Preface

The International Institute for Environment and Development (IIED), ProForest and Rabobank International were commissioned by the International Finance Corporation (IFC)'s Corporate Citizenship Facility and WWF-US to research the environmental and social issues associated with the production of a wide range of agribusiness commodities. The project aimed to understand how useful the development and application of 'Better Management Practices' (BMPs) would be for these commodities. Specifically, the project has sought to provide guidance on:

- the commodities future initiatives should focus on;
- the potential partners for these initiatives; and
- the key opportunities and constraints associated with each commodity.

The first phase consisted of a scoping review, which involved the collection of basic data and industry intelligence on each of ten commodities (cocoa, coffee, cotton, oil palm, salmon, shrimp, soy, sugar, tea and timber pulp). At the end of the first phase, IFC and WWF-US selected four commodities (cotton, palm oil, soy and sugar) for further investigation, on account of the perceived magnitude of sustainability impacts, financial sector traction, and the potential added value of an IFC/WWF initiative for each commodity.

This report is the product of the second phase of the project and is intended as a basis for discussion regarding future work on BMPs and agribusiness commodities. For each of the four selected commodities, it sets out background information on the sector; key environmental and social impacts; prospects for tackling these impacts through the adoption of BMPs; and preconditions, risks and strategic choices in relation to developing a BMP approach. The four commodity-specific chapters are preceded by a summary of common themes and potential approaches that emerge.

The research focused particularly on production issues (rather than processing, trading or retail). Processing issues were addressed where they are integrated with primary production (e.g. carried out at the same location as production). However, where non-production issues have significant implications in terms of the potential for BMPs, the research also highlights these.

This report was written by IIED and ProForest in co-operation with Rabobank. Readers should note that the report is intended as a rapid, 'first-pass' assessment of these commodities, and, given the evolving nature of commodity production and trade, elements of the report may be inaccurate or out of date. Furthermore, it should be emphasized that Rabobank provided input for this publication and was not involved in the final editing or writing of the report. As such the report does not necessarily represent the views of Rabobank in all areas.

4 Soy

4.1 The soy sector

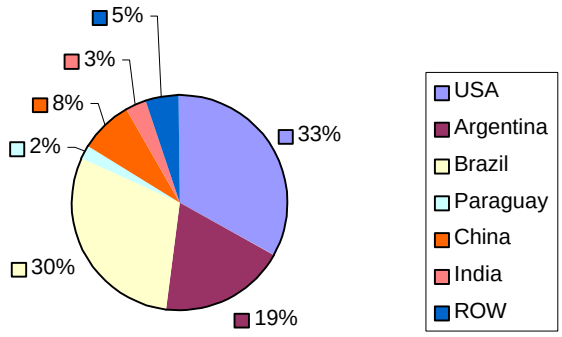
4.1.1 Production volumes and regions

Soybeans were first grown as a crop in China 5000 years ago. The first shipment occurred in 1804 when a Yankee clipper, returning from China to the US, carried a cargo of soybeans as ballast. The first commercial crop of soybeans was planted in 1929 to provide beans for soy sauce. Soybean is now an essential and dominant source of protein and oil with a multitude of uses in both human food and animal feeds and with numerous industrial applications. Soy is an annual crop, now grown widely on all continents (figure 4.1), mostly in temperate zones. Most soybeans are crushed to produce soymeal (e.g. for animal feed) and soy oil. However, a small percentage is used directly in food consumption, primarily in Asia.

Figure 4.1: Top 10 soy producers, consumers, exporters & importers (basis average 1997/02)[45]

	Production		Consumption		Exports		Imports	
Rank	Country	"000T	Country	"000T	Country	"000T	Country	"000T
1	USA	74.746	USA	44.165	USA	26.009	EU15	16.543
2	BRAZIL	35.999	BRAZIL	21.928	BRAZIL	11.852	PRC	8.108
3	ARGENTINA	23.860	ARGENTINA	17.122	ARGENTINA	4.626	JAPAN	4.875
4	PRC	15.000	EU15	16.160	PARAGUAY	2.195	MEXICO	3.418
5	INDIA	5.194	PRC	15.450	CANADA	726	TAIWAN	2.365
6	PARAGUAY	3.140	INDIA	4.492	PRC	217	INDONESIA	1.103
7	CANADA	2.519	MEXICO	3.873	BOLIVIA	134	BRAZIL	835
8	EU15	1.331	JAPAN	3.772	URUGUAY	36	ISRAEL	602
9	INDONESIA	1.185	S-KOREA	1.169	VIETNAM	34	ARGENTINA	446
10	BOLIVIA	1.105	BOLIVIA	1.105	HONGKONG	16	IRAN	375

Figure 4.2. Global soybean production in 2003 (million metric tonnes)[46]



The USA has been the world's largest producer of soybean for many years, with South America recently becoming a dominant producer, followed by China and India (figure 4.2). Most of the soybean grown in the USA is cropped in rotation with corn on prime agricultural land in the US 'corn belt'. The states of Iowa, Illinois and Minnesota are the largest producers. Production in the USA is expected to remain stable. Soybean production in Brazil, Argentina, Paraguay and Bolivia is rapidly increasing.

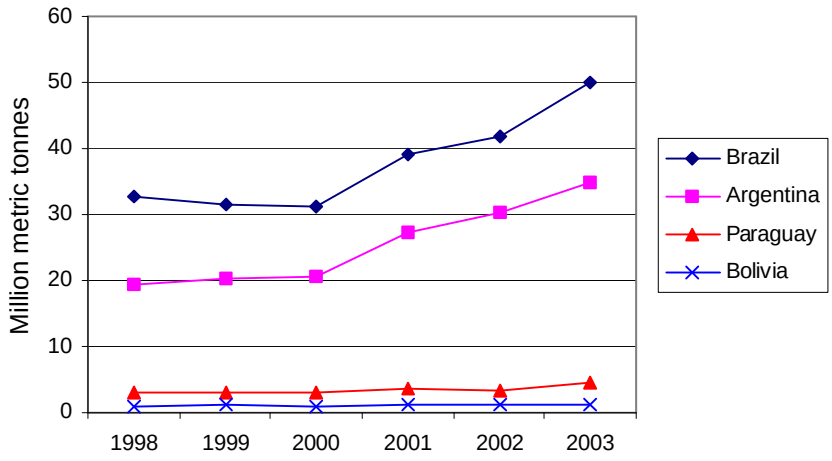
[45] Source: Rabobank International.
[46] Source: USDA. Based on total production of 202 million tonnes.

Brazil is likely to surpass the USA in the next few years as the world's largest producer. Brazilian output currently represents about 27% of global production; Argentina 18%; and Bolivia and Paraguay approximately 3% between them. China produces about 8% of the world's soybean but is a net importer. India produces about 2% of the world's soybean, and exports soymeal, primarily to Asia.

The production of soybeans is migrating from North to South America, due to cost competitiveness and the large potential for further acreage growth (figure 4.3). South American countries enjoy a large production cost advantage compared to the US, especially in relation to land costs. This competitiveness has been further boosted by the recent devaluations of the Argentine and Brazilian currencies. Additionally, improvement in yields, particularly in Brazil, and the adoption of GM soybeans in Argentina has allowed production to double in the last 10 years. The USA is expected to continue as an important player because of its large domestic demand for soybean meal and oil, its large crushing capacity, its efficient logistical infrastructure and both direct and indirect farm support.

Production in South America is strongly geared to export. In 1999 Brazil exported 65% of its soymeal production and 38% of its soy oil. Brazils domestic demand for meal and oil is also growing, but this is less true of Argentina. The biggest export markets for soymeal are the EU and China. Exports of soymeal from South America to the EU and China have grown dramatically over the last 5 years. The USA is still the worlds leading exporter of un-processed soybean, but exports far less meal and oil than Brazil and Argentina, and consumes correspondingly more of these products. It currently exports about 37% of its soybean production. Its major customers for unprocessed soybean are the EU, China, Japan and Mexico.

Figure 4.3 Growth in South American soybean production since 1998[47]



4.1.2 The value chain

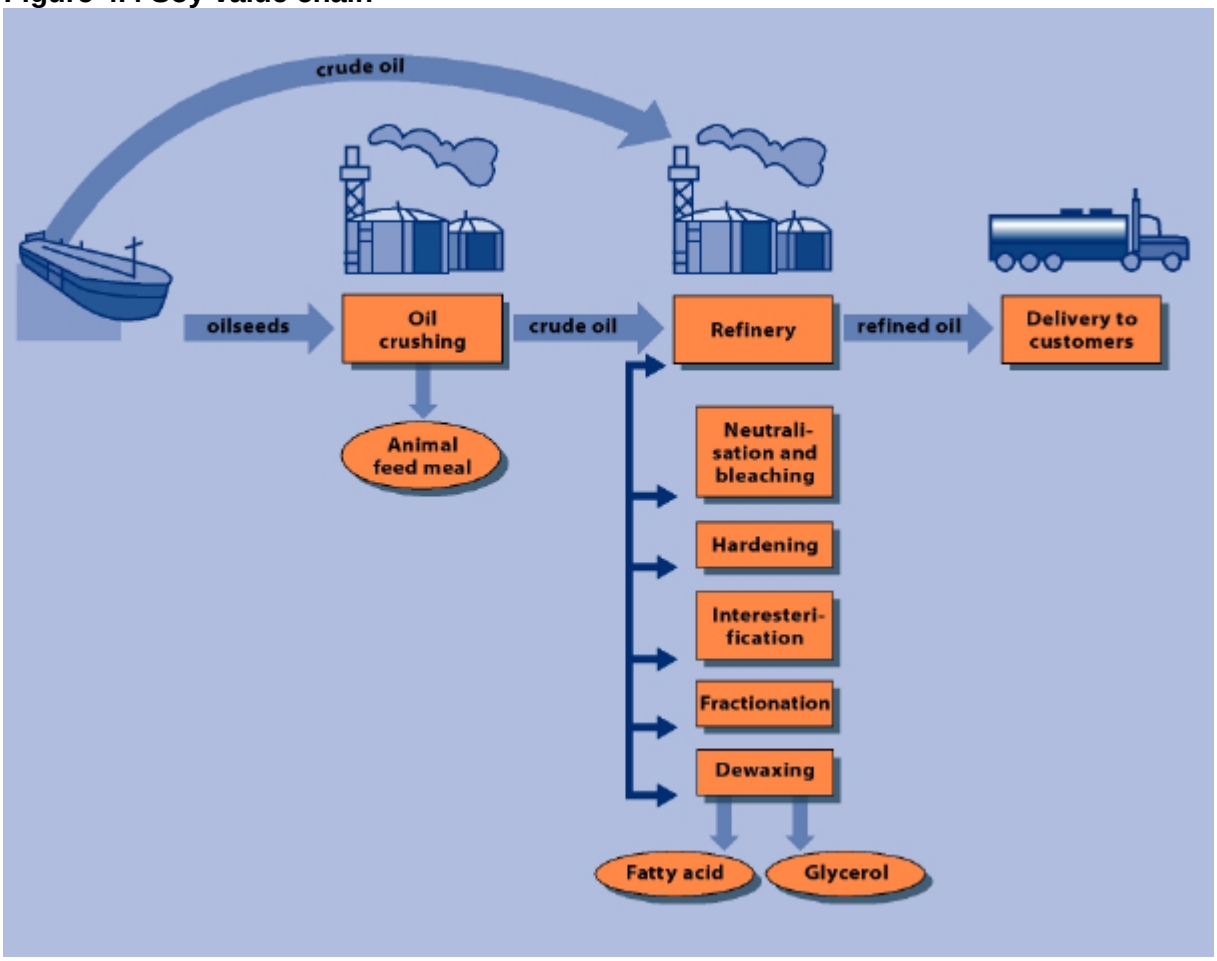
Figure 4.4 presents a typical soy value chain. Once the crop has been harvested, it is sold to a trader or collector, who collects the soybeans, stores them if necessary and sells them on to the crushing or processing industries. There are also increasing instances of crushing companies purchasing directly from the producer, sometimes through contract farming arrangements. At a global level there are a limited number of oilseed traders but competition between them is fierce. These global traders are also active in crushing and in the trade of oil and meal as this allows them to exploit price differentials within the oilseed complex (seeds, meals and oils) given that they can alternate between selling unprocessed beans, or oil and meal as prices change.

[47] Source: Dros 2003 *Accommodating growth: Two scenarios for soybean production growth*. AIDEnvironment / WWF.

The USA was the largest crusher in the world, but recently the volume of soybeans crushed in South America (Brazil and Argentina combined) has exceeded that of the US. The crushing of soybeans in China is increasing rapidly as a result of the growth of protein requirements for the animal feed industry. New investments in crushing capacity in the former Soviet Republics is realigning crushing capacity in Europe, reflecting higher import requirements of soybeans into the CIS republics as well as the CEEC countries. In the EU and its immediate surroundings, crushing capacity is shifting from west to east, as new capacity is constructed in the CEEC countries that will shortly join the EU. China has recently become the world's largest importer of soybeans, ahead of the EU with estimates for the current crop year exceeding 25 M tonnes.

During the crushing process the soybeans are cleaned, cracked, dehulled and rolled into flakes. This ruptures the oil cells for efficient extraction. After removal of the soybean oil, the remaining flakes are processed into various edible soy protein products or used to produce protein meal for animal feeds. Soybeans yield 70-80% meal when crushed, and the majority of revenues are derived from meal. The fact that there has been sustained demand for protein meal has driven soybean production in particular in Brazil and China where demand growth for protein meals is high. In most countries soybean meal is used as a protein supplement in animal feed, although in China and Japan it is also used extensively as fertiliser and soil conditioner. Demand for it is dependent on livestock populations as well as on the price of competing animal feed ingredients, in particular cereals. Soybean oil is the co-product from crushing. It can also be seen as a main product in view of its higher overall value. Most soy oil is destined for human consumption, in particular cooking oils, margarines and shortenings in the baking industry. The market for soy oil for non-food applications is small but growing, mainly because the high prices of petroleum have aroused interest in fuel uses of vegetable oils, including soy oil.

Figure 4.4 Soy value chain



4.1.3 The different types of producers

Soybean is not a subsistence crop and is generally grown on a large scale with extensive mechanisation and low labour inputs. In the Americas, soybeans are mostly grown on large-scale farms (1,000 to 3,000 ha), whereas there are some small-scale producers in Asia.

4.1.4 Financing requirements within the sector

Financing requirements for soy crop **production** can be broadly divided into two categories: short term crop financing (working capital), and long term agricultural development financing (e.g. for infrastructure projects, irrigation, etc.). Short term crop financing is required for farmers to purchase inputs (e.g. fertiliser, agrochemicals) required to produce their crop. Such finance is an activity primarily for domestic banks whereby the farmers provide security via a mortgage over land or equipment.

In the case of large farms or estates in South America, finance can be channelled to farmers through the crusher. This allows international banks to participate in the short-term financing requirements of farmers. The relationship between crusher and grower is close, even in the event that the crusher is based overseas. Additionally, there is a trend for crushers to provide certain social benefits (e.g., schools, medical/first aid facilities) that can be accessed by growers and the processor's staff.

Longer term financing of projects, designed to have a lasting impact on the size or efficiency of agricultural operations (e.g., development of new crop land, establishment of new irrigation schemes) in developing and emerging markets, often tends to be driven by international, regional or national development banks rather than the private sector, given the risk/reward profile of such projects and their time frame.

Processors also have both short- and long-term financial requirements. Working capital is required in order to buy the soybeans and process them into oil and meal. Longer-term finance is required for such investments as capacity expansion, updating of factory technology, or for acquisitions.

Large scale and profitable processors are well equipped to raise funds for working capital from local or international commercial banks on the basis of their own creditworthiness, even without issuing a corporate guarantee to a bank. Another alternative for powerful players is to issue short-term debt via commercial paper in order to raise funds for working capital.

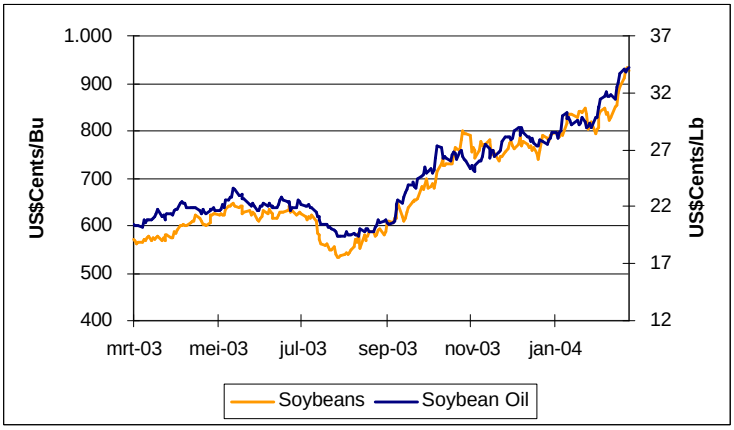
In some developing and emerging markets, crushers may not be financially robust enough for commercial banks (local or international) to accept such corporate guarantees. This particularly applies in markets with heavy import duties for processed products e.g. India. However, in such cases there are generally alternative means of providing working capital via pledging assets to the bank. These assets may be soy meal or oil stocks, as well as receivables from creditworthy clients of the crusher. The main risks facing the crushing industry are interest rate, currency and underlying commodity price risks. The industry has highly developed risk management practices. The Chicago Board of Trade (CBOT) houses one of the most efficient (and liquid) futures contracts in the world, often referred to as the soybean complex. This quotes online prices for soybean, soybean meal and soybean oil for up to two years in advance. Since the CBOT is increasingly becoming a global reference for the soybean complex, there are plans to broaden delivery points also outside the USA (e.g. in Brazil and/or Argentina).

Longer-term financing does not present significant problems for the large crushers that are part of large international conglomerates such as ADM, Cargill, Bunge and Louis Dreyfus. And even for domestic crushers, access to finance with tenors[48] over 1 year is feasible. However, it should be noted that the recent rapid price increase of the soybean complex (soybeans, soy meal and soy oil) has caused most traditional banks to increase the availability of credit in countries where production or consumption has grown rapidly. As such the rapid production increase in Brazil and Argentina and the strong increase in import requirements in China resulted in record high working capital requirements for active players in

[48] The length of time until a loan is due.

the soy industry. Figure 4.5 illustrates the extent to which the prices of soy and soy products have rapidly increased over the last year, mainly as a result of lower output in the Americas and record demand for soybeans and products in Asia, in particular in China.

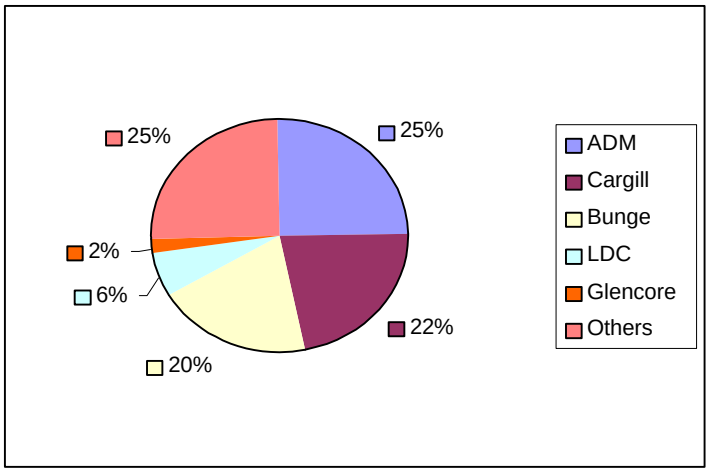
Figure 4.5 CBOT prices soybeans/oil, 2003-04[49]



4.1.5 Key players and financiers by region

As stated above, soybean growing increasingly takes place on large estates, a trend which is driven by the crushing industry being highly concentrated. The five largest crushers (ADM, Cargill, Bunge, Louis Dreyfus and Glencore) account for more than 75% of global crushing and are typically highly integrated large-scale producers (figure 4.6). Domestic or local crushers in the various production regions undertake the remaining 25%. But even the latter typically operate large-scale crushing facilities in order to capture sufficient economies of scale. As in any commodity setting, logistics continue to play an important role in lowering procurement costs and give larger companies a competitive advantage over smaller ones.

Figure 4.6 Global crush capacity by company[50]



USA

As the world's largest soybean producer, the United States is also the largest crusher and user of soy meal and oil. Within the US oilseed crushing business, soybeans account for 92% of the processed volume, followed by cottonseeds and sunflower seed crushing. As such, soy crushing drives the US oilseed crushing industry. Furthermore, in contrast to other agribusiness sectors, the US oilseed crushing industry is relatively exposed to volatility and competition from world trade. A weakening

[49] Source: Bloomberg.
[50] Source: Rabobank International estimates.

demand for oil meals together with the expansion of soybean production in South America may pose a threat to the US farmer who may turn to alternative crops.

The main crushers in the US are ADM, Cargill and Bunge. Generally speaking, access to finance for most of these companies is easy, and they are usually financed by major home-country banks. Among this group, the leaders are probably Citibank, Bank of America, Bank One, Standard Chartered, CoBank ABC and JP Morgan Chase & Co. Union Planters Bank, SunTrust Bank, Northern Trust, Mellon Bank are also active in the soy business.

Brazil

Soybean will continue to dominate Brazil's agricultural mix for the foreseeable future. However, in recent years crushing in Brazil has stagnated somewhat, in contrast to Argentina, where it has doubled. Brazil has managed to capture increasing demand for soybeans, especially in Europe and China. Argentina, by contrast, is attempting to increase domestic oilseed production in an effort to halt the rapid rise of soybean imports. Countering this is Brazil's soybean growing and marketing experience, (characterized by consistent, good yields); US weather-related price rallies; and a weakening currency favouring dollar-denominated exports.

The dominance of international crushers in Brazil is relatively low as more than half of the crushing capacity is in domestic hands. The Brazilian company Amaggi is the largest crusher in the country and continues to expand. This means that Brazilian banks are heavily involved in the soybean industry. Global players operating in Brazil are first and foremost Bunge, followed at a distance by Cargill and ADM. Louis Dreyfus is also present in Brazil, although less dominant here than in Argentina.

The leading banks involved in the soybean industry in Brazil are Banco Ribeirao Preto, Banco Europeu, Brasil Sudameris, Itau Bank, Banco Espirito Sancto, Banco Santos de Brasil and Bradesco Bank. In addition, most large US and European banks are directly or indirectly active in Brazil, as are many specialised financial service companies.

Argentina

The most active multinational companies in the crushing sector are Cargill, Bunge, Dreyfus and Glencore, but domestic players also remain significant. Soy production, crushing and exports are continuing to increase. Indeed, Argentina has overtaken Brazil as the largest exporter of soy oil and meal in South America. Argentine farmers have been very quick to adopt genetically modified soybeans and the cultivated area for these varieties now exceeds 90% of the total area planted to soybeans. This gives Argentine farmers a cost advantage (as do their lower average crushing costs in comparison with Brazil), but means that they do not benefit from access to the EU market.

Leading banks active in soy crushing in Argentina are Banco Nacion and Banco de Rio, which is a subsidiary of Banco Santander in Spain. In addition, most large US and European banks are directly or indirectly active in Argentina, as are many specialised financial service companies.

Europe

While US soy crushers are shifting capacity to South America, western European crushers are increasingly turning towards Eastern Europe and Russia. Until recently, European crushers have had the reliable alternative of increasing rapeseed supplies, and feed producers can rely on rapidly expanding soy meal supplies out of South America. This trend is likely to continue as the EU will be enlarged by 10 new member states in 2004 and as feed production is further curtailed in the EU-15.

Leading banks involved in the European soy industry are BNP Paribas, WestLB, Credit Lyonnais, Commerzbank AG, SocGen, HSBC, ABN-AMRO, ING, Fortis and Rabobank. KBC Bank, Standard Chartered, Deutsche Bank, DZ Bank, Credit Suisse, Credit Agricole, IntesaBci are also active in the EU soy business.

Asia

Rapid growth in crushing in Asia is mainly driven by Chinese consumption. As a result of an internal policy favouring local crushers through tariff differentiation, there has been a shift in crushing capacity from the US to China. This has led to a rapid increase in import requirements of beans – in 2004 this is set to be in excess of 25 million tonnes. The key players in China's vegetable oil industry are vertically integrated and located near major ports or close to big urban zones. The large multinational crushers are mostly active in the domestic market through joint ventures with local groups, e.g. ADM is closely linked with Wilmar.

The main banks actively involved in financing the soy industry in Asia are the global trade finance banks like Fortis, Standard Chartered, HSBC, SocGen and Rabobank. Local banks involved in financing the processing industry are the big four Chinese banks (Bank of China, Industrial & Commercial Bank of China, Agricultural Bank of China and the Construction Bank of China). The Development Bank of Singapore, and Thai banks such as Bangkok Bank, Thai Farmers Bank and Krung Thai Bank, also finance domestic trading companies.

Traders and end users

Crushers: Soybeans and related products are traded to a large extent by local exporters and/or regional distributors and there are few companies that could be described as global soy traders. However, global crushers do trade large volumes of beans, meal and oil themselves mainly as a result of their strong origination network. The number of banks involved with these large players is enormous. In practical terms, large, well-capitalised companies with dominant positions in their own markets are attractive customers for banks. This means that it is difficult to provide an exhaustive list of banks involved with these companies. In addition, most of the local and national players – and many international traders – are privately owned, which makes it difficult to obtain reliable data.

Refiners: Most of the oil produced needs to be refined for further application in food production. The large multinationals such as Cargill, ADM and Bunge are to a large extent forward integrated. Despite the fact that the refining industry has undergone a process of consolidation, the market is still divided between global players (e.g. Saipol, Aarhus Olie, Unimills, Karlshamn and Unilever), and family-owned refining and bottling companies, each with a distinct regional focus. The latter are often financed by local banks, or international banks with a local presence.

Further processing: Little data is available on companies that further process soy meal, but it is clear that a large proportion is used directly or indirectly (through the compound feed industry) for the production of animal protein. Only a minority is used by the food and chemical industries. The compound feed industry tends to be regionally structured, but there are a few large players active in the industry that are forward integrated to a large extent. Land O Lakes Farmland (US), Charoen Pokphand (Thailand), Tyson Foods (US), Cargill (US) and Zen-Noh co-operative (Japan) are among the top 5 companies active in this sector. The current trend in the industry towards further integration within the value chain from feed to food may lead to larger companies being established in the near future.

Other stakeholders

- Seed companies: Monsanto; EMBRAPA (Brazilian government agriculture research and development organisation) has been active in the development of improved seed for Brazilian farmers.[51]
- NGOs including AIDEnvironment, Cordaid, WWF, Friends of the Earth, Greenpeace.

[51] Companies in other sectors may become key stakeholders in the future, even though their interest is not yet significant. For example, Dupont is involved in work to use agricultural raw materials, including soy, to produce fibres, paints, etc. If this emerging technology takes off, such companies may be key soy stakeholders in the next one or two decades.

4.1.6 Macro issues facing and affecting production

Trade restrictions and subsidies: Trade in oilseeds is free relative to most other agricultural commodities but many countries impose import duties, especially on vegetable oils and to a lesser extent on oilseeds and meals. Governments have been withdrawing from direct intervention in domestic markets (for example the EU15 and the US). In many other countries state trading agencies regulate the domestic market. Nevertheless, US government subsidies for domestic soybean production have expanded rapidly since 1996 to provide a financial safety net for US farmers. A perceived effect of these has been to maintain pressure on South American farmers to expand their production capacity and lower their costs. These subsidies, which include export assistance, have led to knock-on effects on the price of other oil seeds. The long-term decline in the price of vegetable oil is believed by some to be due to over production in the soy sector.[52] The latest Farm Bill (2002) in the USA has been favouring corn in order to increase ethanol production, and there has been a partial migration by farmers from soy to corn.

GMOs: Oilseeds were early targets for genetic engineering and much of the early research was taken on rapeseed and soybeans. The US, Argentina and Canada have been the leading adopters of GM crops. Genetic modification has been controversial in a number of important consuming countries with some countries having restricted access for GM products to their markets. This has hindered trade both directly, through requirements for safety certificates and indirectly through food processors reformulating their products and/or excluding GM sources. Sales of US and Argentinean soybeans to the EU15[53] and China have declined significantly as a result. The range of measures includes import restrictions on sanitary and phyto-sanitary grounds, and the introduction of technical requirements such as product labelling and traceability. New EU legislation re-affirming a commitment to labelling of GMOs and GM derived products (EC Regulation 1830/Sept 2003) is likely to further depress US and Argentinean soybean imports to the EU. Brazil, where the growing of GM soybean was illegal, had enjoyed preferential access to EU and Chinese markets. However, the ban was lifted in September 2003 amid considerable controversy, and the use of GM soybean is now legal. It remains to be seen how this will affect Brazilian exports.

Investments in Brazil and Argentina: Soybean exports have increased as a result of large investments in Brazil and Argentina more than offsetting lower US exports. Brazil is still the second largest producer (after USA) but will soon be first if current growth continues. The Avanca Brazil programme has greatly facilitated the development of the export market through improved transport links. There has been a substantial increase in the proportion of soybeans and soybean oil traded internationally over recent years, as crushing in the country of destination has risen. Destinations are widespread. Oversupply is thought to be a problem, although current global demand for soymeal remains strong, fuelling continued growth in the sector.

There has been massive **growth in Chinese soybean imports** over the last 10 years (by 1000%, according to the Corn and Soybean Digest, 1 March 2002), accounted for by growth in livestock production in China.

[52] Rao, V. (2003) in: *Globalisation and its impact on the palm oil industry. Proceedings of an International Planters Conference 2003*.

[53] China had also imposed restrictions on the import of GM soybean (in 2001), which temporarily affected US exports, but these restrictions have now been eased (as of February 2004).

4.2 Key sustainability impacts

The major social and environmental impacts of soy production are described below. The order of this list is not intended to reflect an assessment of priority, for two reasons: Firstly, although there are numerous case studies and other sources identifying impacts, there are currently no assessments of how common (or severe) each of the impacts is over a wide geographical range. Secondly, it is likely that the severity of each impact will differ between production locations. Nevertheless, all have been reported as significant in one or more instances.

4.2.1 Environmental impacts

Forest and savanna conversion: Expansion of cultivation into forest areas is regarded by WWF as a major threat to biodiversity, especially in the drier savanna areas of the Brazilian centre west (the cerrado ecoregion) in the states of Piaui and Mato Grosso. The cerrado is home to around 10,000 species of plant of which 4,400 are endemic to central Brazil as well as endangered animals such as the maned wolf, the giant armadillo and the giant anteater. The cerrado is one of the least protected ecosystems in Brazil. For example, only 7 of the 37 Nature reserves in Mato Grosso are demarcated and policed by the state environment agency (FEMA).[54] The southern margins of the Amazon rainforest are also threatened by the expansion of soybean agriculture. Greenpeace claim Amazonian forest clearance increased 40% between August 2001 and August 2002 as a direct result of soybean farming. Soybean farming has been cited as a major cause of clearance of 795,000 hectares of forest in Mato Grosso in 2002, helping the soybean area grow by 18% to 4,500,000 ha.

The low cost of real estate has stimulated rush to acquire land. Irregular land transfers are reportedly common in the three key states of Brazil (Piaui, Mato Groso and Amazonas) but especially so in Piaui. There is also an apparent lack of land use planning and agro-environmental zoning in this area. Environmental impact assessments are required for clearances over 1000 ha, but it has been reported that some producers sub-divide the legal holding of farms to circumnavigate this regulation. The Forest law states that 35% of all landholdings in the Piaui cerrado should be protected in their natural state. However this legislation is poorly enforced, due to a combination of Environment Agency (IBAMA) personnel limitations and the rapid pace of land ownership change and agricultural expansion.

The development of soybean varieties that will perform well in higher rainfall tropical areas of the Brazilian north west is will make the cultivation of these areas more economically attractive and may well lead to increased forest conversion within the Amazon basin. In Mato Grosso, yields of soybean have increased from 2.4 tonnes/ha in 1995 to 3.1 tonnes/ha in 2003 thanks to research by the Brazilian government agricultural research corporation EMBRAPA.

The majority of Argentina's recent expansion in soybean agriculture has come through the use of readily available agricultural land. However, the Argentinean government has set aggressive targets to further expand the agricultural area in order to bring about another dramatic increase in soybean production for export. It is thought this will come at the expense of areas of the forested Chaco biome (in the north) and the remaining Atlantic forest in Missiones. These biomes, together with the remaining Atlantic forest of Paraguay are now highly threatened. One estimate predicts that they may have disappeared completely by 2010.[55]

Clearance techniques: It is considerably easier to clear savanna lands for agriculture than forest. Initial clearing involves two crawler tractors dragging a heavy chain between them, which strips out most native vegetation. Wood waste must be collected and manually cut for burning or transport, and roots are cleared manually to facilitate machine planting. Fires resulting from agricultural clearance of savanna areas affected 1.2 million hectares of rainforest land in the northern Amazonian state of

[54] Bickel and Dros 2003 *The impacts of soybean cultivation on Brazillian ecosystems*, WWF.
[55] Dros 2003 *Accommodating Growth: Two scenarios for soybean production growth*. AIDEnvironment/WWF

Roraima in 1998. Clearance of forest margins causes drying in the exposed forest, increasing the risk of fire.

Soil Erosion: Soil erosion arises from poor soybean cultivation practice and inadequate provision of riparian buffer zones. Erosion reduces the fertility of the soil and pollutes water courses with sediment. Conservation tillage practices can combat the erosion risk, but are not suitable on all soil types. The practice of reduced or zero-till cropping can reduce soil erosion, but is dependent on the heavy use of herbicide.

Chemical use: Conventional soybean cultivation also requires heavy pesticide use, and with inadequate attention paid to erosion and runoff, pesticide contamination of watercourses is reportedly commonplace.[56]

GM Soybean: The use of GM Roundup Ready Soya (RRSB) promises to lower production costs by decreasing the total amount of herbicide used on the crop by 20%. For this reason, it has quickly become very popular amongst South American farmers who wish to maintain low production costs. However, RRSB can only be sprayed with Roundup, increasing the farmers' dependence on this chemical herbicide and its producer (Monsanto) who also provide the RRSB seed. The combined cost of the seed and the herbicide can become a significant burden to farmers once they are committed to its use. Various ENGOs (e.g. Greenpeace and FoE) have raised concerns about the environmental impact of GM crops and their safety for human consumption. Soya production in the US and Argentina is heavily dependent on GM technology.

The use of GM soybean remains a controversial issue. The EU has recently re-affirmed a commitment that all imported GM food or feed products should be labelled, to facilitate consumer choice. It remains likely that EU buyers will continue to demand GM free ingredients and meat fed on non-GM feed and that there will be a premium market for non-GM soybean.

4.2.2 Social impacts

Changing land use: Large-scale expansion of industrial soybean farming in subtropical areas of northeast Brazil has driven peasant farmers into more marginal areas and may indirectly contribute to increased forest conversion. Although this issue involves a complex set of inter-related factors, this is certainly one of the major social impacts cited for the recent expansion of soybean cultivation.

Land ownership: Land distribution is highly inequitable in Brazil. The large expansion of soybean cultivation in South America is believed to have contributed significantly to this problem. For example, while the number of large farms in Mato Grosso has steadily increased, the number of smallholdings fell from 23,900 in 1980 to 9,800 in 1996.[57]

Labour issues: Soybean is not a subsistence crop. It is generally grown on a large scale with extensive mechanisation, low labour inputs and high inputs of pesticide and herbicide. The expansion of soybean agriculture into subsistence farming areas inevitably results in a loss of rural employment and urban migration. While the initial clearance of land can be relatively labour intensive, cropping soybean in Piaui requires about one worker per 200 ha. Working conditions can be extremely poor for casual labourers clearing, cutting and preparing land for planting. Workers were paid $1.70 a day, or $0.27 for cutting a stacked cubic metre of wood. Some instances of slavery have been reported by the state government in Piaui.[58]

[56] Bickel and Dros 2003, op cit.
[57] ibid.
[58] ibid.

4.3 Prospects for taking a BMP approach

4.3.1 Which of the key impacts a BMP approach could seek to address

The key issues that the development of BMPs could address are:

- Forest/Savanna conversion and rational land use.
- Clearance techniques.
- Reduction of soil erosion.
- Minimising chemical use and pollution
- Fair terms, conditions and wages for farm labourers.
- Provision of appropriate protective equipment for farm workers.

The environmental and social issues listed above apply to both GM and non-GM soybean. Growing RRSB under BMPs that address the above issues may have far fewer negative environmental consequences than growing non-GM soybean on converted forest land. There are legitimate concerns about the use of GM crops, but while BMPs could specify the use of non-GM seed, this decision should be reached through the consensus of a wide range of stakeholders. It should be based on the best available scientific information about the negative (and positive) effects of growing GM RRSB, in the context of other environmental and social issues.

The potential improvements that BMPs could bring include the following:

- Reduced conversion of high conservation value areas to soya without compromising South America's potential to lead the global soybean export market. Dros (2003) claims production levels in Brazil could be maintained if existing degraded land was used in the place of newly converted lands. This would also reduce the need for new infrastructure development in frontier areas preventing further indirect deforestation.
- Rehabilitation of existing degraded land through the use of soybean in rotation with pasture and other crops will lead to higher overall productivity in these areas.
- Higher levels of on-farm biodiversity conservation and landscape diversity. Adequate zoning and rational land use, together with rigorously enforced regulations on conservation and non-intervention zones should facilitate a much higher level of on farm biodiversity conservation. Riparian buffer strips and erosion sediment traps can also be used to increase connectivity in the landscape.
- Soil conservation measures give both improved water quality and long-term productivity benefits through the maintenance of soil fertility.
- Improved labour relations and higher levels of training and competency amongst workers. This can have several indirect impacts that can lead to increased productivity, including higher levels of motivation amongst workers; fewer incidences of sickness and injury associated with dangerous working practices; and fewer incidences of labour disputes and associated lost production time.

4.3.2 To what extent there is agreement on BMPs

With the exception of reduced tillage and organic standards[59], there has been limited development of improved management practices in soybean farming. In South America attention to date has been focussed on rapidly expanding the available land base for short-term gain with relatively little development or implementation of the long-term sustainability of farming practices. As an annual agricultural crop, there are many generic agricultural BMPs that could be adopted by soy producers. In addition to these, proposed BMP approaches for soy are likely to include:

Forest conversion: There is little agreement on acceptable levels of forest loss. However most environmentalists are in agreement that all four habitat types mentioned above are associated with important high conservation values. The Amazon is well known to be of immense global ecological

[59] cf. University of Minnesota BMP recommendations for tillage and corn/soybean rotations.

value, and both the Atlantic forest and cerrado ecosystems are listed as biodiversity hotspots by Conservation International (CI). The extent of the threats and the limited extent of these two ecosystems should guide any BMP approach to set 'acceptable impacts' at very low levels.

- **Zoning and rational land use:** This implies the identification of lands that should be protected and those that can be used for soybean. The concept of HCVF may prove useful in the zoning and identification of areas to be protected. Dros (2003) has suggested existing degraded pasture land in Brazil and Argentina can be made profitable through responsible land use, reducing the pressure on forest or savanna ecosystems. One encouraging advance in this area is a project under the G7 pilot program that combined GIS-based zoning and legislation to guide land use planning in Mato Grosso.
- **Assessments of environmental impact:** Some form of assessment should be mandatory before any existing native vegetation is cleared to create new agricultural land. It will be necessary to develop generic survey techniques that can be easily and cheaply applied, even on small scales, to determine the conservation values that are important.

Conversion techniques:

- **Use of fire** The use of fire should be avoided or carefully controlled in areas contiguous with any form of natural vegetation. This will apply to most areas of Amazonia, where only 20% of any forested estate is available by law for conversion and most new agricultural land is carved out of existing forest.

Soil erosion/degradation:

- **Conservation tillage** Conservation tillage techniques are widely used in Brazil and the USA to reduce soil erosion. Various techniques have been developed to plant seed without removing post-harvest residues or disturbing the soil. Most of these techniques are specific to soil types. Adoption of conservation tillage practices may go hand in hand with the use of GM RRSB
- **Rotational Cropping:** Rotational cropping of soybean on pasture improves the quality of pasture land (through the input of nitrogen from soybean) which could increase the land's productive life span and enable higher cattle stocking levels.
- **Riparian buffer zones:** Riparian buffer strips and sediment traps have the combined effect of preventing eroded soil entering water courses in runoff, and providing some valuable wildlife habitat within an agricultural land use matrix.

Reduced chemical use and pollution:

- Adoption of agricultural techniques that minimise the use of pesticides (e.g., IPM) and herbicides;
- Adoption of guidelines for the safe disposal of toxic chemical wastes

Management of large-scale social transformation:

- Provisions for minimising the impacts on vulnerable groups, spreading the benefits to local communities, etc.

Labour terms and conditions:

- **Contracts:** Most Brazilian farms own land and machinery, but labour is hired on a casual basis. Farmers should be encouraged to provide contracts for all employees which include provisions that are consistent with international norms (e.g. appropriate ILO conventions)
- **Term and conditions:** Farmers should take appropriate actions to ensure they provide fair wages and are not using child labour.
- **Training:** Appropriate training for all personnel carrying out hazardous
- **Appropriate protective equipment** should be available to labourers at the place of work to cover all potentially hazardous operations, such as woodcutting, burning, and pesticide application.

4.3.3 To what extent different BMPs would be required for different types of producers and different regions

Environmental and social impacts that are caused by soy cultivation (rather than by expansion of the soy-producing area) are to some extent in common with other annual crops produced by intensive agriculture. These include issues such as soil erosion, over-use of pesticides, workers' terms and conditions, etc. It is unlikely that BMPs dealing with these issues would be applicable in both the USA and South America, unless regional adaptation of generic BMPs was allowed to take into account the different social, agricultural and environmental circumstances of these regions.

Land conversion is an important issue in all South American producer countries, but not an issue in North America. The native vegetation types that are threatened by the soybean expansion are different in their composition and perceived environmental value. While the disappearance of the Amazon is something that will sensitise most people, the threats to the Brazilian cerrado savanna, the Argentinean Chaco, or Paraguayan Atlantic Forest are less emotive. For this reason BMPs should emphasise that important conservation values may be present in all of these areas. Individual land holdings need to be evaluated on a case-by-case basis.

4.3.4 Examples: Where BMPs have already been identified and/or implemented

Given the priority issues identified above, thinking on new BMPs focuses on the three major environmental impacts associated with soybean production in South America: forest conversion, conversion techniques and land degradation. Issues such as chemical use, soil erosion, terms and conditions for workers etc are not specific to soy cultivation and could readily be adapted from BMPs for other crops and from international norms (e.g. ILO conventions for social issues). For example, pesticide use could be minimised by adoption of integrated pest management (IPM) systems that could be easily applied to soybean in South America.

Two initiatives that may lead to the development of BMPs are at an early stage of development:

- Development of a Roundtable on Sustainable Soy – this is expected to include leading producers, supply chain interests and NGOs including WWF. This is a parallel development to the Roundtable on Sustainable Palm Oil.
- Exploratory meetings in relation to Brazilian production, between Maggi, IFC, TNC and WWF.

4.4 Obstacles to the adoption of BMPs

4.4.1 Producer level

Obstacles at the producer level relate to cost, knowledge and awareness, and the regulatory and institutional environment.

- **Land pricing**: Clearance of virgin lands occurs because this land is considerably cheaper than existing agricultural or pasture land ($20 per hectare in some areas of the Brazilian north west). Existing agricultural land is likely to be ten times more expensive. Attempts to improve the long-term sustainability of land use will be undermined without changes to land pricing.
- **Low cost of conversion of virgin land**: Clearance of land is attractive because the cost of clearance can be offset with revenue from timber or fuel wood sales. Restricting access to a significant portion of these areas will necessarily impose a greater financial burden on farmers wishing to expand their existing landbase. Similarly, setting aside the required conservation areas (e.g. 35% of total in Piaui, Brazil, 80% in Amazonia) within an existing estate has an obvious production cost. This cost also applies to any measures that would oblige farmers to leave non-intervention areas around watercourses and increase the width of field margins. There are costs associated with assessments of environmental or social impact, especially where experts in particular fields are required to have input. Assessments of biological values are typically difficult and require expertise, and the lengthy consultation processes associated with assessing social impacts can be both time consuming and expensive.
- **Short-term financial horizons:** Soybean agriculture can deliver a rapid return for limited investment. The importance of short-term economic gain may divert attention from measures that can secure a return over a longer period. The low cost of virgin land also undermines attempts to emphasise the benefits of long-term sustainability.
- **Relative cost of different conversion techniques**: Burning areas of degraded forest or savanna vegetation is the traditional way to clear land in much of South America. It also has the benefit of the rapid delivery of mineral nutrients to the soil (ash) which can give dramatic short term yield increases. However, experience from elsewhere suggests that mechanical clearance is economically viable and helps to maintain long-term soil fertility. Forgoing the use of fire would is

therefore likely to be seen by many producers as imposing a higher financial cost on clearing operations, which may not in fact be the case.

- **Cost of soil conservation techniques**: The initial cost associated with approaches to soil conservation such as terracing is only offset in the long term through maintained soil fertility. However, the adoption of conservation tillage to reduce soil erosion should not carry a short-term financial penalty (the main reason why this approach is common in Brazil) and has direct financial benefits in the long term through the maintenance of soil fertility. Similarly, adopting crop rotation practices to maintain soil fertility in the long term has double benefits: higher average yields and reduced inputs of chemical fertilizer. However, these practices require investments in machinery and more advanced farm management. On poor soils, short-term yield increases through fertilizer applications are very financially attractive. Discounting future benefits discourages lower input agriculture geared towards long-term sustainability (i.e. crop rotations). Land pricing, tenure security and market conditions all have influence on this. Short-term fluctuations in market prices can cause farmers to gamble with long-term sustainability.
- **Cost of improved labour terms and conditions**: Improved conditions for labourers (e.g. provision of appropriate protective equipment, improved training etc) will incur a cost to farmers, but may also have longer-term benefits in terms of employee productivity.
- **Lack of awareness of conservation value**: One of the key obstacles to the uptake of more responsible management practices on soy farms may be the limited awareness of conservation values that *other* people place on biological habitats like the Cerrado or the Atlantic Forest. These are designated as global biodiversity hotspots, of immense conservation importance, yet this status is not reflected in conventional land use choices. There is also a lack of awareness of how to assess land for the presence of conservation values, and thus how to zone land use appropriately.
- **Regulatory capacity**: The lack of institutional capacity to regulate the agricultural sector is commonly cited as a problem in Brazil and Paraguay. Forest laws that specify only a limited percentage on land may be converted (e.g. 20% in Amazonia) are poorly enforced. This reflects the economic and political power wielded by the industry, and the practicalities of policing these vast frontier areas. External donor support building institutional capacity to monitor and regulate may be necessary.
- **Lack of fiscal incentives for rehabilitation:** Existing forest/virgin land is regarded a low value commodity. It is often thought to be 'in need of development', and it has remained cheap to acquire. So cheap that the 20% rule in Amazonia may even have increased the speed of conversion, as companies acquire ever-larger concessions to make up for the area which cannot be farmed. Tax reforms that make it easier to acquire and rehabilitate degraded land would help ease the pressure on virgin areas. The tax system could be a much more effective instrument to encourage sustainable practices.
- **Government guidance**: Governments have a responsibility to publicise and inform. The Brazilian government has undergone a process of identifying areas of high biodiversity and conservation importance.[60] The information exists to begin more rational land use planning, but the importance of the conservation of these areas needs to be publicly acknowledged by all stakeholders. Guidance for baseline assessments, monitoring and land use planning should be available from government.

4.4.2 Throughout the value chain

- **Agreement of BMPs**: at present, there are no widely accepted BMPs for soy production.
- **Limited proportion of direct supplier-buyer relationships:** Soybeans (and their products) are typically transported, mixed, bulked, traded, refined and processed several times before they is used to make a final product. This means that there are difficulties in tracing soy produced from a particular farm. As a consequence, it is difficult to reward individual farms that follow good environmental and social practice, and, conversely, to exclude or otherwise penalise those whose performance falls below those requirements. These problems are not insurmountable, but are likely to result in increased costs.

[60] Probio & Directoria de Conservacao da Biodiversidade SBF-MMA-Brazil 2003.

- **Incentives**: Uptake of BMPs, particularly when they are likely to impose increased costs on production, is unlikely to be widespread without clear market signals. A mechanism of supporting uptake of BMPs through encouraging the players throughout the supply chain (e.g., who might commit to buy an increased proportion of soy produced according to BMPs each year) would help stimulate adoption of BMPs. The market premiums currently paid for GM-free soybean are a working example. Where incentives are used, there are associated questions relating to the verification that soybean has been produced in accordance with BMPs.
- **Lack of consumer visibility of the major processing companies**. Soy products are used in the production and manufacture of many products and soy is not always visible to the end consumer. This is particularly the case when soy meal is used for animal feed – the role of soy is one step removed from the final customer. Public awareness and ability to discern between products using soy produced in different ways is therefore likely to be limited. This may in turn limit the ability of civil society to lever greater adoption of BMPs. Nevertheless, with increasing pressure from NGOs and with from financial service institutions, there exists potential for greater leverage in the future.

4.5 Preconditions for the successful adoption of BMPs

There is already some tension between North and South American growers, and between South American growers and the EU. This is often connected to market access and free trade issues. South American growers are unhappy with the subsidies provided to N American growers, while N American growers are sceptical of management practices in the south. The debate surrounding the illegal use of RRSB seed became particularly vitriolic, with N American growers claiming the Brazilians were reaping financial rewards from the illegal growing of RRSB with the tacit support of the Brazilian government.

Questions remain about the role played by import tariffs (in the EU) and agricultural subsidies (in the US) in driving the current rapid expansion of soybean agriculture in South America, and associated land degradation. Brazil in particular has pursued export markets in the EU and China as its main vehicle for economic growth, and is aware that future success depends on its continued increase in productive area. Increasing productive area is the quickest and cheapest way for Brazil to gain market share and maintain a competitive edge over the US as current trade rules make the export of processed products less profitable While the macro-economic issues are beyond the scope of BMPs, the uptake of BMPs may be conditional on international trade issues.

There is the potential that any initiative coming from ‘the north’ could be seen as further efforts to undermine the competitiveness of south American growers, at a time when they are gaining the ascendancy. This would severely reduce the uptake of such practices. It is therefore essential that BMPs emphasise productivity gains and reduced costs at the farm level through better planning, training, etc.

General preconditions to improving the environmental and social impacts of soybean production include:

- Improved institutional regulatory capacity (possibly through donor support).
- Tax reform to decrease the attractiveness/availability of virgin lands
- Increased political accountability and transparency with balanced consideration of environmental social and economic issues.
- Improvement of land use planning, zoning and the enforcement of existing conservation regulations.
- Increased awareness, amongst all stakeholders, of existing national and regional definitions of high priority conservation areas or HCVF.
- Development of widely agreed BMPs
- Pressure from the major processor companies to improve management practices
- Market incentives for responsible producers; clear market signals to producers and possibly a BMP compliance auditing scheme.

One of the key problems in the soybean sector is the lack of consumer visibility of the major processing companies. These companies are the major industrial stakeholders and have considerable influence on

growers. Due to the nature of the commodity, these companies are not in the public eye (cf. oil industry or chemicals). Increased consumer visibility of the major processing companies through NGO campaigns in the USA and EU may be necessary to initiate the involvement of these industrial players.

4.6 Risks of adopting a BMP approach

Risks to growers: Soybean agriculture has been a rich vein of economic growth for members of the farming community in South America. It is probable that some BMPs will lead to increased production costs, at least in the short term, especially where there is a requirement to assess environmental impact. If there is no market premium for sustainably produced soybean, there is the possibility that growers would seek to offset profit losses by engaging in exactly the activities that BMPs are seeking to reduce. This may manifest itself in a drive to expand the land base, to reduce the labour force or reduce wages, or to increase the reliance on mechanisation and chemical inputs.

Substitution by other edible oils: The edible oils market is extremely competitive, and one in which soy oil currently enjoys a dominant position. The soybean industry in South America is in a position to wield significant political influence, and is likely to lobby strongly against any measures that it perceives could damage its market share. Furthermore, any initiative that targets management practices in soybean production, should consider the impacts this may have on management practices across the edible oils sector. An initiative that makes the production of soybean more complex or costly may stimulate investment into the unsustainable production of other edible oils (e.g. palm oil), unless equivalent actions are developed for that crop.

Further tension between North and South: Current environmental concerns are focused almost exclusively on land conversion in South America. While the growing of soybean in North America is not without environmental impacts, these are more readily controlled through generic agricultural BMPs. The weight of new environmentally orientated BMPs for soybean will fall disproportionately on the south, which may further aggravate the existing ill feeling related to trade issues.

Costs associated with certification: In order to check compliance with BMPs, some form of verification may be necessary. If there is a market premium associated with the use of BMPs, this may cover the cost of verification auditing, but it becomes important to segregate certified products from non certified. This has cost implications for the processing industry, which would be required to segregate production from certified farms. It also has implications for the commodity markets, as it may reduce liquidity.

GM Debate: The experience in Europe, India, Brazil and elsewhere shows that GM is an emotive issue and certain stakeholders are likely to lobby strongly against the use of GM RRSB. Not addressing the use of GM crops may be seen by these stakeholders as a failure to deal with one of the major issues connected with the growth of soybean. However, it could be argued that there are other more pressing environmental concerns and there is a risk that the BMP discussion could be drawn into a debate about the ethics of GM and loose its focus on forest and savanna clearance. Nevertheless, if the proposed BMPs deliberately avoid addressing the issue of GM crops, any requirements to reduce chemical use, or move towards organic practices would still bring GM into the spotlight. While this will please many ENGOs, there are powerful agribusiness interest groups that will resist any requirements to reduce the use of GM soybean.

4.7 Strategic Choices

#1 Whether to support the development of BMPs?
As yet there has been no development of widely agreed BMPs for soybean in South America. However, several of the major industrial players may come under pressure from environmental NGOs and their own CSR commitments to develop BMP criteria. Any such initiatives should be supported.

#2 Whether to support stakeholder engagement through existing processes?
WWF is in the process of setting up a Roundtable on Sustainable Soybean. The roundtable process is a way to bring together the various stakeholders and to combine the best features of individual approaches. It also has the advantage of keeping all stakeholders abreast of ongoing developments in the field and prevents issues from becoming overly politicised, if the process remains equitable and open to different perspectives. Engaging with this initiative provides one option for moving forward and needs to be considered alongside other approaches.

#3 Whether to encourage buyers to adopt purchasing guidelines?
Criteria for sustainable production can be broadened to include purchasing guidelines encouraging buyers to demand that products meet best practice. Such guidelines could include the recommendation that buyers seek to increase the proportion of soybean coming from farms that meet the best practice criteria. Encouraging buyers to join a roundtable process may be the best way to leverage such commitments.

#4 Whether to encourage the adoption of BMPs into investment criteria?
Investment represents an important means of changing management/production practices. If financial sector players accept BMPs, they can be used as a screen for investments, providing a powerful stimulus to the growers. BMPs can also be integrated into screens for pre-finance to third parties.[61]

#5 How traceable should sustainable soy be?
There may be significant benefits to growers in North America who are able to supply certified GM free soybean. However, the dominance of GM soybean production means that when the soybean is bulked for processing or shipment, its identity and its premium are lost. Processors are unwilling to invest in segregating GM and non-GM soybean. The same issue of traceability applies to soybean produced on farms subject to BMPs. Any future initiative would need to consider the advantages and disadvantages of taking a segregated, area-wide or pooled approach (see 1.1 for further discussion on this issue).

#6 Whether and how to engage with governments?
Some of the most serious environmental impacts of soy production involve issues wider than can be addressed by individual companies, or by the sector as a whole. These include forest conversion and large-scale social transformation. Solutions to these problems include BMPs, but also require input from, for example land-use planning procedures, legal requirements and the implementation of these. The possibilities for enabling governments in producer countries to reform their procedures, regulations and the way that these are implemented will need to be explored.

[61] For example, IFC finance provided to the Brazilian company Amaggi requires Amaggi to apply IFC guidelines and policies as a screen for the availability of pre-finance to third parties. If this approach can be linked to auditable BMPs, this offers significant opportunities for reaching growers through key points of influence within the value chain.