-kind commodity donations, with donation volumes inversely related to US domestic food prices.[35] Wheat is the top commodity shipped as food aid, followed by corn, vegetable oil, rice, and a corn flour-soy powder blend used to make gruel for famine relief. In 2003, America donated 14.7 million bushels of corn and 6.7 million bushels of soy products as food aid.[36]

Soy-specific policies

In addition to general commodity programs, soybean producers have been involved in programs that include preventing disease in soybeans, monitoring biotechnology regulation, addressing non-tariff barriers in foreign markets and promoting infrastructure development in the United States.

The US soy industry has faced major export barriers in Europe and some other countries because of its use of biotechnology. Over 75% of US soy plantings in 2004 were herbicide-tolerant soybeans developed using biotechnology. However, because US producers have focused mainly on those varieties that are approved in major markets, only a few biotechnology-derived soy varieties are commercially grown in the US, although more are on the way. EU traceability and labeling requirements for GM foods, the replication of these requirements in many other countries, and the emerging requirements of the Biosafety Protocol for shipments containing "living modified oils" have together acted to significantly reduce US soy market share in the EU and may pose challenges for other markets. Many food companies now rely on palm oil.

Biodiesel

The recent focus on domestic energy policy and price increases in crude petroleum have emphasized the use of biodiesel as an alternative fuel in the United States. Though price is still an inhibiting factor, incentive programs already in place will certainly boost in biofuels production. USDA's Bioenergy Program authorizes $150 million of biodiesel subsidies each year based on production. The JOBS Bill of 2004 introduced a federal excise tax credit for biodiesel to promote its production and blending with petroleum diesel. The Energy Bill of 2005 combines a renewed tax credit with a 7.5-billion gallon renewable fuel standard by 2012, which would include both ethanol and biodiesel. National Oilseed Processors Association (NOPA) estimates that short-term biodiesel availability can be increased from current levels (130-260 million gallons per year or 0.6% of transportation diesel fuel use) to account for up to 4 billion gallons (or 10% of transportation diesel fuel use) in the long term.[37]

However, alternative fuel use policy has favored ethanol (corn-based) production, and there is some question as to the extent to which biodiesel (mainly soy oil) can achieve market penetration.

Policies on biodiesel will tend to increase soybean planted area with small negative impacts on water quality and loss of habitat. Biodiesel has a small net positive impact on air quality in comparison to fossil diesel. We rated the social impacts as positive due to increased employment in processing facilities in rural areas.

6.1.2 Environment

ESI ratings[38]

The ESI, the above-described non-oilseed-specific study of environmental indicators, gave US agriculture a neutral performance rating on air quality, a negative score on green house gas emissions, a slightly better than neutral one on biodiversity (better than the negative rating for its peer group), a moderately good score on land, a good score on water quality, a very bad score on reducing air pollution, a negative score on natural resource management and a good score on environmental governance. Its rating is appended to this report.

Regulatory Structure and Programs

The US agencies most directly responsible for environmental performance of the agricultural sector are the USDA and the Environmental Protection Agency (EPA). Federal agency responsibilities are also mirrored at state level. The USDA's Natural Resource Conservation Service (NRCS) operates programs to provide producers with financial and technical assistance to "reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters."[39] Participation is voluntary.

The 2002 Farm Bill focused on protecting working land rather than taking land out of production. It created a small Conservation Security Program (CSP), which recognizes ongoing stewardship, and a Grassland Reserve Program to create contract or easement agreements to maintain grassland for grazing and haying. The USDA also provides maintenance and funding for programs in:

- Land retirement: The Conservation Reserve Program, a land retirement program, limits use of environmentally sensitive land for 10-15 years, after which it can be returned to production. It is capped at 2% of harvested cropland (mostly in wheat and corn producing areas). A Wetlands Reserve Program provides cost sharing and long-term or permanent easements to restore wetlands on agricultural land.
- Working Land Conservation. The Environmental Quality Incentives Program (EQUIP) provides financial and technical assistances for crop and livestock producers to implement environmental practices. Approximately 60% of this program goes to livestock producers to comply with water quality regulations in animal waste disposal. This benefits soy producers by allowing for environmentally responsible maintenance of a bigger livestock industry. The Wildlife Habitat Incentives Program (WHIP) provides cost sharing to landowners for improvements in wildlife habitat. The CSP program is also in this category as is Conservation Technical Assistance (CTA), provided to producers who adopt agri-environmental best management practices, and the Emergency Conservation Program, which provides financial assistance to farmers who conserve water while recovering from natural disasters.
- Agricultural Land Preservation: the Farmland Protection Program (FPP) funds purchases of agricultural land in urban fringe areas, including "historically important land areas and structures."

Observers of the USDA programs note that their environmental success may depend not only on the level at which they are funded but also on the nature of projects selected. USDA programs have traditionally focused on handling damages rather than changing practices, although more attention to the "amenities" of agriculture, such as open space, scenic vistas and small-scale farms, are within the purview of the 2002 Farm Bill.

The US Environmental Protection Agency also administers several statutes integral to environmental protection relating to agriculture. Regulatory programs include the Clean Water Act, the Federal Insecticide, Fungicide and Rodenticide Act, and the Clean Air Act. The Endangered Species Act, also relevant, is administered by the Department of the Interior.

Finally, several compliance (rather than incentive) programs are administered by USDA; these include:

- Conservation Compliance, under which conservation systems on highly erodible land must be maintained to receive other funding,
- Sodbuster, under which producers using highly erodible land in production must use strict soil conservation systems, and
- Swampbuster, under which producers who convert wetlands for production can lose farm program payments.

Growth in Acreage

Soybean acreage increased in recent years following policy changes in the 1996 Farm Bill, although projected soy acreage in the 2005-06 year was 74 million acres, down slightly from 2004, reflecting producer concern about Asian rust and growing competition in South America. These concerns, together with market conditions, will likely continue to influence production decisions. Diminished levels of domestic support might lead to reduced soy acreage but demand fueled by biodiesel could offset those reductions.

Farmers in the US are unlikely to try to develop new cropland in response to increased demand. Rather, they are likely to substitute soy for other crops, such as corn or cotton, and look to new varieties to produce gains in productivity.

Soil conditions

The United States benefits from an abundance of good soil in most growing areas, although the rate of erosion is of concern in some areas. Since 1950, one third of US farmland is estimated to have been abandoned due to erosion, and in the 1980s the rate of loss over replenishment was estimated as a factor of seventeen.[40] However, some areas of cropland in the United States are so rich that not even these rates are likely to cause serious damage in the near future. Crop rotation and other anti-erosion programs are advocated and supported by USDA. Data collected in the National Resources Inventory (NRI), which USDA conducts every 5 years, indicates that soil erosion and erosion rates in the country have declined by two-thirds since 1985.

Other Environmental issues

Air and water pollution stemming from agriculture are always relevant environmental issues, but soy culture in the United States is no more damaging than other forms of production agriculture and may be more environmentally friendly due to the widespread use of no-till methods that cause less erosion and greater sol health, and require fewer herbicides. These methods require fewer passes through fields of large machinery, consume less fuel and cause less air pollution. More generally, while biodiversity conservation and wildlife habitat is of concern in all areas of the United States, perhaps the three most important issues intersecting with agriculture have been runoff in watersheds of agrochemicals, including fertilizer and animal waste, and loss of wetlands.

Agrochemical runoff concern has focused on those watersheds most in need of protection. This includes the Chesapeake Bay, where fertilizer runoff is thought to have seriously compromised native oyster and fish populations, and the Gulf of Mexico, where nutrient runoff from agriculture and other sources in the Mississippi River has led to the formation of a “dead zone” where fish and other aquatic species suffer from hypoxia, or oxygen deprivation. Nationwide, nitrogen input is estimated to be more than 11 million metric tons (mmt) in the form of commercial fertilizer (6.3 mmt), animal manure (2.8 mmt), legumes (1.1 mmt), domestic and municipal waste (.6 mmt), and atmospheric deposition (0.5 mmt).[41] Although there has been much activity at state and local levels to address this problem, there has as yet been no regulatory approach on a federal level. [42]

On local levels, there is also concern about “CAFO’s”, or concentrated animal feeding operations, whose waste streams pollute local water sources and must be managed. EPA has recently published a regulation that will regulate them as non-point-source polluters under the Clean Water Act.

Environmental Enforcement

Environmental enforcement in the United States is generally good, despite periodic critiques of the EPA.[43] Environmental laws and regulations are enforced both on state and federal levels.

Performance-based and market-based tools are being developed. The Natural Resources Conservation Service (NCRS) has used a soil conditioning index (SCI) in 2004 to estimate the amount of net carbon stored in the soil and the reduction in sediment leaving the land on an annual basis. The payment to the farmer is based on the value of the outcome, rather than the cost of implementing the activity. NRCS is also developing performance-based indexes similar to the Soil Conditioning Index for other resource concerns, along with a payment structure that corresponds with the environmental benefit produced.[44] Similarly, pollution trading concepts are under discussion to address the Gulf of Mexico hypoxia and the US began emissions trading after passage of the 1990 Clean Air Act, which authorized EPA to cap sulphur dioxide.

Social Changes

Social change in the US farm sector, namely the disintegration of farm communities as the sector consolidates and young people move out of rural areas, has been taking place for some time, although many argue that the pace has begun to slow. In 2004, less than 10% of rural people lived on a farm and only 14% of the rural workforce was employed in farming.[45] Rural populations rebounded somewhat in the 1990's but growth has been small since then. In general, rural populations are poorer, and older than their urban counterparts. Hispanic in-migration has taken place in many counties in the South and Midwest. Manufacturing in some rural areas has increased, while other areas have attracted large retirement populations. Ex-urban sprawl has also begun to change farm scenarios.[46] Growth in biodiesel will lead to some increased farm sector employment, but elimination of domestic support and export subsidies could have the opposite effect, leading to a diminution of employment as the farm sector shrinks.

6.2 Brazil

All of the effects of trade liberalization and expansion of the biodiesel industry work in the same direction in Brazil – towards a major expansion in the area planted to soybeans. Much will be land newly brought under cultivation. The matrix scores in Table 9 reflect this but also consider assessments of other experts that Brazilian agriculture rates comparatively high in terms on long-term sustainability.

Table 9: Brazil Matrix

	Explicit Distortions/Policy Measures					Implicit Distortions		
Environmental Effects	Bio-diesel	Market Access – Tariffs/ Quotas	Non-tariff Barriers	Domestic Support	Export Subsidies	Externalities (e.g., envtl. enforcement, defined property rights)	Non-pollution Externalities: environmental	Pollution Externalities
Soil Erosion/Quality	-	-		-	-	- -	-	
Air Quality	+ -			-		- -	+	
Water Quality	-	-		-	-	- -	-	
Loss of Habitat/ Biodiversity	-	-		-	-	- - -	-	
Social Impacts	+ -	+ -		+ -		- -		

6.2.1 Economy and Trade

Brazil's huge land resources, combined with abundant labor, low labor costs and a climate that can produce two soy crops annually in many regions, mean that Brazil will become the primary world exporter in the near term. It currently represents about 27% of global production.[47] As such, Brazil has much to gain from the reduction of distortions in world markets and has called for the reduction of all trade-distorting domestic support measures on a product-specific basis.[48] In addition to its leadership role in Doha, Brazil continues to pursue regional integration through Mercosur and bilaterally.

Foreign investment is expected to reach US$15 billion by the end of 2004, 50% higher than 2002. The United States accounts for more than one-third of total foreign investment in Brazil, but Brazil is not without investment barriers. Foreigners may not own rural property larger than a quarter of the municipality in which the property is located, and foreign ownership of land adjacent to national borders is prohibited under Brazilian law.

Tariffs

Brazilian tariffs on agricultural products are on average lower than those applied on industrial goods, but there is tariff escalation on many processed goods. Brazil maintains import duties ranging from 8 to 12% on soy and soy products, with soy oil at the high end of the range. Imports from Mercosur countries enter duty free and from Mercosur associate countries (Peru, Bolivia and Chile) at a 60% discount. There is an additional Merchant Marine Tax of 25% on the value of freight (except for imports to the North and Northeast, and for Mercosur countries). Brazil requires labeling of food and feed products containing genetically modified material if it exceeds 1%.

Brazil will benefit more from increased market access than the United States because it can bring additional land resources into production, albeit at some environmental cost. Moreover, reductions in domestic support and export subsidies in other countries will work in the same direction for Brazil as improvements in market access. Therefore changes in all three pillars of the Round are mildly negative in terms of their environmental consequences.

The European market's preference for non-biotechnologically-derived oilseeds could work against Brazil's exports to that market, since GM planting has now been legalized. However, Doha is not expected to significantly off set either this, or other, non-tariff barriers.

To the extent tariff escalation is reduced in importing countries, and if differential export taxes in Argentina and Malaysia are disciplined, then a larger share of Brazil's soy exports will be in the form of meal and oil rather than beans. The increase in domestic soybean crushing would have some negative effects on air and water quality.

Domestic Support

In the 1990s Brazil provided $10.5 billion in state financing to agriculture, but support now primarily takes the form of rural credit at preferential rates, tax incentives for certain kinds of developments and minimum-price supports. These are complemented by marketing schemes, and increasingly market-oriented price and stabilization mechanisms.[49] Rural credit assistance has been concentrated in the South and Southeast regions. (In 2003 this amounted to over 70% of rural credit, corresponding to distribution of agricultural production). The private sector has increasingly assumed credit risk, but the state still plays a major role.

Some of Brazil's programs include:

- A system of income tax exemptions and reductions for industrial or agricultural companies (mostly in North and Northeast regions). Tax exemptions include an initial ten-year 75% reduction of income tax. Rebates are given for regional development (including private sector agricultural and tourism development) in the Amazon and the Northeast.
- Constitutional Funds, regionally-administered loans for development, including agribusiness, in the North, Northeast and Midwest regions. Most recipients are small producers.

- Programs to secure and refinance agricultural debt, end the indexation of financial costs, and promote private financing. A new debt restructuring program was initiated in 2004.
- Programs to promote family farming, reduce poverty and reduce rural exodus to urban areas. This includes rural resettlement (which amounted to 36,301 families in 2003). Brazil has announced lines of credit worth about $2.24 billion for 2004-05 production by small family farmers and resettled people under the land reform program.

Brazil also provides price supports to agricultural producers including (in 2003-04) soy.[50] However, since prices are set below world levels, they act mostly as a safety net rather than an incentive for production and trade. For example, in February 2004, the minimum price for soybeans was about 31% of export parity.[51]

Soy-specific policies.

Apart from general regional development assistance there has also been a long history in Brazil of specific assistance and expertise targeted to the soy sector. The research complex in universities and EMBRAPA, Brazil's agricultural research agency, have developed cultivars and specific management practices for the Cerrado.[52] The private sector has also participated in the R&D process. The result is evident in the over 80 cultivars developed over 20 years of research, and the continuing research on new techniques such as precision agriculture. Early development of the industry was also aided by the government's Program for Development of the Cerrado, which enabled producers to obtain subsidized loans of $577 million between 1975 and 1982 and to convert 2.4 million hectares to agriculture.[53]

Brazil has also provided substantial infrastructure development in aid of the soy sector, which has become a strong domestic lobby. In the 1980s, Brazil subsidized farmers in developing regions by guaranteeing uniform diesel fuel prices throughout Brazil.[54] More recently, port development in the Amazon, such as the Madeira River Waterway,[55] is aimed as reducing transport costs for the soy sector in the Cerrado regions and enabling other forms of development, much of which is financed by domestic commercial and foreign investment. Brazil reportedly intends to invest more than $40 billion in the Amazon over the next few years, justified primarily by soy cultivation.

In addition to port development, there are plans to connect production areas in Mato Grosso to the Pacific by rail. This will enable producers in Mato Grosso to access European, North American, and Asian markets without the use of the Panama Canal. The Br-163 highway already connects the growers to North America and Europe through deep water ocean ports on the Amazon River more than 450 miles from the coast. Short-term plans are to update this highway by completing the paving. The reduction in transportation costs represented by these infrastructure projects will greatly benefit soy producers in the Cerrado to access world markets.

Export Assistance

Brazil's soy production is export-oriented. In 1999, Brazil exported 65% of its soy meal and 38% of its oil. This is facilitated in part by a value-added tariff on soy movement among states applied even when the raw material will be processed by Brazilian industries. The tax disadvantages the soy crushing industry, but in most states (under the "Kandir Law") it has not been applied to exports. Internal debate in Brazil on whether to reintroduce the tax on exports has not been resolved. However, not paying the tax has exempted Brazilian soy producers from paying about $1.39 billion per year and has thus made them more competitive in world markets. Reintroducing the export duty might result in a significant reduction in the area under soy cultivation in the Cerrado.[56] However, introducing technologies to reduce costs might offset losses resulting from the taxation.

It is advantageous for Brazil to maintain competitiveness in soybeans rather than in soy oil at this point. Given the tariff escalation in markets of its major trading partners,[57] oil exports cannot be expected to be as competitive as beans. However, this may change somewhat as the result of the Doha negotiations. Currently, more than half of the crushing capacity is in domestic hands[58], but multinational investment in the sector is strong.

Biodiesel

Brazil has ample experience in promoting renewable fuels, stemming from its PROALCOHOL program launched in the 1970s that turned the country into the world's major user of ethanol for automotive fuel. In 2002, the government announced its PROBIODIESEL program. Soybean oil will obviously be the main feedstock under the program. Four production facilities accounting for about 10% of that target have been inaugurated in 2005. Brazil is reputedly planning to reduce taxes on biodiesel to encourage domestic use, and its goal is to become the world's largest renewable fuels supplier.[59]

Biodiesel will result in more land being planted to soybeans in Brazil, most likely in the Cerrado and areas in or near the Amazon, with resulting loss of habitat and biodiversity, and negative soil and water effects. Air quality and social impacts will be mixed. Domestic use of biodiesel will be less polluting than fossil diesel, but logging and burning for land clearing and the increase in soybean crushing and refining will be negative for air quality. Socially, there will be greater pressure on indigenous populations, but a positive impact on employment and incomes. We therefore gave biodiesel plus/minus scores for air and social impacts, but mildly negative scores for soil, water, and habitat effects.

Biotechnology

Illegal planting of biotechnologically-derived seeds was common in the South for several years, but legalized annually under successive Presidential degrees. A new law signed in March, 2005, legalizes genetically modified crops and regulates the biotechnology sector, authorizing sales and research of new products on the domestic market. This could increase productivity in Brazil's soy sector. However, exports of biotech beans will continue to face barriers in European markets. New international rules governing documentation of shipments of genetically modified organisms (GMO's) could encourage enhanced domestic processing capability.

6.2.2 Environment

ESI rating[60]

The ESI gave Brazil a somewhat negative rating on air quality, a slightly positive score on green house gas emissions, an almost neutral one on biodiversity (slightly better than the neutral rating for its peer group), a good score on land, a slightly positive score on water quality (but very good on water quantity), a slightly positive score on reducing air pollution and a neutral score on environmental governance. Its rating is appended to this report.

General

The 2004 WTO Trade Policy Review report notes WWF's 2003 assessment of the environmental effects of Brazil's soybean production for export,[61] in particular the explosive growth of production and its increased concentration in environmentally sensitive areas, primarily the Cerrado, a dry savanna in the Mid-Western Region of Brazil (Matto Grosso and Piaui), and the southern margins of the Amazonian region, in the North.[62] The Cerrado is estimated to contain over 10,000 species of plants, 4000 of which are endemic to Brazil, and a number of species of endangered animals.[63] It is generally considered well-suited for many kinds of production agriculture, but converting large swaths of it to soy culture is resulting in irreversible habitat destruction, and on a scale that raises fears of promoting declines in precipitation.[64] It is relatively ill-protected by law, with only 1.5% of its land in reserves.[65]

The deforestation and destruction of habitat that conversion requires is the principal source of environmental concern for Brazil, Paraguay and other parts of the region although the detrimental environmental effects of production agriculture, soil erosion due to cultivation and pesticide residues in water and soil, are also likely to occur. Accompanying social effects of large production units, including loss of livelihood of large numbers of small producers, and environmental effects of crushing and refining facilities, have also become issues of concern in the region and beyond. As infrastructure is developed to service the production agriculture in the mid-west, the possibility of expansion into the more environmentally sensitive Amazonian regions is also enhanced. Growth in demand will almost certainly increase production, and these infrastructure corridors could foster expansion of soy production into the Amazon. However, Brazil also has many abandoned farms that could also be converted to soy use and therefore an opportunity to encourage production on less environmentally sensitive sites.

Regulatory Structure

The right to a healthy environment and its priority over private property rights and economic development are established in Brazil's 1988 constitution. A 1998 environmental crimes law holds corporate CEO's criminally responsible for environmental crimes, and also has hefty administrative penalties. However, Brazil's environmental regime is generally characterized by lack of resources to implement too many laws, and a lack of coordination among the many agencies responsible for them.[66] Most observers of Brazil's environmental regime concur that it is sophisticated and strict – on paper – but difficult to enforce and therefore weak, especially in the face of demand-driven pressure to engage in the soy boom, "green gold." The total land mass of Brazil claimed by deed is said to exceed the actual land mass, and there are also many areas in which there is no ownership of record.[67]

Brazil maintains an ecological and economic zoning regime at state level. However, as of this writing, few states in the Amazon and Cerrado areas have completed their planning. The WWF reports that even where this process has been started, biodiversity conservation is not receiving the attention that it deserves,[68] and typical development strategies result in setting aside land for conservation that is already unsuitable for agriculture and ranching,

The Brazilian Forest Code determines Areas of Permanent Preservation on private lands. These include, for example, forests along watercourses (gallery forests), springs, and forest on steep slopes. A conservative estimate would put these areas at 5% of the country. The Brazilian Forest Code also demands that natural forests be maintained over 80% of private properties in the Amazon and 20% of private rural properties elsewhere. The code also determines measures for the recovery of degraded areas. Their exploitation or use is allowed only in the form of sustainable management. Similar development restrictions are applicable to the Cerrado. These do not appear to be a deterrent to developers, who can purchase very large tracts of land and develop them with little regulatory supervision.

Growth in the Cerrado

The need to create incentives to develop new land rather than use degraded land[69] was a central theme of a recent "Roundtable on Sustainable Soy" held in Brazil in 2005.[70] Participants to that conference pointed to the need to use no-till cultivation methods and to focus on soy cropping of already-deforested land rather than new acreage.[71]

Brazil's undeveloped land area in the Cerrado is larger than the total production area of the United States and is expected to develop another 50 million acres in the next 10 years. Advocates of controlled expansion argue that abandoned farms and marginally profitable ranches should be opened first to soy cultivation because many of them have worker housing, power generation and basic infrastructure for internal access to fields and soils have permitted return of native grasses.[72]

It is estimated that by 2020 Brazil could be producing as much as 105 million tons of soybeans on an additional 8 million hectares, distributed throughout the country.[73] Effective incentives for utilization of already-cleared land, and for cropping methods that retain soil quality, could be paramount to sustainable development there, as would productivity increases more generally. If productivity gains of 1.5% annually could be realized, a 70% increase in production would require only 37% more land.[74]

Farmers in the region report that the fertility of the native Cerrado soil is low because of the high leaching effect of seasonal rainfall and aluminum saturation. WWF adds that as a general rule, soils in frontier areas have low levels of potassium and phosphorus, high levels of aluminum and iron, high acidity and heightened fragility under stress.[75] In order to retain soil quality they also require careful management (such as rotation planting). The cost of fertilizers and pesticides in Brazil are high compared to Argentina. This will likely encourage use of biotechnologically derived seeds that do not need as much herbicide treatment during the growing season as do conventional varieties.

Growth in the Amazon

Ports to facilitate soy shipment from the Cerrado also encourage cultivation in the Amazon, particularly in the Santarem region in the western part of the northern state of Para.[76] The region is surrounded by secondary forests, and its topography is considered ideal for industrial farming. Other soy-cultivated areas in the Amazon region are savannahs, but soy could expand to tropical ones, because the reduced area allowed to be developed in the Cerrado has increased prices in areas of degraded pastureland, and increased incentives to convert rainforest; and low transportation costs encourage development of land close to ports, particularly where roads are not paved.

Development restrictions applicable by law to land in the Amazon have, according to some sources, caused fragmented development and allowed uncontrolled incursion into reserved forest lands. A developer of a large tract can by law deforest only 20% of it, but could build logging roads through the other 80% to provide access to it. Logging can fund the cost of other infrastructure, such as better roads. Such roads can allow uncontrolled access to a much larger area (including by illegal loggers and miners) and initiate growth of new communities to service the new farming activity.[77] More than two-thirds of deforestation in the Amazon has occurred within 50 kilometers of major paved highways.[78] Providing “soy export corridors” thus leads to further development and potential deforestation.

Environmental and Social Law Enforcement

Externalities, like poorly defined property rights and lax environmental enforcement, have more serious negative environmental effects than those associated with biodiesel development or trade liberalization. In the matrix we marked Brazil down heavily for the environmental impacts of these implicit distortions. These externalities are associated with the ongoing year-by-year expansion in Brazil’s soybean sector. That being said, Brazil does tend to receive high marks compared to other developing countries for longer-term environmental sustainability.

Brazil’s ability and willingness to adequately police the soy boom in legal and enforcement terms is reported to be weak. Irregular land transfers are reported to be common in Piaui, Mato Grosso, and Amazonas, accompanied by a lack of legally-required land use planning and environmental zoning. The subdivision of farms to evade environmental impact assessments required for clearances over 1,000 hectares has also been reported. Expropriation of large estates has also hampered development, and confrontation between landowners and landless people has taken place in Mato Grosso and other areas.[79]

The Environmental Sustainability Index ranks Brazil below its peer group in terms of environmental governance.[80] Transparency International gives Brazil a score of 4 on a scale of 10 to 0, where 10 is least corrupt and 0 most corrupt.[81]

Social changes

Brazil exhibits one of the greatest extremes of wealth and poverty in the world. Its rural environment is currently experiencing rapid social change, as small farmers move to urban and marginal areas and indigenous communities are dispersed or destroyed by formidable development pressure. Unemployment in urban areas has been high. A landless workers movement has been active for many years, and has taken on new momentum since 2000.

Despite social policies designed to facilitate expansion of smallholder access to land and credit, soy expansion does not always result in increased employment, since initial clearing of land is labor intensive but production of soybeans using the mechanized culture demanded by industrial production methods can require as little as one worker per 200 hectares[82] New agricultural and poverty reduction programs have recently been announced that could shift agricultural policy focus from large agribusiness support. However they are unlikely to stall expansion in the soy sector.

6.3 Malaysia

Malaysia ranks somewhere between the United States and Brazil in our assessment of the environmental impacts of trade liberalization and biodiesel. As Table 10 suggests, the direction of the environmental impacts is uniformly negative, but the scale of the impacts is moderate, in part because of limitations on land available for additional palm production, and in part because Malaysia has a reasonably good legal system that enforces property rights and environmental regulations.

Table 10: Malaysia Matrix

	Explicit Distortions/Policy Measures					Implicit Distortions		
Environmental Effects	Bio-diesel	Market Access – Tariffs/ Quotas	Non-tariff Barriers	Domestic Support	Export Subsidies	Externalities (e.g., envtl. enforcement, defined property rights)	Non-pollution Externalities: environmental	Pollution Externalities
Soil Erosion/Quality	-	- -		-	-			
Air Quality	-	- -		-	-			-
Water Quality								-
Loss of Habitat/ Biodiversity	-	- -	-	-	-		-	
Social Impacts								

6.3.1 Economy and Trade

The WTO ranked Malaysia's economy as "relatively open" in 2001. Malaysia significantly restructured many sectors in the wake of the 1997 financial crisis, and acted to address structural weaknesses. Although the 2001 WTO review noted the relative decline in the contribution of agriculture to GDP, it also noted that land area used for palm oil increased significantly. It also suggested that the lack of arable land and the small average size of farms might constrain development of the agriculture sector in Malaysia, and lead to increasing reliance on foreign labor. The WTO noted in 2001 the presence of some 190,000 foreign workers, accounting for 13.4% of total agricultural employment.[83]

Malaysia's palm oil industry is arguably the most mature in the world, and its productivity among the highest. Government has played an essential role in developing settlement schemes for estate land, and established institutions for research, planning and enforcement of policy. Malaysia's Third National Agricultural Policy for the period 1998-2010, proposed to raise productivity and intensify land use to improve the sector's competitiveness, accomplished by expanding and modernizing domestic food production and management, encouraging large-scale and organized agriculture, and shifting agricultural production from mono-cropping to mixed farming as well as from monoculture to polyculture. Notably absent is expanding land use for agriculture to new areas.

Trade policy

Malaysia's import tariffs on most agricultural products are low with the average rate of duty collected on total imports at 1.3% in 2000. Among the least tariff-protected products are animals and animal products, vegetable products, and animal and vegetable fats and oils.

Though Malaysia has no export subsidy programs subject to present reduction commitments, it maintains export taxes on some agricultural products, including crude palm oil, palm kernel, rubber, pepper, and some timber products. The overall average of the *ad valorem* export duties is 11.7%.[84]

Malaysia's major oil palm product export is Refined Bleached Deodorised (RBD) palm oil, which illustrates the government's emphasis on investment in value added processing. Malaysia encourages processing by imposing an export tax on crude palm oil (CPO) while RBD and other processed palm oil products are exempted from export duties. CPO exports are taxed on a graduated scale according to market prices, and can climb up to 30%.[85] Malaysian authorities justify Malaysian export duties because they promote the use of locally produced commodities in domestic downstream industries.

The largest impacts on the oilseed sector from trade liberalization will be on vegetable oil through higher prices and increased international trade and production. Malaysian palm oil production and exports will therefore increase to some degree, although land and labor availability are serious constraints. Nevertheless there will be both expansion of plantations and replanting with higher yielding seedlings.

Any disciplines on differential export taxes would slightly reduce oil refining in Malaysia, with small positive environmental effects due to the reduced industrial activity.

Biodiesel

Biodiesel programs in the EU will also work to expand output due to significant exports of palm oil to Europe in coming years, as well as active programs to promote and/or mandate use of palm oil to produce biodiesel for domestic use. Therefore Malaysia scores moderately negative due to the biodiesel demand on soil and air quality and loss of habitat/ biodiversity.

Water quality issues do not loom large in palm production so for both biodiesel and trade liberalization Malaysia is neutral on this count. However soil erosion and loss of habitat from land clearing and air pollution associated with processing palm fruit are potential problems, and there are some moderate pollution and other environmental externalities affecting air and water quality also. Some argue that palm plantations have biomass similar to the jungle, therefore, there is no negative effect on carbon in the atmosphere.

6.3.2 Environment

ESI rating

The ESI gave Malaysia a slightly lower than neutral performance rating on air quality, a negative score on green house gas emissions, a slightly lower than neutral one on biodiversity (worse than the neutral rating for its peer group), a moderately good score on land, a slightly better score on water quality, a slightly positive score on reducing air pollution and a slightly better than neutral score on environmental governance.

General

Malaysia's tropical forests have garnered worldwide attention because they are sensitive ecological systems and important reserves of biodiversity. In fact, the entire country lies within a Conservation International biodiversity hotspot. Malaysia is party to most of the major multilateral environmental agreements including the Kyoto Protocol, CITES, and the Convention on Biodiversity. It has had a generally good record of environmental conservation and has been a leader in the region although its problems with illegal logging and forest conversion have also captured some attention.

It is clear that forest conversion and palm oil plantation growth have been closely linked, and that the expansion of palm oil was initially one reason for deforestation in Malaysia. There is also evidence that concessions granted for palm oil production have sometimes been abused by logging interests.[86] Many estates, however, have been established on former rubber plantations and have not required clearing of native forest. More recently, in light of a labor shortage, the Malaysian government has discouraged the conversion of marginal land to oil palm plantations, and has instead focused on improving yields.

Regulatory structure

Environmental management in Malaysia is complicated by the relationship between the federal and state governments, particularly in the resource-rich East Malaysian states of Sabah and Sarawak where state governments retain relatively stronger competence over natural resource management than in West Malaysia.

Malaysia's framework environmental law has introduced provisions on open burning, industrial wastes and environmental impact assessments (EIAs).[87] The Malaysian Palm Oil Board (MPOB) is largely responsible for establishing these measures in the palm oil sector. The MPOB has helped develop environmentally frugal technologies and best management practices, as well as EIAs for palm oil plantations. The Malaysian Palm Oil Promotion Council (MPOPC) has also been integral in pushing awareness of the types of initiatives that foster responsible environmental practices, such as ISO 14001 certification.

Major players in the supply chain – approximately 70% of private sector ownership – are organized under the Malaysian Palm Oil Association (MPOA), which collaborates with environmental and public interest groups in various initiatives. It has established the Round Table on Sustainable Palm Oil (RSPO), a forum for stakeholder dialogue and negotiation. There is increasing recognition by players of sustainable development.

Growth in Acreage

The annual expansion of plantations onto new land has followed a decelerating trend (see figure 1). Palm oil expansion in Malaysia has encountered a scarcity of suitable land, with the only remaining land resources in Sabah and Sarawak. Malaysia plans for limited expansion – mainly in Sarawak where the government is planning to develop 1 million hectares of oil palm plantations in total.[88] Much of the remaining available forested land for conversion in Malaysia marginalizes oil palm production and land for increased palm production will likely come from areas currently dedicated to rubber and cocoa.

Ongoing forest conversion for the planting of oil palm in Malaysia is still a source of criticism. Arguments center on the effects of forest disturbance on the diversity of fauna and flora, as well as problems related to soil erosion on bare land in initial planting and replanting, causing sediment loading in waterways.

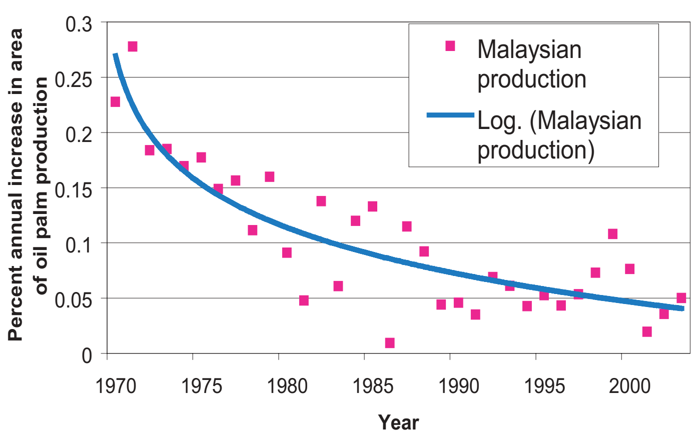
The lack of documentation on forest reduction and destruction make it difficult to assess the extent of the damage. According to the MPOA, about two-thirds of new oil palm plantations are converted from prior use in rubber and cocoa production. This suggests an impact much less than that purported by some major NGOs.[89] A study by Basiron, Balu, and Chandramohan (2004) contends that in Sabah, where oil palm plantations are both predominant and contentious, the one million hectares of oil palm occupies 13% of its total land area; an area proportionally equal to the land covered by cereals in the UK or by vineyards in France.[90] The International Tropical Timber Council in 2000 reported that Malaysia has developed the appropriate conditions and management practices to ensure the sustainability of its forests.[91]

Table 11: Forest Area Statistics for Malaysia

Country	Land area	Forest Area 2000			Area change 1990-2000 (total forest)		Forest under management plan	
	000 Ha	000 Ha	%	Ha/ capita	000 Ha/ year	%	000 Ha	%
Malaysia	32,855	19,292	58.7	0.9	-237	-1.2	14 020	73

FAO, 2003

Figure 2: Annual change in Malaysian oil palm production



FAOSTAT, 2005

Biodiversity

Though Malaysia's production of palm oil has slowed somewhat, the push for increased productivity has often been paralleled by a move to monoculture that threatens fauna and flora. In addition, many endangered species found in the increasingly fragmented forests of Malaysia, have had their movements restricted. Research shows that Malaysian oil palm plantations reduce the number of species by 80% relative to its rainforests, and that even those animals that can survive are often regarded as pests by landowners.[92] As of 2004, the IUCN had classified 892 species of flora and fauna in Malaysia as threatened on its Red List of endangered species.

While the enforcement of federal and state laws protects various wild animals, efforts have been mainly focused on the conservation of large mammals and birds. The government cannot realistically defend any significant number of species the list of threatened species described so it concentrates on models for protected area management and wildlife reserves. The FAO estimates that over 14 million hectares or 73% of Malaysia's forests are under Permanent Reserved Forests (PRFs), and managed sustainably (Table 11). In addition 2.3 million hectares of Malaysian territory are within conservation areas protected by legislation with 0.36 million hectares located in the PRFs.[93]

Environmental Enforcement

Wakker (2004) cites fours major sources of environmental pollution from palm oil production: 1) air pollution caused by forest and peat fires, 2) heavy sediment loads in waterways; 3) excessive or improper chemical applications; and 4) palm oil mill effluent (POME).[94] Malaysia's government has helped develop sound practices to minimize negative impacts of these issues.

The strict enforcement of a ban and on burning and severe penalties on violators has led to drastic reductions of the practice.[95] Integrated Pest Management (IPM) is widely promoted by the MPOA and practiced by large plantations, and chemical applications are relatively low.[96] In terms of processing, mills receive firm disciplines for effluent discharge above strict standards, including having their operating licenses revoked. Extremely low allowable limits of biochemical oxygen demand (BOD)[97] combined with innovative solutions have not only curtailed the damage from effluent but have converted them for use as livestock feed and fertilizer.[98]

Some of the larger companies such as Golden Hope Plantation and Palmol Plantations, in a demonstration of Unilever's global policy on sustainability, have taken steps in their stream of processes to meet and surpass the industry's environmental and social obligations with regard to the aforementioned threats.[99] The implementation process and costs of compliance, however, are still beyond the scope of most producers.

Developments in Malaysia's oil palm research indicate both positive and negative potential effects. On the plus side there are good indications that the production of oil palm in Malaysia is making good progress toward the MPOB's ultimate aim of producing zero waste. The prospect of using oil palm biomass and waste as fuel is also on the horizon. On the other hand, the lack of labor has put into motion large efforts focused on facilitating cultivation and collection through mechanization and genetics. The consequences of this could well be shorter palm trees and increased monocultures.

Social Issues

In Malaysia's palm industry the Federal Land Development Authority (FELDA), bestowed the responsibility of improving social condition in agriculture in Malaysia, is credited with contributing in large part to Malaysia's poverty reduction through land settlement strategies and the development of the oil palm sector. By focusing on smallholder programs involving oil palm, the government helped reduce the incidence of poverty in the agricultural sector from a high of 68.3% in 1970 to 11.8% in 1997.[100]

FELDA has shifted its strategy toward improving the quality of life among settlers through land management and extension services, and may help control the expansion of land for oil palm in East Malaysia. An issue of great potential contention involves the fact that most of the suitable land for oil palm in Sarawak is claimed under Native Customary Rights (NCR). By the same token this extends interesting opportunities for indigenous people to raise their own incomes.

6.4 Indonesia

Of all countries studied for this report, Indonesia proved to be the most worrisome in terms of the potential adverse environmental impacts of trade liberalization and biodiesel, with more negative signs to the effects of both explicit and implicit distortions.

Table 12: Indonesia Matrix

	Explicit Distortions/Policy Measures					**Implicit Distortions**		
Environmental Effects	Bio-diesel	Market Access – Tariffs/ Quotas	Non-tariff Barriers	Domestic Support	Export Subsidies	Externalities (e.g., envtl. enforcement, defined property rights)	Non-pollution Externalities: environmental	Pollution Externalities
Soil Erosion/Quality	-	- -	-	-	-	- -		
Air Quality	-	- - -	-	-	-	- -		-
Water Quality	-	-				-		
Loss of Habitat/ Biodiversity	-	- - -	- -	-	-	- - -	- -	
Social Impacts	+	+	- +			-	-	

6.4.1 Economy and Trade

Uncertainty associated with Indonesia's difficult political situation along with periodic social unrest has hampered Indonesia's recovery from the 1997 Asian financial crisis.[101] A lack of contract enforceability, discriminatory taxation, the absence of a transparent and predictable regulatory environment as well as arbitrary and inconsistent interpretation and enforcement of laws have further contributed to problems for the business community and foreign investment.[102]

The WTO reported in 2003 that many aspects of Indonesia's trade policy were unchanged from 1998, but that it now appears to more *ad hoc,* especially with regard to sensitive sectors.[103] Political reforms designed to address corruption in central government bodies have decentralized fiscal powers to provincial and local governments, and this has potential implications for business and investment, as well as environmental policy. Weak regional governance and administration is a major challenge, given that there are some 353 districts and 30 provinces now responsible for key public services.

Trade Policies

Indonesia has liberalized tariffs beyond its multilateral commitments. Many of its bound rates, however, remain considerably higher than the applied duties (especially in agriculture, where 1,341 tariff lines have bindings at or above 40%).[104] Pronounced escalation is also apparent for semi-processed products in the food, beverage, and tobacco industries, among others. In the current Doha negotiations, Indonesia has been advocating special products exemptions from tariff reductions for rice, sugar, soybeans, and corn. The Yudhoyono administration has announced plans for a review of all rules and regulations related to trade and business licensing in order to identify and rectify onerous bureaucracy and ill-conceived trade policies.

Indonesia maintains a number of import barriers to food products and raw materials, including import licensing, de facto quotas and prohibitions, and food labelling requirements. It also maintains a labelling regime for food containing "genetically modified" ingredients and irradiated products, although this has not yet been enforced.[105]

Labor-intensive agriculture and resource extraction still characterize Indonesia's economy, with regulatory controls varying by sector. Regulatory controls and export restrictions have done little to address the forestry sector's problems, including over-exploitation.

Indonesia's *ad valorem* export taxes, which ensured an ample domestic supply of cooking oil in the domestic market, were reduced from their high range – between 40% and 75% in 1994 – to current rates of 1% and 3% for processed and crude palm oil respectively. There was even a period in late-1997 when a ban on exports of palm oil was imposed. Historically, such bans, or high export taxes, have been implemented when world prices for CPO are high in order to maintain domestic supplies. In 2004, the Indonesian government ended several credit programs that offered subsidized loans to agriculture and small and medium sized businesses to support exports.

However, as in Brazil and Malaysia, the environmental effects in the oilseed/palm sector will arise not so much as a result of changes in Indonesia's trade policies, but due primarily to changes in policies in other countries and the world economy. Just as Brazil will be the major beneficiary of increased world demand for oilseeds, Indonesia – powered by Malaysian investment - will likely lead the way in producing more palm oil because of the availability of land that can be converted to this purpose. We therefore gave Indonesia two negative marks for market access effects on soil quality and erosion, and three negative marks for impacts on air quality and loss of habitat/ biodiversity. We judged that reductions in domestic and export subsidies in other countries would have small negative effects on these same environmental indicators.

Palm Oil Development

Indonesia is focused mainly on acreage expansion to boost output of CPO, the growth of which is illustrated in the chart below, but development of crushing capability is also a priority. The Malaysian palm oil sector has by contrast focused its efforts on productivity gains to supplement its supply. Where the average yield increase in Malaysia over 1996-2002 was 0.95%/yr., Indonesia's yield has been decreasing by 0.15%/yr. over the same period.[106]

Table 13: The development of Indonesian oil palm ('000 ha)

Year	Government	Private	Smallholders	Total
1969	84.1	34.9	0.0	119.0
1975	120.9	67.9	1.3	190.1
1979	176.4	81.4	3.1	260.9
1980	199.5	88.8	6.2	294.5
1991	376.1	552.6	347.5	1276.2
1994	411.4	796.0	585.1	1792.5
1996	441.2	1028.4	757.3	2226.8
1998	489.8	1494.5	892.0	2876.3

Corley and Tinker, 2004

Foreign direct investment was significantly liberalized in 1997 and 1998 after the Asian financial crisis.[107] The result has been a flood of foreign investment in order to replace the domestic capital lost in prior years and regain export earnings. This has facilitated the process of establishing plantations through a number of regulatory changes and has offered about half of the area for palm oil development to foreign companies, mostly on the outer island of Indonesia: areas such as Kalimantan and Sumatra, Irian Jaya, Riau. Individual provinces have been eager to accept investment.

Malaysian plantation companies have been especially quick in picking up on the opportunity; they owned 1,341,200 hectares of Indonesian land in 1999.[108] Though Malaysian companies are environmentally responsible at home, there are indications that they may not share the same attitude in the face of less stringent environmental regulations.

6.4.2 Environment

ESI rating

The ESI gave Indonesia a very bad rating on air quality, a slightly bad score on greenhouse gas emissions, a slightly lower than neutral one on biodiversity (worse than the neutral rating for its peer group), a moderately good score on land, an extremely negative score on water quality, an almost neutral score on reducing air pollution and a negative score on environmental governance.

Regulatory Structure and Enforcement

Weak environmental enforcement, in part due to government restructuring, and lack of well-defined property rights are major problems that will contribute to continuing loss of habitat and biodiversity, and to lower soil, air and water quality in the absence of effective policies designed to reverse these trends. In the matrix we marked Indonesia down heavily in these categories.

Continuation of illegal logging will also exacerbate the problems. Soil erosion and air pollution are expected to be bigger issues than water quality for palm oil production, although water quality is greatly affected by other developmental issues (e.g., mining). There are many social issues that will also materialize with greater production. Logging will disrupt communities, but domestic policies leading to more processing in-country will also add jobs and increase social welfare in some communities. There are also some non-tariff barriers associated with logging that stimulate expansion of palm plantations, and we therefore gave Indonesia mildly negative scores in this dimension of the matrix.

Decentralization, reliance on private sector largesse and voluntary compliance, lack of regulatory infrastructure and multiple regulatory layers all appear to be factors in Indonesia's weak environmental governance. Although Indonesia is a party to numerous international or regional environmental treaties including the Kyoto Protocol, the WTO reported that it "seems to be facing major environmental problems such as rapid deforestation (owing to illegal logging and agricultural burning), air pollution (caused by motor vehicles), water pollution, and carbon emissions." Indonesia's reforms on the environment and its regulatory framework have simply not come to fruition. FDI targeted to palm oil, which relies on forest conversion in its initial stages, is no doubt partly to blame.

Many aspects of Indonesia's weak environmental regulatory structure have been identified. One such example thought to constrain implementation of environmental policy is fragmentation of information; various Ministries, such as Mines and Energy, Agriculture, Forestry, and Public Works, collect data, but these are not cross-referenced. Lack of enforcement power is another. The Environmental Impact Management Agency (BAPEDAL) has no enforcement powers, but relies on voluntary compliance by industry with its environmental programs (e.g. Clean River Program, Blue Sky Program, Cleaner Production Program).[109] Recent years have seen much reorganization of the forest authorities in Indonesia, but the role of local communities in forest management is receiving increasing encouragement.

Indonesia's problems of enforcement are most apparent in its inability to adequately control wildfires. A ban on burning practices by the government in 1997 has been relatively ineffective in stemming the use of fire to clear land. Several reports estimate that plantation companies were largely at fault – accounting for the majority of larger Indonesian fires – with palm plantations responsible for approximately three-quarters of the damage. The environmental and health costs have been visibly apparent; fires that burn regularly in Indonesia have been known to blanket the country and its neighbors in haze, and have been concentrated in West and Central Kalimantan.

Growth in Acreage

Estimates for Indonesia's rate of deforestation during the 1990s range from a conservative annual average of about 1.3 million hectares (FAO) (see Table 1) to over 2 million hectares (Global Forest Watch). Over 9 million hectares have been released for future plantations, with some estimates putting the figure at around 14 million hectares.[110] There is great concern regarding the emerging trend for companies to neglect or abandon projects on designated oil palm land after having felled the rich forest stocks. Companies that are interested in Irian Jaya and Kalimantan, where timber stock are much higher than elsewhere, have suspiciously strong ties to logging companies, whereas companies concerned with efficiency and infrastructure for oil palm production have tended to develop estates in Riau, Jambi and South Sumatra. Of the 871,211 hectares in West Kalimantan for which plantation permits were issued in 1999, only 18,278 were actually planted with oil palm.[111] The Indonesian Palm Oil Research Institute (IOPRI) estimates that 66% of productive oil palm plantations involved forest conversion, 3% encroached on primary forests and 63% on secondary forest and brush.[112]

Table 14: Forest Area Statistics for Indonesia

Country	Land area	Forest Area 2000			Area change 1990-2000 (total forest)	
	000 Ha	000 Ha	%	Ha/ capita	000 Ha/ year	%
Indonesia	181,157	104,986	58.0	0.5	-1,312	-1.2

FAO, 2003

Soil conditions

Anecdotal evidence points to widespread deforestation outside of concessional boundaries and into areas of high conservation value, even though protected areas account for only 19% of the forested area.[113]

Sawit Watch, an Indonesian NGO, and Friends of the Earth Indonesia, have judged from satellite map analysis that in many cases illegal clearing has been on deep peat swamps, where felling is relatively easy. The deterioration of these fragile peat soils has direct effects on the wetlands. It also helps propagate forest fires, which can spread through the peat itself, making wild fires all the more persistent and unpredictable.

Biodiversity

With the number of concessions granted to oil palm production, it is clear that even if illegal practices were mitigated, the effects of legal oil palm expansion would still be substantial. In terms of biodiversity, this represents a threat to the most diverse set of animal species in the world. Indonesia holds a disproportionately high percentage (16%) of the world's bird species (ranked first in bird endemism) and about 10% of its animal species.[114] These are concentrated in three biodiversity centers; in Irian Jaya, Kalimantan and Sulawesi, exactly where forest conversion for oil palm is most threatening.

Social Changes

Government policies geared toward keeping palm oil prices low in the domestic market have gone a long way to ensure that a significant share of the land and production has returned to the hands of small farmers. Over a third of all land dedicated to oil palm plantations is owned by smallholders. Nevertheless, conflicts over the land rights of indigenous people and the expropriation of land are rampant, as are the inequities in labor relations. The government's promotion of ownership and operation programs that encourage investors to cooperate with local farmers and rural society have been innovative in their approach, but they lack clarity and have also been considered too complex to be implemented properly.

Endnotes

[1] Promar International, "Impact of Trade Liberalization on US Soybean Producers", April 1998.
[2] Mielke, Karl D. and Mitch Wensley, "Trade Liberalization of the International Oilseed Complex", Policy Branch, Agriculture and Agri-Food Canada, July 1998.
[3] Diao, Xinshen et al, "A Global Analysis of Agricultural Reform in WTO Member Countries" in Burfisher, M.E., ed., "Agricultural Policy Reform in the WTO – the Road Ahead". AER 802, USDA, May 2001.
[4] Elbehri, Aziz et al, "Global Impacts of Zero-for-zero Trade Policy in the World Oilseed Market: A Quantitative Assessment", Paper presented at 4th Conference on Global Economic Analysis, Purdue University, West Lafayette, Indiana. June 2001.
[5] FAO Commodities and Trade Division, "Implications for specific commodity markets of possible modalities for commitments in the areas of domestic support, market access and export competition", November 2002, available at http://www.fao.ort/trade/docs/8-11-02-Paper_IV-final.htm
[6] IIED, ProForest and Rabobank International, "Better Management Practices and Agribusiness Commodities: Phase II Commodity Guides", March 29th, 2004
[7] USDA 2003 reports on agricultural chemical use allow a comparison of soybeans with corn and wheat, the other two leading field crops. In every case where a comparison is possible, a switch to corn or wheat would result in increased nitrogen, phosphorus, and potash use. The only exception arose for the application of herbicides, where wheat required less than soybeans.
[8] IIED, op.cit.
[9] Clay, Jason, "World Agriculture and the Environment: A Commodity-By-Commodity Guide to Impacts and Practices", Island Press, Washington DC, 2004, p. 208
[10] Held in August, 2003, available at http://www.sustainable-palmoil.org/meetings.htm
[11] http://ianrpubs.unl.edu/fieldcrops/g1076.htm
[12] http://www.greenergy.com/products/technical_product_info/biodiesel/biodiesel_faqs.html
[13] Oil World Annual 2003, ISTA Mielke, Hamburg, May 2003.
[14] USDA GAIN report, 1/10/2005, Report Number FR5002, available at http://www.fas.usda.gov/gainfiles/200501/146118448.pdf
[15] European Biodiesel Board, at http://www.ebb-eu.org/biodiesel.php
[16] Nguyen, T. "Energy Bill boosts biodiesel." Fleet Owner, August 8, 2005
[17] The Canadian Renewable Fuels Association reports that biodiesel production in Canada is still not economically competitive nor is it expected to be in the foreseeable future. Canada is a large net exporter of energy, rich in land and energy resources. Canadian law has encouraged use of biodiesel but Canada does not currently have environmental legislation that encourages the production of biodiesel. Therefore, biodiesel fuel is unlikely to achieve much, if any, market penetration in Canada under normal market conditions. Available at www.greenfuels.org.
[18] Personal communication with Fediol President
[19] See, for instance, the report of the National Center for Food and Agricultural Policy, which found that biotech soybeans resulted in reduction in pesticide use of 20.1 million pounds in the US in 2003, accounting for an additional $1.2 billion in income. The study is available at http://www.ncfap.org/whatwedo/biotech-us.php.
[20] Corn rootworm damage in the US is estimated to cost farmers $1 billion a year. This cost is avoided with use of rootworm-resistant varieties developed via biotechnology.
[21] The arrival of biotech herbicide-resistant soybeans in 1996 in the US led to a huge increase in the number of US acres devoted to "no-till."
[22] ISAAA studies, available at http://www.isaaa.org
[23] http://www.isaaa.org/kc/CBTNews/press_release/briefs32/figures/es_map.jpg
[24] Dixon, J.A., and M.A. Tutwiler. "Trade, Agriculture and the Environment: The sustainability of free and more open markets." Washington, International Food & Agricultural Trade Policy Council Discussion Paper, 2004.
[25] Malunga observes that "after six years of reductions on Amber box subsidies as per the Uruguay Round decisions, developed countries still retained about 80% of their original domestic support and export subsidies. The 3 boxes are extensively used by countries with high domestic support, and rather than true reductions, support is often shuffled or redefined so as to fit into boxes that are not subject to reductions." The Impact of Export Subsidies on the Environment, Vincent G. Malunga for the International Center for Trade and Sustainable Development, at http://www.ictsd.org/dlogue/1999-02-10/MALUNGA.pdf
[26] Idem.
[27] Comments by New Zealand, as reported in WTO, Trade and Environment News Bulletin, May, 1996 available at http://www.wto.org/english/tratop_e/envir_e/te009_e.htm
[28] CUTS briefing paper, "Tariff Escalation, A Tax on Sustainability," Dr Basudeb Guha - Khasnobis, Assistant Professor, Indira Gandhi Institute of Development Research, Bombay, INDIA, January 1998, Number 1, at http://www.cuts-international.org/1998-1.htm
[29] Property Rights and Environmental Remedies, Richard O. Zerbe, Jr., Professor of Public Affairs and Adjunct Professor of Law, University of Washington, Washington Policy Briefs, March, 1999, at http://www.wips.org/Environment/PBMisfeldtEnvironmentSalmon.html
[30] 2005 Environmental Sustainability Index, Benchmarking National Environmental Stewardship, Yale Center for Environmental Law and Policy, Yale University, available at www.yale.edu/esi.

[31] Kansas Farm Bureau, at http://www.kfb.org/pdf/news%20releases/April5thFarmBill.pdf
[32] Dispute Settlement (DS) 267, available from www.wto.org
[33] The WTO Cotton Case and US Domestic Policy, By Darren Hudson, C. Parr Rosson III, John Robinson, and Jaime Malaga, in Choices Magazine, 2nd Quarter 2005, Vol 20-2, available at http://www.choicesmagazine.org/2005-2/wto/2005-2-10.pdf
[34] Technically, the Farm Security and Rural Investment Act, available at www.usda.gov/farmbill
[35] WTO, Trade Policy Review Body, "Trade Policy Review – United States." WT/TPR/S/126, December 17, 2003.
[36] "Putting food aid in perspective." The Truth About Trade, Oct. 31, 2004. Available at http://www.truthabouttrade.org/article.asp?id=2858
[37] Presentation by John B. Campbell, Vice President AGP, NOPA 2005 Annual Meeting, Tuscon, Arizona, February 12, 2005
[38] "Environmental Sustainability Index (ESI): Benchmarking National Environmental Stewardship." Esty, D.C., M. Levy, T. Srebotnjak, and A. de Sherbinin, eds. New Haven: Yale Center for Environmental Law & Policy, 2005.
[39] http://www.nrcs.usda.gov/programs/
[40] Clay, op.cit.
[41] http://www.soildoctor.com/Hypoxia.html
[42] Eleventh Meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, September 1, 2004, Saint Paul, Minnesota, available at http://www.epa.gov/owow/msbasin/meet_summ11.pdf
[43] The Bush Administration has been charged with weak environmental enforcement, as per Congressman John Dingell's critique, at http://www.waterconserve.info/articles/reader.asp?linkid=19972
[44] Knigh, B.I. "Sustaining the movement for conservation." NRCS, April 12, 2005. Available at http://www.nrcs.usda.gov/news/speeches05/fbsummit_0405.html
[45] Whitener, L. "Policy Options for a Changing Rural America." *Amber Waves*, April 2005. Available at http://www.ers.usda.gov/Amberwaves/April05/Features/PolicyOptions.htm
[46] "Rural America at a Glance," Karen Hamrick, ed., available at http://www.ers.usda.gov/publications/aib793/
[47] IIED, op.cit.
[48] WTO, Trade Policy Review Body. "Trade Policy Review – Brazil." WT/TPR/S/140, January 11, 2004.
[49] Idem.
[50] Idem.
[51] Idem.
[52] Casson, A. "Oil palm, soybeans and critical habitat loss." A review prepared for the WWF Forest Conversion Initiative, August, 2003.
[53] Kaimowitz, D., and J. Smith. "Soybean technology and loss of natural vegetation in Brazil and Bolivia." In *Agricultural technologies and tropical deforestation,* Angelsen , A., Kaimowitz, D. (eds.). Wallingford, UK: CABI International, 2001.
[54] Niesten, E.T, Rice, R.E., Ratay, S.M. and Paratore, K. 2005. Commodities and Conservation: The Need for Greater Habitat Protection in the Tropics, Washington D.C., Conservation International.
[55] This $100 million-plus project is estimated to have reduced soy transport costs by a factor of three, as reported by Kaimowitz, D., and J. Smith, op. cit.
[56] D´Alembert, J. et al. "Sustainability Assessment of Export-Led Growth in Soy Production in Brazil."Brasília, Brazil, WWF-Brazil and WWF-International, 2003.
[57] Idem.
[58] IIED, op.cit.
[59] Statement of Lula de Silva, Brazil's President, Reuters
[60] "Environmental Sustainability Index (ESI): Benchmarking National Environmental Stewardship." Esty, D.C., M. Levy, T. Srebotnjak, and A. de Sherbinin, eds. New Haven: Yale Center for Environmental Law & Policy, 2005.
[61] WWF, "Sustainability Assessment of Export-led Growth in Soy Production in Brazil,"
[62] Greenpeace has claimed that Amazonian forest clearance increased 40% between 2001 and 2002 because of soybean farming.
[63] IIED, op.cit.
[64] The WWF Reports that only 7 of the 37 Nature reserves in Mato Grosso are demarcated and policed by the state environment agency (FEMA).
[65] D´Alembert, J. et al., op. cit.
[66] http://www.inece.org/newsletter/10/regional_americas.html
[67] www.adventurefarming.com
[68] D´Alembert, J. et al., op. cit.
[69] Farmers assert that the law requiring inclusion of deforested land in the reserve acreage calculation provides an incentive to develop new land. www.adventurefarming.com
[70] www.sustainablesoy.org
[71] Idem.
[72] Idem.
[73] "An Outlook on Growth in the Brazilian Soy Industry," presented by Fabio Triguerinho at the Roundtable on Sustainable Soy Conference, 17-18 March, 2005, Foz do Iguacu, Brazil. Available at www.responsiblesoy.org
[74] Idem

[75] D´Alembert, J. et al., op. cit.
[76] Interpress Service News Agency, Oct. 18, 2004.
[77] www.adventurefarming.com
[78] Niesten, E.T, Rice, R.E., Ratay, S.M. and Paratore, K (eds.). "Commodities and Conservation: The Need for Greater Habitat Protection in the Tropics." Washington D.C., Conservation International, 2005.
[79] www.adventurefarming.org
[80] "Environmental Sustainability Index (ESI): Benchmarking National Environmental Stewardship." Esty, D.C., M. Levy, T. Srebotnjak, and A. de Sherbinin, eds. New Haven: Yale Center for Environmental Law & Policy, 2005. Available at http://www.yale.edu/esi/b_countryprofiles.pdf
[81] "Brazil Country Profile." World Resource Institute, 2005. Available at http://earthtrends.wri.org/text/environmental-governance/country-profile-26.html
[82] Idem.
[83] WTO, Trade Policy Review Body. "Trade Policy Review – Malaysia." Report by the Secretariat, WT/TPR/S/92, 2001.
[84] Idem.
[85] Amiruddin, Mohd, N. "Palm oil products exports, prices and export duties: Malaysia and Indonesia compared." *Oil Palm Industry Economic Journal,* Vol. 3 No. 2 (2003): 21-31.
[86] Petebang, Edi. "Illegal logging rampant along Indonesian-Malaysian Border." Jakarta Post May 23, 2000. Available at http://www.dayakology.com/publications/articles_news/eng/illegal.htm
[87] Tan, A. K-J. "Recent Institutional Developments on the Environment in South East Asia – A Report Card on the Region", Singapore J. Comp. & Int'l. Law, Vol. 6 (2002). Available at http://law.nus.edu.sg/apcel/docs/Alan%20K.J.Tan.pdf
[88] Dros, J.M. "Accommodating growth: two scenarios for oil palm production growth." AIDEnvironment, 2003.
[89] Teoh, C.H. "The palm oil industry in Malaysia: from seed to frying pan." Report for WWF Switzerland, 2003.
[90] Basiron, Y., N. Balu, and D. Changrmohan. "Palm oil: the driving force of world oils and fats economy." *Oil Palm Industry Economic Journal,* Vol. 4 No. 1 (2004): 1-10.
[91] FAO. The State of the World's Forests 2003, FAO, Rome, 2003.
[92] Teoh, C.H. "Land use and the oil palm industry in Malaysia." Report for WWF-Malaysia, 2000.
[93] FAO. The State of the World's Forests 2003. op. cit.
[94] Wakker, E. "Greasy palms: the social and ecological impacts of large-scale oil palm plantation development in Southeast Asia." Friends of the Earth, London, 2004.
[95] A few concerns have been raised on compliance in Sabah and Sarawak.
[96] IPM is a regimented approach to eliminating pests and reducing crop loss that applies biological, cultural and a minimum of chemical measures.
[97] The oxygen depleting potential of palm oil mill effluent (POME) is 100 times that of domestic sewage, and every ton of palm oil produced generates 2.5 tons of POME.
[98] Corley, R.H.V., and P.B. Tinker. The Oil Palm. Fourth Ed. World Agriculture Series, Blackwell Publishing, 2003.
[99] Teoh, C.H. "Land use and the oil palm industry in Malaysia." Report for WWF-Malaysia, 2000.
[100] Simeh, A., and T. Ahmad. "Case study on the Malaysian palm oil industry." Presented at the Regional Workshop on Commodity Export Diversification and Poverty Reduction in South and Southeast Asia, Bangkok 3-5 April 2001, UNCTAD and ESCAP.
[101] WTO, Trade Policy Review Body. "Trade Policy Review – Indonesia." WT/TPR/S/117, May 28, 2003.
[102] USTR. "2005 National Trade Estimate Report on Foreign Trade Barriers." USTR, 2005. Available at http://www.ustr.gov/Document_Library/Reports_Publications/2005/2005_NTE_Report/Section_Index.html
[103] WTO, Trade Policy Review Body. "Trade Policy Review – Indonesia." op. cit.
[104] USTR. op. cit.
[105] Idem.
[106] Dros, op. cit.
[107] WTO, Trade Policy Review Body. "Trade Policy Review – Indonesia." op. cit.
[108] Casson, A. "The Hesitant Boom: Indonesia's oil palm sub-sector in an era of economic crisis and political change." CIFOR Occasional Paper No. 29, 2000.
[109] This program contains written guidelines for specific industries, such as textiles, electroplating, tapioca, tanning, pulp and paper, palm oil, and gold mining.
[110] Siscawati, 2001; Glastra R, Wakker E, and Richert W. "Oil Palm Plantations and Deforestation in Indonesia. What Role Do Europe and Germany Play?" WWF Germany. 2002.
[111] Casson, op. cit.
[112] Wakker, E. "Greasy palms: the social and ecological impacts of large-scale oil palm plantation development in Southeast Asia." Friends of the Earth, London, 2004.
[113] Glastra R, Wakker E, and Richert W. "Oil Palm Plantations and Deforestation in Indonesia. What Role Do Europe and Germany Play?" WWF Germany. 2002.
[114] Idem.

IPC Sustainability Program: Commodity Study

Specific Environmental Effects of Trade Liberalization: Oilseeds

Agricultural production is intimately connected with aspects of economic development and environmental sustainability. As a sector that employs seventy percent of the world's poorest citizens and uses half of the world's habitable land, changes in agricultural policy have a direct bearing on the creation of economic welfare. As its basic inputs – land, water, air, plants and animals and their interactions – comprise the environment, agricultural management is closely linked to that of the earth.

Agricultural trade, however, remains highly distorted, and while producers' decisions regarding the various aspects of food production and land use are driven by signals in the domestic and international policy environment, those signals often misrepresent the market and distort resource allocation. The subsidization of agricultural inputs such as water and animal feed, for example, has been shown to maintain unsustainable densities of livestock and has prevented the adaptation of more efficient and sustainable production techniques. Trade policy reforms now being considered on a multilateral level are certain to have both positive and negative repercussions for environmental sustainability. Therefore, **it is vital that we understand how domestic agriculture and trade policies will affect environmental sustainability.**

To address these challenges, the IPC has convened a task force on sustainability and trade, which includes experts in environment, economics, farming and science as well as former government officials and corporate executives. The IPC Sustainability Task Force has developed a framework to illustrate the linkages between government policies and the promotion of sustainable agriculture and enhance the understanding of how the agricultural and trade policy environment can promote or impede sustainable agricultural production.

This study on oilseeds is the first to test this analytical framework and provide concrete evidence of linkages between trade policy and sustainability. Using the framework this study assesses how the policies for oilseeds affect environmental, economic and, where relevant, social sustainability.

About the IPC

The International Food & Agricultural Trade Policy Council (IPC) convenes high-ranking government officials, farm leaders, agribusiness executives and agricultural trade experts from around the world and throughout the food chain to build consensus on practical solutions to food and agricultural trade problems.

An independent group of leaders in food and agriculture from industrialized, developing and least developed countries, the IPC's members are chosen to ensure the Council's credible and impartial approach. Members are influential leaders with extensive experience in farming, agribusiness, government and academia.