



Biofuels trade and sustainable development: The case of ecuador's palm oil biodiesel

María Amparo Albán

Helena Cárdenas

Working document
December 2007

Acknowledgments

The authors would like to thank the following institutions for providing us with valuable information, through both interviews and documents, during the research phase: Ecuadorian National Association of African Palm Farmers (ANCUPA), National Council for Biofuels, Ministry of Agriculture, Ministry of Industries, Ministry of Energy, Petroproducción. Special thanks to Carlos González-Artigas, General Manager of La FABRIL for providing us with information on their biodiesel operation.

Our thanks and recognition are due to Annie Dufey of the International Institute for Environment and Development (IIED), for all of her support, guidance, and comments on the drafts. We also thank the Ecuadorian Centre for Environmental Law (CEDA), for facilitating the infrastructure and support necessary to carry out this study.

Finally, we are very grateful to the UK Department for International Development (DFID) and the Dutch Ministry of Foreign Affairs (DGIS).

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Acronyms

CP	African, Caribbean and Pacific Countries
ALADI	Latin American Association for Integration
ANCUPA	Ecuadorian National Association of African Palm Farmers
AoA	Agreement on Agriculture
APALE	Ecuadorian Association of Alcohol Producers
ATPA	Andean Trade Promotion Act
ATPDEA	Andean Trade Promotion and Drug Eradication Act
BCE	Ecuadorian Central Bank
CAP	Common Agricultural Policy
CAAM	Environmental Cooperation Commission
CBI	Caribbean Basin Initiative
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanisms
COMEXI	Council of Foreign Trade and Investments
CORDELIM	National Office for the Promotion of Clean Development in Ecuador
CLIRSEN	Ecuadorian Center of Integrated Indicators for Natural Resources
CPO	Crude Palm Oil
CTE	Committee on Trade and Environment
DDA	Doha Development Agenda
EBA	Everything But Arms
EGS	Environmental Goods and Services
EC	European Community
EMPA	Swiss Federal Institute for Material Testing and Research
EU	European Union
FAO	United Nations Food and Agriculture Organisation
FEDEPAL	Ecuadorian Federation of African Palm Producers
FELDA	Federal Land Development Authority
FFB	Fresh Fruit Bunches
GATS	General Agreement on Trade and Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GLP/LPG	Liquefied Petroleum Gas
GHG	Green House Gases
GSP	Generalised System of Preferences
HS	Harmonised System
IPC	International Food and Agricultural Trade Policy Council
IPR	Intellectual Property Rights
INEFAN	Ecuadorian Institution for Forests and Protected Areas
MPOB	Malaysian Palm Oil Board
MEA	Multilateral Environmental Agreement
MERCOSUR	South American Market Community
MICIP	Ministry of Trade, Industrialisation and Fisheries
NAMA	Non-Agricultural Market Access Negotiations
NAO	Nafta of Octane
NGO	Non-Governmental Organisation
NB	Basis Nafta or “Nafta Base”
N ₂ O	Nitrous oxide

OCP	Pipeline for Oil Products
OPEC	Organisation of the Petroleum Exporting Countries
PetroEcuador	Ecuadorian State-owned Petroleum Company
REIL	Renewable Energy and International Law
RBD	Refined, bleached, and deodorised oil
RFS	Renewable Fuels Standard
RSPO	Roundtable on Sustainable Palm Oil
RSB	Roundtable for Sustainable Biofuels
SCM	Agreement on Subsidies and Countervailing Measures
SIAGRO	Ecuadorian System for Agriculture Indicators
TBT	Agreement on Technical Barriers to Trade
UNCE	Ecuadorian National Union of Cane-Farmers
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute
WCO	World Customs Organisation
WTO	World Trade Organisation

1 Introduction

Global biofuels production is one of the topics that amply illustrates the complexity of harmonising the different variables of sustainable development. Pursuing environmental protection and implementing social standards, while assuring economic feasibility in industrial activities is vital for developing countries to compete in the global economy. Adding other elements such as food security risks and subsidies in the production of biofuels, as well as taking into account the vulnerability of commodity prices in the external market, can make the biofuels scenario even more complex, especially for developing countries interested in becoming major exporters of this new fuel to the international market.

These elements combine to challenge the strategic position of developing countries and their capacity to become real players in biofuels production worldwide, taking advantage of their privileged access to natural resources and their land availability for agricultural production.

Regardless of their natural capacities and the opportunities in the international and domestic market, developing countries in the region need to undertake a broad analysis when implementing biofuels production policies. They need to assess carefully the institutional capacities, the appropriate balance of development and the economic opportunities, in order to avoid solving one problem, while creating others, whose effects will be felt not only domestically but also globally.

The debate on the advantages and disadvantages of biofuels production began by questioning the conditions in which biofuels were being produced in some countries. Its effects on the environment and on worker rights, its economic impacts, as well as its possible threat to food security. Therefore it is important to provide decision makers, private and public actors with timely and comprehensive information on the different aspects of production, including trade and sustainable development in the policy discussion.

In the case of Ecuador, the palm oil industry took the lead in producing biodiesel for export. Production is still not very high, but shows potential for the development of a whole new industrial sector.

Palm oil production in Ecuador is currently enjoying a boom in terms of the international price of palm oil. This has led to a decrease in the interest of many local palm industries in the production of biodiesel.

With this background, the following study intends to offer an initial analysis of the production and trade of biodiesel in Ecuador in the light of its impacts on sustainable development, which we hope can make a contribution to policy makers and the private sector involved in this field.

2 Executive Summary

Overview

African palm is increasingly one of the main agricultural crops in Ecuador, both in terms of production and its contribution to exports. During the last decade, the palm oil sector has accounted for 15.2% of the national agricultural GDP and approximately 1.4% of the total GDP of Ecuador. In addition, Ecuador currently exports approximately 40% of its palm oil production, including crude oil and palm oil derivatives. Moreover, this sector has experienced considerable growth in the last decade, with even higher growth projected in the national economy for the years to come.

Around the world, palm oil has gained an important share of the vegetable oil market, particularly in the last two decades, and is expected to be the major contributor in the next few years. In terms of palm oil production, Ecuador is the seventh largest producer in the world, and the second largest in South America. Nevertheless, its production only represents 0.95% of world production, because Malaysia and Indonesia, which are the first and second largest palm oil producing countries, account for 86% of the world output. Currently, Ecuador has 207,000 cultivated hectares of African palm and the 2006 production was 340,000 tons. Of this, 200,000 tons was used for national consumption, and the remaining 140,000 tons was surplus for export.

Biodiesel production is a minimal share of oil palm production in Ecuador. Only one company has engaged in this initiative, and that intermittently. La FABRIL produced biodiesel in 2005 and 2006, and during those years its production only comprised around 3% of total production. During the current year this production has stopped altogether because of uncertainties in the profitability of this new business. The biodiesel produced in 2005 and 2006 was sold only in external markets. The domestic market was not an option because Ecuador lacked the legal and technical frameworks to facilitate biodiesel consumption. Although the government created a National Biofuels Program in 2004, it lacked clear goals until 2006. The Program is currently assessing the possibility of mixing Diesel#2 with biodiesel, either in a mix of 2% or 5%. In either of these cases, Ecuador would still have the potential to provide palm oil biodiesel to international markets.

Despite the fact that Ecuador is a petroleum oil producing country, its oil exports are dominated by primary products, mostly crude oil, while it imports significant amounts of petroleum derivatives, including diesel. The current national demand for diesel corresponds to more than 20 million barrels per year and such demand increases annually due to industrial and population growth.

One of the key national interests in producing palm oil biodiesel is to reduce dependence on diesel imports. Biofuels production also offers incentives to Ecuador's industrial sector, as it promotes technological innovation and value added production. Nevertheless, it is expected that palm oil producers will continue to export their production rather than providing biodiesel for the domestic market, unless a legal and economic framework promoting domestic consumption can be put in place. However, before that, proof is needed that palm oil biodiesel can compete with oil products in terms of price and sustainability impacts.

The ability to produce and consume biodiesel in Ecuador depends on domestic prices, which fluctuate in line with two international markets where prices are already extraordinarily

volatile: vegetable oils and petroleum oil. Palm oil prices are very volatile, not only because of the vulnerability of international markets, but also because of its interchangeability with other vegetable oils, such as those from soya, rapeseed and sunflower, among others. Additionally, biofuel prices are also dependent on petroleum oil prices – a heavily distorted market. Biofuels aim to substitute petroleum oil derivatives; thus fluctuations in oil prices directly affect the price of biofuels, as well as their demand and production. This is a key concern for biofuel traders and producers in Ecuador, and so they remain hesitant about joining the biodiesel business.

International and domestic trade policy

Biofuels trade does not have a defined legal framework at the international level or within Ecuador's domestic trade laws. A key issue to be addressed in the multilateral trading system is the lack of a unique classification for biofuel at the World Trade Organisation (WTO). Biodiesel is classified as an industrial good while bioethanol and feedstocks are classified as agricultural products. This means that different types of 'biofuels' are subject to different trade rules. Moreover, 'biofuels' could also be included within an environmental good list for accelerated liberalisation under the current Doha round of trade negotiations. The lack of a unique classification and the fact that Harmonised System (HS) codes make no distinction between whether vegetable oils are used as fuel or for other purposes, presents many difficulties for the biofuels trade: it puts an additional burden on solving issues such as liberalisation of tariffs on biofuels, government support measures, and technical regulations, among others.

In many countries a range of government support policies, both direct and indirect, have been applied to develop biofuels, but in Ecuador, no government support measures have been put in force yet, because of the slow emergence of this sector. The impact of these policies needs to be analysed, and the private sector is pushing the government to start this process. Government and policy makers need to be aware of forthcoming international resolutions when analysing regulatory and public policy for the biofuels sector. Members of the WTO are shortly to discuss legislation on this issue. Additionally, public incentives for this sector should be thoroughly analysed, as they could have different impacts not only in the energy sector but in others as well.

Ecuador has not yet experienced any difficulties regarding trade barriers or tariff escalation for its biofuel sector because of its limited biofuels production and trade. To date, Ecuador has only exported palm-oil-based biodiesel to the United States. At present, together with Northern subsidies, certifications based on sustainability criteria are the main non-tariff barriers under analysis; however no decisions have formally been made on the latter at the international level. As the biofuels trade increases globally, many of these themes will be debated in the different producer countries, either for application or for discussion. Where no clear policies and legislations are in place to control the international trade in biofuels, issues and disputes will destabilise the sector's development and sustainability.

On the other hand, biofuels represent a new opportunity for Ecuador to diversify its exports and markets in the same way that other countries in the region have done. The United States makes up 49% to 55% of Ecuador's total exports. The five main destinations for Ecuadorian exports in the last three years (United States, Peru, Italy, Colombia, and Chile) represent approximately 62% to 75% of the total exports.

Socio-economic analysis

Palm oil biofuel production has the potential to become a new source of job creation. The cultivation and harvesting of palm is mainly carried out manually and approximately 1 direct job is created per 2,3 hectares of cultivation. If job creation is linked with sharing in the profits of the industry, this could provide better living and working conditions for the workers. Most plantations are located in rural areas where living conditions - according to available socio-economic indicators from the national census - are below the national average.

In addition to the economic pressure to use primary forests in palm oil production, the socio-economic reality of the sector has previously not encouraged employment creation. However, several companies have begun to define strategies to work with local communities, avoiding negative environmental impacts and implementing social programmes as part of a corporate strategy. In addition, health and education programmes are expected to be promoted directly, not only through palm oil companies, but also through tax resources that the palm oil sector generates locally. Various companies are already implementing campaigns to inform local populations about its operations in rural areas.

Regarding food security, palm oil does not represent a threat to food security in Ecuador in terms of food use of this crop. However, if land for palm oil cultivation was extended to areas designated for food-crops, food security could become a cause for concern. Further studies and a legal framework are required to protect and differentiate those lands that should be kept for food crops and those where palm oil plantations could be constructed without creating a threat to food security.

Environmental analysis

A key environmental impact of palm oil production in Ecuador has been primary forest deforestation. Although this is not only due to oil palm plantations and there are no formal statistics on the actual contribution of palm oil to deforestation, these plantations are considered a contributing factor. According to the Food and Agriculture Organisation (FAO), tropical forest deforestation is concentrated in few countries, with Ecuador ranking with the 9th highest deforestation rate in the world. Projections for new palm oil cultivation indicate, however, this will not be located in areas of primary forests but rather in lands formerly used for agriculture.

To date, there are no specific studies on palm-oil biodiesel Greenhouse Gas (GHG) emissions through the production and distributions stages in Ecuador or the Andean region. Neither La FABRIL in Ecuador, nor another palm oil Colombian company, have performed such studies. While data obtained through secondary sources by palm oil companies suggest GHG emissions reduction, other studies, such as one performed by the Swiss materials science and technology research institute (EMPA), shows that Malaysian palm oil biodiesel would not provide a better overall environmental performance and fewer GHG emissions than petrol diesel. However, the same study shows that the Malaysian palm oil biodiesel would have a better environmental performance than other feedstocks such as soy or rapeseed.

In-situ studies on GHG emissions from Ecuadorian palm oil biodiesel are needed to foster research and debate on this topic and to produce evidence on the relation between biofuels and fossil fuels GHG emissions. Such studies should provide an entire life-cycle analysis.

There are also environmental impacts on the air, water, soil, geomorphology and terrestrial and aquatic ecosystems. Negative effects are mainly produced during work required for water management, drainage construction, agro-chemicals usage, and disposal of solid wastes from the extracting plants, among others.

Controlling and monitoring how these activities are carried out could reduce the negative effects. However, implementation of an environmental legal framework in the country has so far been lacking, especially on control and monitoring.

Value chain of palm-oil-based biodiesel

Biodiesel production based on palm oil covers different levels of agriculture and industrial processes. The value chain of palm-oil-based biodiesel is composed of palm agricultural production, oil extraction, and the industrial process for biofuel production. Generation of biodiesel corresponds to the third level of the value chain, because African palm is first cultivated, then palm oil is extracted and finally crude palm oil is processed into biodiesel.

Currently, there are 5,515 palm growers, 62.9% of which are small producers, defined as landowners of 1 to 10 hectares; 32.6% are medium producers, landowners of 11 to 100 hectares, and 4.6% are big producers. In addition, there are 40 oil extractor companies in Ecuador, some of these companies are independent, others are associated with palm-farmers, and others are associated with the processing industries. All the 40 extractor companies are Ecuadorian.

Although there are 4 processing companies in Ecuador, only one of them, La FABRIL, is producing biodiesel, a fairly new sector in the Ecuadorian palm oil industry. However, there is interest from other palm oil processing and extractor companies to join the initiative. Biodiesel production could contribute to the different levels of the value chain (producers, extractor companies, and processing companies) by generating socio-economic development. However, for this to be sustainable it will need to be guided by responsible corporate practices, an efficient regulatory system and environmental-friendly production processes.

Conclusions

- √ The potential of palm-oil biodiesel exports in Ecuador will need to be analysed according to economic feasibility and sustainability requirements. Even though small quantities of palm oil biodiesel has been produced and exported in 2005 and 2006, this production stopped in 2007 because of uncertainties regarding profitability, markets and prices, as well as the absence of a national policy and regulatory framework.
- √ Currently, the cultivated area of palm oil in Ecuador is 207,000 hectares. Private palm-oil processing companies are preparing to increase cultivation to produce palm oil, biodiesel and other finished-products. In terms of agronomic feasibility, approximately 2 million hectares of land would be favorable for oil-palm cultivation, including some hectares that have previously been used for agriculture. However, given that 1 million of these hectares are primary forests, only 1 million hectares currently have favorable growing conditions.

In any case, further evaluation to determine suitable agricultural areas for palm oil cultivation are needed. Ecuadorian palm oil and biodiesel production and commercialisation not only depend on land availability and agronomic feasibility, but also on socio-economic and environmental factors. To make accurate projections about extending the land under palm oil cultivation, further socio-economic and environmental feasibility studies are needed, as well as analysis of the national and international markets.

- √ Institutional capacity to respond to the new biodiesel market trend in Ecuador is still deficient. Three years ago a national programme and guiding Council were created to promote biofuel production. However, no significant steps have been taken to develop these because of lack of information in key areas, including optimal feedstocks, geographical areas, impacts and profitability. Research and analysis on these topics are needed for policymakers and entrepreneurs. Lack of funding and current political instability has made it difficult for the National Biofuels Program to work closely with private and public institutions. There is still much work to be done in planning and, more importantly, discussing the new policy and legal framework necessary to set guidelines for sustainable Ecuadorian production, trade and use of biofuels.

3 Overview of Ecuador's economic conditions and its palm oil and biodiesel sector

3.1 Ecuador's economy

Throughout the last decade¹ the economy of Ecuador has shown increased activity, with an unexpected growth in the gross domestic product (GDP) especially after 2000, when the country reached one of the highest economic growth rates in Latin America². Economic growth was 7.9%, 4.7% and 4.3% in 2004, 2005 and 2006, respectively, according to the Central Bank of Ecuador (BCE). This economic push came after a very depressed period in the late 1990s when the economy underwent one of the strongest recessions ever registered³. This economic standstill gave rise to a radical change in the monetary and exchange policies of the country, and dollarisation was adopted in 2000.

Ecuador's economic growth in the period 2000-2006 is mainly attributed to the strong increase in petroleum oil activity in the last few years, including the increase in petroleum oil production due to the operation of a new pipeline for oil products (OCP), and the increase of hydrocarbon prices. Additionally, reduced inflation contributed to an improvement of the competitive levels of local production.

The contribution to GDP of almost all the country's economic sectors increased, on average, during the period 2000-2006. The GDP for mines and quarries exploitation (which includes extracting of petroleum crude oil, natural gas and related activities and services) showed an average real growth of 39.2%; agriculture, stockholding and forestry GDP grew by 44.3%; manufacturing industries - which excludes petroleum refining - grew by 13.5% while the fishing sector grew by 9.9%.

The country has achieved an annual trade surplus since 2004. However, the composition of Ecuadorian exports is strongly dominated by primary products: 78.7% of total exports in 2004 were primary products and 21.3% industrialised products. Moreover, exports are very specialised - main exports are crude petroleum oil (approximately 65%), banana and plantain, and shrimp.

Such a trade background, together with dollarisation, has provided lower rates of competition for its products in relation to neighbouring countries. One of the consequences of the dollarisation process is that Ecuador can no longer use exchange policies to assist its market competitiveness. Also, recent juridical and political instability have contributed to a drastic reduction in foreign direct investment,⁴ compromising Ecuador's role in the international market.

The conditions mentioned above place Ecuador in a difficult position in seeking alternative sources of economic growth, consolidating its international market, and in creating policies for the promotion of a industry based on value added products and technological development. These goals are to be pursued through trade policies.

¹ With the exception of the years 1999 and 2000

² CEDA-OEA. *Evaluación de los Impactos Ambientales y Capacidad Institucional Frente al Libre Comercio*. 2006

³ Ibid.

⁴ In 2003 the direct investment rate experienced a reduction of 61.1%, the highest reduction in the last decade

Moreover, the current political situation in Ecuador is uncertain; a new government took office on January 2007. The leftist stance of this new government proposes major changes, not only in the political sphere, but also in reworking the economic priorities for state expenditure and investment.

3.2 *Ecuadorean energy deficit*

Paradoxically, despite the fact that Ecuador's petroleum-oil exports constitute a significant source of income to the national economy, and that mining activities have shown an increase in the last decade, Ecuador still has a serious deficit in its ability to generate energy to satisfy its domestic demand. National institutions have not invested adequately to cope with increasing demand coming from the rise in population and industrial growth.

Additionally, Ecuador production and exports are still concentrated on agricultural commodities and on crude oil. Crude petroleum oil production alone accounted for 20% to 23% of the GDP from 1995 to 2005, while the oil refining industry accounted for 4.8% to 8.6% of the GDP during the same period⁵. Although the refining sector has increased its production in the last years, this increase has been relatively small and not enough to supply national demand.

National demand for refined products has also increased, thus exacerbating the problem. Between 2005 and 2006 alone, national demand for diesel fuel increased by 13.2%⁶. To satisfy the national demand Ecuador requires importation of approximately 40% and 60% of its diesel and gasoline needs, respectively.

The industrial oil petroleum sector therefore has not developed adequately for the needs of Ecuador. The country has not developed a petrochemical industry and continues to have a deficit in producing value-added oil petroleum products. This situation will be further explained in the economic analysis section below.

3.3 *Palm oil sector*

The palm oil agricultural sector accounted for 1.3% of the Ecuadorian national GDP in the period 1999-2005, while the palm oil manufacturing sector accounted for 0.4% of the Ecuadorian national GDP in the same period⁷. Although such percentages represent a small share of the national GDP, it is important to acknowledge that the productive sector is in a state of continuous growth. During the period 1990-1995 the palm oil sector experienced an average growth of 9.2%; between 1996-2000 the average growth rate was 5.1%, and between 2000-2005 it was 7.6%⁸. Therefore, projections indicate that this sector will increase its importance to the national economy in the coming years.

The palm oil sector has become a very dynamic agroindustrial activity that generates employment, promotes enterprises, and creates national economic resources through its exports. These benefits have grown throughout the years of palm oil production in the country, which started around the 1950s. In general, African palm cultivation and palm oil production in Ecuador has maintained an upward trend. The average growth rate of harvested

⁵ Data from Ecuador Central Bank.

⁶ Statistic calculated with information from the Ministry of Energy.

⁷ Diana Carvajal. *Análisis del Acuerdo de Complementación Económica No. 59 CAN-MERCOSUR y el Sector Oleaginoso. Caso Palma Africana*. 2006.

⁸ Ibid.

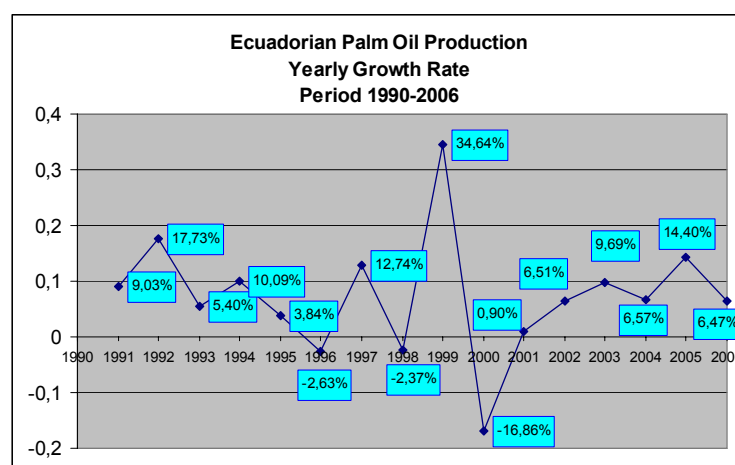
areas from the period 1999 to 2005 was 9.5%, while the average growth rate of sown areas in the same period was 6.3%. The following table shows data and growth rates for sown and harvested areas during this period.

Table 1: Area of palm oil sowed and harvested in Ecuador

Period 1999 – 2005					
Year	Sowed Area (ha)	Sowed Area Growth Rate	Accumulated Area (ha)	Harvested Area (ha)	Harvested Area Growth Rate
1999	10,020		133,706	103,233	
2000	10,044	7.5%	154,586	113,686	10.1%
2001	7,616	4.9%	162,202	123,686	8.8%
2002	7,433	4.6%	169,635	133,706	8.1%
2003	19,839	11.7%	189,474	141,585	5.9%
2004	9,527	5.0%	199,001	150,893	6.6%
2005	8,285	4.2%	207,285	177,540	17.7%
Average Growth Rate		6.3%			9.5%

Source: ANCUPA

Figure 1: Ecuadorian palm oil production



Source: ANCUPA

3.4 Biodiesel production

Biodiesel is one of the palm oil derivative products. Biodiesel production represents a minimum share of oil palm production in Ecuador, corresponding to 0.8% in 2005 and 0.4% in 2006, approximately⁹. There are four palm oil processing companies: ALES, EPACEM, DANEC, and La FABRIL. Only one of these companies, La FABRIL, has produced biodiesel.

In 2005 FABRIL produced US\$ 80 million in palm oil derivatives and US\$ 110 million in 2006. Only 3% of that amount corresponded to biodiesel. In 2005 La FABRIL produced

⁹ Statistic calculated by Authors with data from the FABRIL Company and ANCUPA

2,000 tons of biodiesel per export ship (one per month). In 2006, biodiesel production reached between 2,000 and 3,000 tons per month, having an annual production of approximately 35,000 tons, which represented US\$ 5 million to US\$ 8 million per export ship¹⁰. This shows that biodiesel production is a fairly new segment in the Ecuadorian palm oil sector. However, there is interest from other palm oil processing and extractor companies to join the initiative.

3.5 National policies on biodiesel

In December 2004 the Government of defeated President Lucio Gutierrez, issued Executive Decree 2332, stating that the production and commercialisation of *biocarburantes del agro*, (agricultural biofuels), would be of national interest. By this decree the Biofuels Program Advisory Council and the Biofuels Program Technical Committee were created. The Advisory Council is in charge of issuing national biofuel policies, while the Technical Committee, which includes officers from the different public and private institutions and which is coordinated by the Ministry of Energy and Mining, provides technical support and advice for the Council. The Program Advisory Council is chaired by the President, and includes representatives of the Ministries of Energy, Agriculture and Foreign Trade and the state-owned Petroleum Company PetroEcuador.

The private sector and agribusiness are represented at the Council by the Ecuadorian National Union of Cane-Farmers (UNCE, acronym in Spanish), the Ecuadorian National Federation of Sugar Producers, the Ecuadorian Association of Alcohol Producers (APALE, acronym in Spanish), and the Association of Fuels Distributors.

Two sub-committees were created once the Biofuels Program was signed, one for bioethanol production and the other for biodiesel production. However, the Biodiesel Program is still in its initial phase and has only accomplished about 10% of its intended activities.

So far only one meeting of the technical committee has taken place for the Biodiesel Program and no written reports have been produced. Until now, the only steps taken concern the characterisation of biodiesel samples. The next actions to be directed by the Biofuel Program Advisory Council are to perform studies on the potential geographic zones for the cultivation of palms for biodiesel production¹¹ and studies on the technical and technological assistance required. These studies will provide data on the number and characteristics of the biorefineries that will be needed. So far there are no reports of plans by PetroEcuador to invest in biorefineries or plants for biodiesel production.

In addition to the biodiesel promotion plan, the Biofuel Program includes a bioethanol promotion plan. Actually, the Ethanol Program is more advanced and a pilot plan for bioethanol is ready to start in Guayaquil. This programme will last at least a year and will be undertaken to perform an economic, technological and environmental analysis of the feasibility to mix bioethanol with regular gasoline. There are already three private companies producing bioethanol that are committed to sell their production to PetroEcuador in order to cover the amounts needed during the pilot project in Guayaquil.

¹⁰ Interview with the General Manager of the FABRIL Company.

¹¹ According to information from the Ministry of Agriculture, potential areas for these crops' production could be previous areas of cultivation of coffee and cacao.

3.6 Palm oil biodiesel processing and value chain

The palm oil value chain comprises palm agricultural production, oil extraction, and the industrial process, which produces several by-products, such as biodiesel. The palm oil agroindustrial sector is one of the productive sectors that have grown the most in the last 15 years. The average production growth rate in the period 1990-2006 is 7.3%¹². Altogether the share of GDP of the palm oil sector accounted for approximately 1.7% of the national GDP in the period 1999-2005¹³. Nevertheless, this sector's contribution to the national economy varies between its agricultural and industrial phases. Palm oil production can be divided into three phases: an agricultural phase, an agroindustrial phase and a strictly industrial phase. The agricultural and agroindustrial phases accounted for 1.3% of the national GDP between 1999-2005, while the industrial sector accounted for 0.4% of the national GDP in the same period. The production of palm oil biodiesel involves several agricultural and industrial processes as described below.

Agricultural phase

This phase includes all the growing stages of the palm trees up to the point when the fresh fruit bunches (FFB) are ready for oil extraction. Several activities make up this phase of the value chain, including planting, weed control, disease and infection control, nutritional management, water management, pruning, harvesting, and FFB collection and transportation.

There are two steps in FFB transportation: first, from the place where the FFB are cut to the edge of the growing area. This is usually done by people or using mules, horses, buffaloes or bullocks, and second, from the stock centres to the mills. FFB transportation is often considered a separate stage in the value chain; however, in our analysis we have included it in the two stages of agriculture and industry, so that it is included in the economic analyses. The first step of FFB transportation is therefore part of the agricultural phase as it is still manual work and precedes the industrial process.

Palm oil agricultural investment (excluding extracting activities) accounts for US\$ 840 million, corresponding to 81.5% of total palm oil sector investment¹⁴.

Agroindustrial phase

The industrial phase includes the second step of FFB transportation, usually carried out by tows, trucks and other vehicles, from stock centres to mills, and the oil extraction manufacturing process.

The palm FFB go through several steps in the extracting processes, these are sterilisation, to avoid acidity in the extracted oil; disfruitation, where the fruits are separated from the bunch; digestion, to break the plant cells to liberate the oil contained in them and to detach the pulp from the nuts; extraction, to obtain the oil through press machines; and clarification, the process of recuperation and purification of the extracted oil¹⁵. These processes produce three products: crude palm oil, palm kernel oil and the palm tart, these are stored at the plant before being sent to the refineries.

¹² Statistic calculated with data from ANCUPA.

¹³ Diana Carvajal. *Análisis del Acuerdo de Complementación Económica No. 59 CAN-MERCOSUR y el Sector Oleaginoso. Caso Palma Africana*. 2006.

¹⁴ ANCUPA-FEDAPAL

¹⁵ Diana Carvajal. *Análisis del Acuerdo de Complementación Económica No. 59 CAN-MERCOSUR y el Sector Oleaginoso. Caso Palma Africana*. 2006.

Industrial (palm oil) phase

We have called this phase the industrial “per se” phase, to distinguish it from the agroindustrial phase and because this is how it is referred to in the economic analysis that calculates the GDP share of the economy. It incorporates various steps of advanced manufacturing processes that include refining the oil and generating by-products. The GDP share of the palm oil industrial phase accounts for 2.7% of the national industrial GDP. The investment level of the industrial phase is approximately US\$ 190.000, which corresponds to the 19.5% of the total palm oil sector investment¹⁶.

Palm oil derivative products can be divided into two groups according to the level of processing. There are semi-processed products and processed-ready products. These are presented in Table 2.

Table 2: Palm oil derived products

	Semi-processed First Industrial Phase	Processed-ready products Advanced Industrial Phase
Palm Fruit	- RBD (refined, bleached, deodorized) Oil	- Edible oils
	- Palm Olein	- Margarines
	- Palm Stearin	- Fats for frying
	- Fat Acids	- Fats for baking
Palm Kernel	- Palm kernel tart	- Fats for candies' processing
	- Kernel Palm Oil (deodorized)	- Fats for ice-cream processing
	- Kernel Palm Olein	- Soaps
	- Kernel Palm Stearin	- Animal feed
		- Alcohols
		- Fuels
		- Others

Source: ANCUPA

There are three main semi-processed products: Refined, Bleached, Deodorised (RBD) oil, stearin and olein. The stearin is a solid substance that is generally used for processing soaps and other products, the olein is a liquid substance that is used mainly for margarines and other products, and the RBD oil is processed into edible oil and other products, such as margarines.

The main palm oil derivative products that are exported are: crude palm oil (55%), stearin (11%), olein (10%), palm oil fat (9%), RBD (7%), soaps (4%), edible oil (1.7%), vegetable fat (1.3%) and margarines (1%).

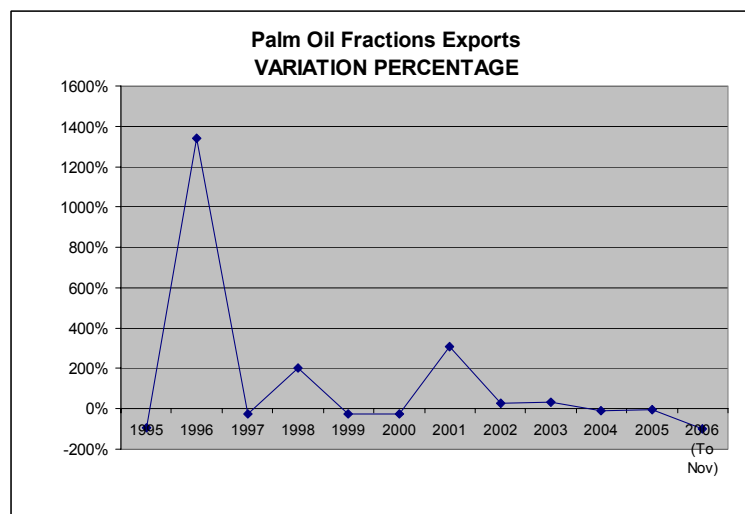
Refined palm oil and all the semi-processed palm oil fractions¹⁷ are included under the same classification in Ecuador's tariff nomenclature system. This is why we analyse the trade flows of all these products as only one group. It is important to mention that this classification does not include other finished products besides refined oil. The next graph shows the variation percentage of palm oil fractions exports between 1995 and 2006¹⁸. This variation percentage has stayed relatively stable since 2000.

¹⁶ ANCUPA-FEDAPAL. This statistic for the investment level includes as well the oil extracting activities.

¹⁷ Palm oil “fractions” refers to the semi-processed derivatives from palm fruit and palm kernel, which includes: stearin, olein, RBD, fat acids, and kernel tart. The term “fractions” is used to differentiate these palm oil derivatives from processed-ready products, such as margarines, soaps, etc. Nevertheless, the only fraction that would be considered finished product is the RBD.

¹⁸ Variation percentage calculated with data from ANCUPA.

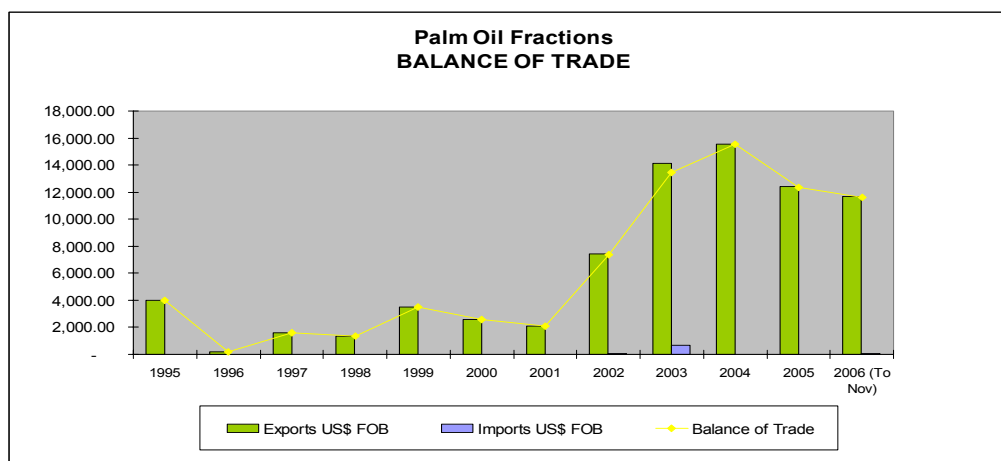
Figure 2: Palm oil fractions exports



Data source: ANCUPA

Furthermore, the balance of trade of palm-oil fractions in Ecuador has been positive (See Figure 3).

Figure 3: Palm oil fractions balance of trade



Data source: BCE

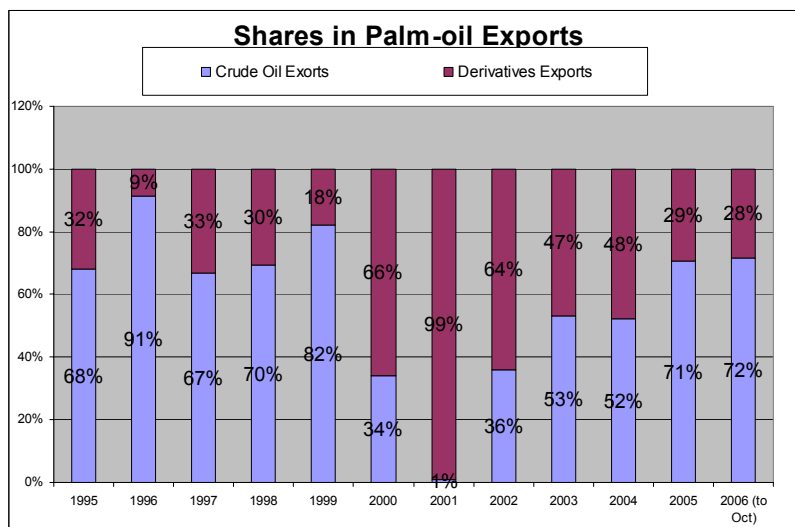
It is important to analyse the data on production and exports of the products obtained at the third level of the value chain. It is evident that the level of palm oil industrial processing has maintained an upward trend, exemplified by its crude palm oil production. This fact is even clearer in the next graph that shows that the share of crude palm oil exports and palm oil derivatives¹⁹ exports during the period of 2000-2006 increased in relation to the period 1995-1999. Nevertheless, a considerable level of fluctuation is evident. Such fluctuations are very much related to exogenous agents, mainly international palm oil prices, and not to production issues²⁰. For example, between 2004 and 2005 the share of fractions exports went from 49% to 28% of total palm oil products as a result of a sudden fall in the palm oil price in the

¹⁹ Meaning by derivatives all semi-processed products and finished products.

²⁰ Freddy Lopez, Economist representative from ANCUPA-FEDAPAL.

international market. This fall occurred unexpectedly since palm oil enjoyed very good prices in 2005; so processing companies could not buy the raw material from producers. Instead, FEDAPAL had to buy and export such surplus of crude oil²¹.

Figure 4: Shares in palm oil exports



Source: ANCUPA

Biodiesel processing

Biodiesel is one of the palm oil derivative products. Biodiesel is produced during the industrial phase. After African palm is cultivated and the palm oil is extracted, the crude palm oil is processed to obtain the “steres metilicos” of biodiesel. The elaboration process of biodiesel consists of mixing an alcohol (in most cases methanol) with palm oil in order to produce “transesterification” (a process requiring a catalyst). Two substances result from this chemical reaction: biodiesel and glycerin.

The technology used for this process includes machinery for catalysing, distillation, and chemical and physical filtration. This technology has already been developed in various countries and Ecuador could have acquired the technology from Colombia, Brazil, or some European or Asian country²². La FABRIL²³ however, chose to use expert advice from abroad to develop the technology in Ecuador. There have been no attempts to build biorefineries for biodiesel production yet. The existing one belonging to La FABRIL has been adapted and this, according to the owners, is proving to be an easy process²⁴.

Nevertheless, estimates of the cost of these plants show much variation, something between US\$ 3,600,000 and US\$ 24,000,000. Evidently, the different characteristics in terms of size and quality of the plants largely determine their cost. Decisions on technology depend on the scale of production that Ecuador will be engaged in. So far, there is no defined legal framework for the acquisition of this kind of technology; no regulations or standards have

²¹ Ibid.

²² Interview with Romel Vargas, representatives of ANCUPA – FEDEPAL.

²³ Interview with Carlos Gonzalez Artigas Looor, General Manager of the FABRIL.

²⁴ Carlos González-Artigas, General Manager of La Fabril.

been established yet on intellectual property rights (IPR), support or other measures to acquire this technology.

Value chain

Because palm oil biodiesel production accounts for a very small share of palm-oil production, the biodiesel value chain analysis must be built on to the whole palm oil value chain.

Currently, the area of palm oil cultivation is approximately 207,000 hectares, in which there are 5,515 palm producers (including producers of all capacities). According to the palm sector census carried out by the Ecuadorian National Association of African Palm Farmers (ANCUPA) in 2005, from the 5,515 producers, 62.9% correspond to small and medium producers (with “small producers” meaning landowners of 1 to 20 hectares), while medium producers represent 32.6% (with “medium producers” meaning landowners of 21 to 100 hectares). This is shown in the table below.

Table 3: Stratification by cultivated area, 2005

Range (ha)	Area (ha)	Area Percentage	Number of Producers	# Producers Percentage
From 1 to 10	14,327.6	6.9%	2,306	41.8%
From 11 to 20	18,664.4	9.0%	1,163	21.1%
From 21 to 50	49,080.5	23.7%	1,336	24.2%
From 51 to 100	38,783.2	18.7%	464	8.4%
From 101 to 200	31,145.8	15.0%	175	3.2%
From 201 to 500	17,775.0	8.6%	52	0.9%
From 501 to 999	11,282.4	5.4%	10	0.2%
More than 1000	26,226.5	12.7%	9	0.6%
TOTAL	207,285.4	100.0%	5,515	100.0%

62.9%

32.6%

4.5%

Source: ANCUPA – SIAGRO. Palm Sector Census. 2005.

Thus, palm oil production in Ecuador is concentrated in small and medium-size producers; although this might be slowly changing with the arrival of new companies of greater size which are increasingly investing in this sector.

About 140,000 to 180,000²⁵ direct and indirect jobs are currently created by the palm oil sector. Approximately 70% of them are created during the agricultural and agroindustrial phases of the value chain²⁶. It is important to mention that the share of GDP of the palm oil agricultural and agroindustrial phases accounted for 15.2% of the national agricultural GDP for the period 1999-2005²⁷. This rate shows the considerable contribution of the palm oil agricultural sector to the whole national agricultural activity, taking into account that the agriculture sector includes important products, such as bananas, coffee, cocoa, and flowers.

Nowadays there are some 40 oil extractor companies in Ecuador. All of them are Ecuadorian companies and during the past ten years they have achieved a good quality in their production²⁸. The industry currently produces 340,000 tons of crude palm oil. National

²⁵ Estimation calculated by La Fabril

²⁶ Ibid.

²⁷ Diana Carvajal. *Análisis del Acuerdo de Complementación Económica No. 59 CAN-MERCOSUR y el Sector Oleaginoso. Caso Palma Africana*. 2006.

²⁸ Romel Vargas, technician from ANCUPA

consumption is estimated to be approximately 200,000 tons. Thus, there is an export potential of approximately 140,000 tons of palm oil or by-products.

Currently, there are four processing companies: La FABRIL, ALES, EPACEM and DANEC, all of them financed by private Ecuadorian capital. La FABRIL and ALES are located in Manta, EPACEM in Santo Domingo and DANEC in Sangolquí. The four processing firms are involved in the three value chain stages.

Biodiesel production accounts for a very small share of palm oil production in Ecuador. Although biodiesel production increased between 2005 and 2006 (in tons), its share over total palm oil derivatives decreased (from 0.8% in 2005 to 0.4% in 2006), suggesting that the increase in palm oil production was bigger than the increase in biodiesel production²⁹. Only one processing firm, La FABRIL, has produced biodiesel. This demonstrates that biodiesel production is a fairly new segment in the Ecuadorian palm oil sector. However, there is interest from other palm oil processing and extractor companies to join the initiative³⁰.

In summary, these are the actors in the palm oil and biodiesel value chains:

Figure 5: Palm oil value chain

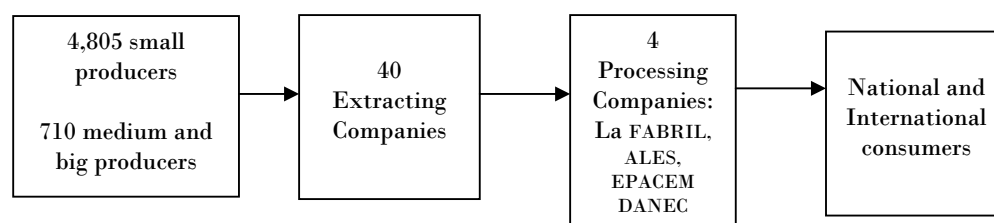
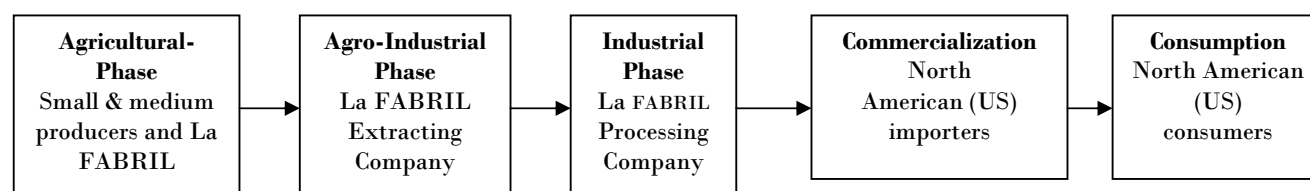


Figure 6: Biodiesel value chain



In the palm oil value chain, small producers sell their product directly to extracting companies, so that there are no intermediaries. Some of the extracting companies are independent, others are associated with palm-farmers, and others are affiliated with the processing industries. In some cases, big producers are also owners of the extracting companies. All four processing companies own extracting facilities, but they also have supply contracts for crude oil and palm fruit with extracting companies and agricultural producers respectively. This applies to La FABRIL and its biodiesel production as well³¹.

²⁹ Statistic calculated by Authors with data from the FABRIL Company and ANCUPA

³⁰ ANCUPA

³¹ See ANNEX# 5 to find a summary Chart of value chain analysis.

3.7 Prices and production costs

Biodiesel production costs include capital and operation costs. According to data from La FABRIL, the capital costs include the industrial plant costs plus the cost of the supporting infrastructure. The first represents 65% and the second 35% of the total. Within the industrial plant expenses, the costs correspond to the following percentages:

Table 4: Biodiesel Industrial Plant Expenses - percent shares

Item	Cost percentage
Processing equipment	35%
Pipes and annexes	21%
Electrical installation	12%
Metallic structure	10%
Automat and security	9%
Isolation	7%
Civil structure	3%
Installation in situ	3%

Data source: La FABRIL

As mentioned above, estimates of the cost of biodiesel plants vary greatly, from US\$ 3,600,000 to US\$ 24,000,000, depending on the expected production scope. Supporting infrastructure includes tanks, batteries, administrative and auxiliary services buildings and the construction area. A preliminary assessment, based on data provided by the company, would indicate that to meet a target of 1,300,000 barrels (or 210,000,000 liters)³² per year, the company would require an approximate investment of US\$ 44 millions (solely for operational facilities).

Of the operational costs, approximately 83% corresponds to operational material (vegetable oil and chemical products). The other 17% corresponds to transformation costs, which includes: labour costs, maintenance, depreciation, public services, insurance, administration and sales and auxiliary services.

Table 5: Biodiesel Production Operation Costs - percent shares

Biodiesel Cost ITEM	Cost percent
Vegetable oil	76.3%
Methanol	5.3%
Catalytic	1.3%
Transformation Cost	17.1%
Total	100%

Data source: La FABRIL

The current operational cost for palm oil biodiesel is around US\$ 810 to US\$ 925 per ton in the different markets. According to the *World Biodiesel Price Report* (October/2007 issue), the prices for biodiesel (palm oil methyl ester (PME)) were US\$ 825 to US\$ 840 per ton in the

³² 1,300,000 barrels (or 210,000,000 liters) of biodiesel per year corresponds to the yield from 50,000 palm oil hectares (used only for biodiesel production).

southeast Asia market and US\$ 897 to US\$ 910 in the European market. These costs include those of vegetable oil, methanol, catalytic, methanol, but not the transfer value and do not include taxes or labour costs.

In Ecuador, in May 2007, the operational cost was US\$ 875 per ton of biodiesel. This cost corresponds to US\$ 119 per barrel (US\$ 2.8 per gallon), prices that are much higher than the conventional diesel#2. This price does not include the transformation factor, which corresponds approximately to US\$ 190³³. In addition, the transportation cost per biodiesel ton from Manta (La FABRIL) to Esmeraldas (refinery), the most likely scenario for this Company, is around US\$ 22 per ton³⁴. In total, these costs would represent US\$ 1,087 per ton (US\$ 148 per barrel or US\$ 3.5 per gallon). Hence, the operational costs for Ecuadorian biodiesel in the global markets are currently expensive and the business profitability is still in question.

It is important to stress that biodiesel costs fluctuate constantly, because of its dependence on palm oil and petroleum prices. As shown in Chart 5, vegetable oil costs are the most influential item within the biodiesel operational costs (76%), and as it will be explained more fully in the economic analysis, the biodiesel price contingency to crude palm oil and petroleum oil prices, makes palm oil biodiesel costs not only vulnerable but also unpredictable.

³³ La Fabril and the Biofuels Advisory Council.

³⁴ Biofuels Advisory Council.

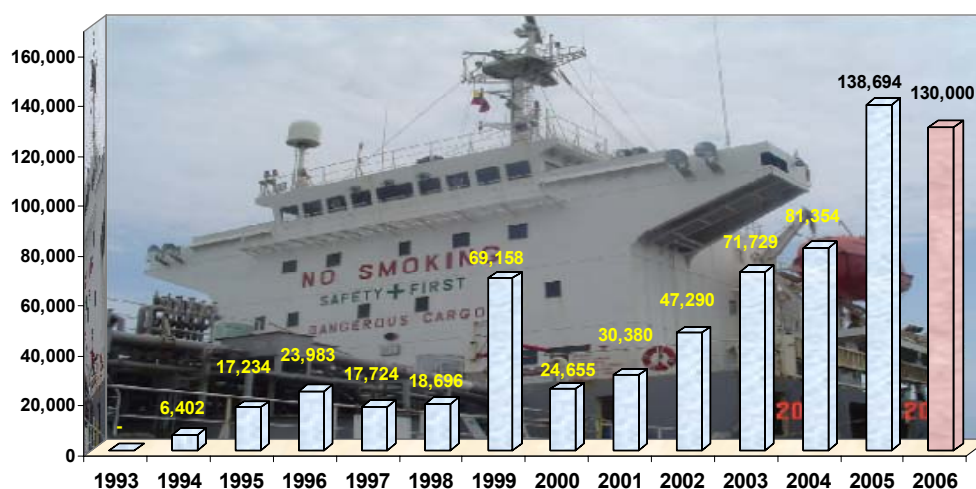
4 Trade analysis

4.1 Palm oil trade

Ecuador is the seventh largest producer of palm oil in the world and the second in South America³⁵. Nevertheless, its production represents only 0.95% of the world production, because Malaysia and Indonesia, the two largest palm oil producers, together account for 86% of the world output. Two other important producers are Nigeria and Thailand, with 2.4% and 2% of the world output, respectively.

Currently, Ecuador has 207,000 cultivated hectares. Palm oil national consumption accounts for approximately 200,000 tons per year, and production continues to rise, from 320,000 tons in 2005 to 340,000 tons in 2006 with expectations of further increases for 2007. National consumption concentrates on oil, edible palm oil, butter, soaps and raw matter for animal feed. Consequently, Ecuador exports approximately 40% of its palm oil production (this includes semi-processed and finished products)³⁶. However, this rate has not been consistent; the percentage of palm oil exports to total palm oil production increased from 11% in 2000 to 43% in 2005. Such exports correspond not only to crude palm oil but also to palm oil fractions. The following figure shows the trends of palm oil exports from 1993 to 2006.

Figure 7: Palm oil exports³⁷



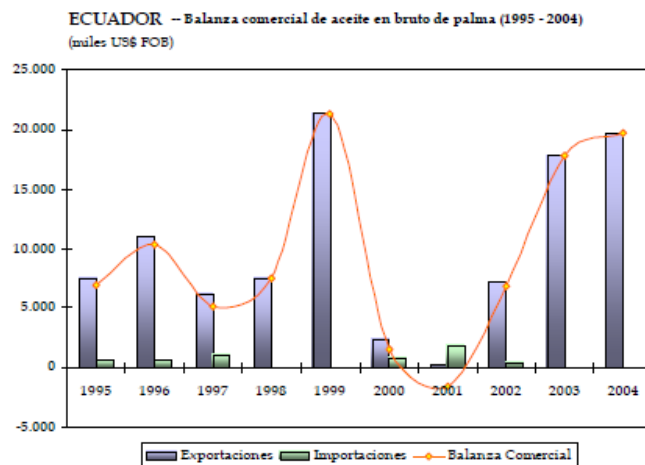
During the last 15 years, Ecuador has achieved a surplus in crude palm oil, except in 1997 and 2001, when the production sector suffered a crisis and was not able to fulfill internal demand. Figure 8 shows the trade balance evolution for palm crude oil suggesting that production has a cyclic pattern and that a contraction took place in tandem with the national financial crisis (from 1999 to 2001).

Figure 8: Crude palm oil trade balance 1995-2004

³⁵ The first palm-oil producer in South America is Colombia, which represent 2% of the world production.

³⁶ Meaning by processed-ready products, all the derivative products that are processed with palm-oil fractions, such as soaps, margarines, cosmetics, etc.

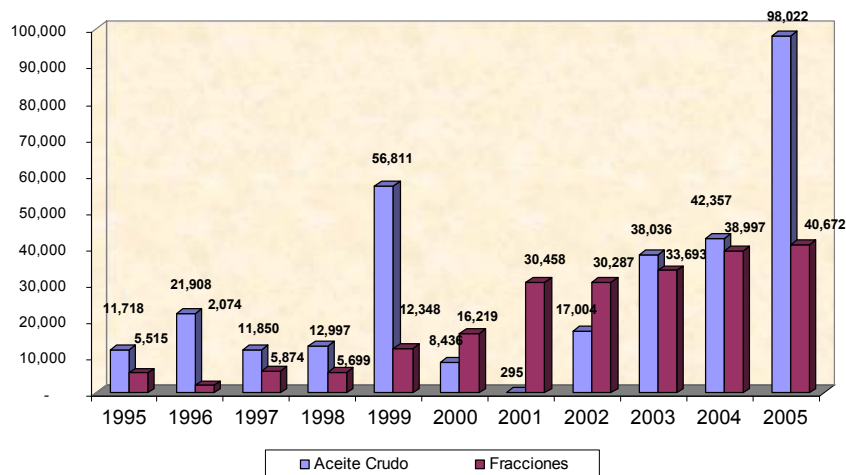
³⁷ Chart elaborated by FEDAPAL



Fuente: Banco Central del Ecuador.

All the semi-processed palm oil fractions are included under the same classification in the Ecuadorian tariff nomenclature system, while finished products (other than refined edible oil), are more difficult to track, because they are registered under different tariff codes in the Ecuadorian customary system. Codes for such products as margarine, soaps, different fats, etc. refer to each processed product. Therefore, this data is not calculated by the Central Bank because of the difficulty of separating the products made with palm oil and other oils. However, ANCUPA calculates some equivalents by considering the percentage of palm oil used for the fabrication of products eg 63% of palm oil is used in the soap industry. Figure 9 shows exports of both crude palm oil and fractions including finished products using this methodology.

Figure 9: Palm oil exports shares



Source: ANCUPA and the Ecuadorian Federation of African Palm Producers (FEDEPAL)

Crude palm oil exports have been larger than fractions exports. Crude oil exports from 1995 to 2006 amounted 409,635 tons, while fractions were 257,653 tons, corresponding to 61% and 39% of the total exports of the sector, respectively.

4.2 Biodiesel trade

Ecuador has been producing biodiesel since 2005 through La FABRIL Company and this production has only been exported and not consumed internally, because there is no legal or technical framework yet to encourage domestic consumption in Ecuador. The only country to which La FABRIL has exported biodiesel is the United States: 24,000 tons (3,358,000 gallons) of biodiesel in 2005, and 35,000 tons (10,780,000 gallons) in 2006³⁸.

Future prospects

According to ANCUPA-FEDAPAL statistics, by 2009 an estimated 240,000 palm oil hectares will be cultivated and crude palm oil production will rise to 400,000 tons, of which 200,000 tons could be used for exports. There are ambitious projects from private palm oil products processors. For example, La FABRIL is currently planning to increase palm oil cultivation for biodiesel production³⁹.

Every hectare of cultivated oil palm yields 4,200 liters of biodiesel per year⁴⁰. Therefore, 100,000 cultivated hectares (which is the target for expansion) could produce 420 million liters of biodiesel per year, which translates to 110.5 million gallons or 359 thousand tons of biodiesel per year⁴¹.

Ecuador's palm oil production would have to first supply the national market, as the National Program for Biofuels states that biodiesel production will be a national priority to help cover the national diesel demand. However, several calculations show that Ecuador's production will be sufficient to supply international markets as well. The following estimations support this conclusion:

- In order to reduce Ecuador's diesel imports, the national Biofuels Program is assessing a policy for mixing Diesel#2 with biodiesel, either in a mix of 2% or 5%. In the case of blending 5% of biodiesel with Diesel#2, the required biodiesel amount would be approximately 1,187,000⁴² barrels per year⁴³, which is equivalent to 161,937 tons per year.
- If the national petroleum diesel demand keeps its current increased rate of 13% in 3 years the national demand of biodiesel will reach 233,658 tons. Over the same time period, once the 100,000 hectares start producing palm oil (expected to start this year), they would yield 359,015 tons, some 35% higher in relation to the expected national demand in these years.
- Moreover, although La FABRIL is the only company in Ecuador producing and exporting biodiesel, there are several companies involved in the processing and extraction of palm oil that are interested in exploring biodiesel production.

These calculations illustrate Ecuador's potential to supply biodiesel not only for the national market but also for the international market. Nevertheless, this analysis is based on facts and projections assessed for 2006. By 2007, the vulnerability of biodiesel prices increased, affecting the decision of La FABRIL and other palm oil companies to increase palm oil production for biodiesel.

³⁸ Interview with the General Manager of the FABRIL Company.

³⁹ The Company has preferred to keep the data (# hectares) of this project off the record.

⁴⁰ Data from Ministry of Agriculture.

⁴¹ Data calculated with conversion measures.

⁴² Calculated from the biodiesel national demand for 2006, which was 23'725,000 tons.

⁴³ Information provided by the Ministry of Agriculture and prepared by the Biofuels Program Advisory Council.

4.3 International trade agreements

A policy framework for biofuels trade has not yet been discussed at the World Trade Organization (WTO). However, as biofuels trade increases in popularity and significance, it becomes a matter of concern for policy makers worldwide. Ecuador has been a WTO member since January 21, 1996, and has been following the developments of this debate and the progress of the different negotiations at the unsuccessful Doha Round, including the General Agreement on Trade and Services (GATS) and the Non-Agricultural Market Access Negotiations (NAMA). As Ecuador is a country with an undeveloped but potentially emergent biofuel industry, it is important to be well informed about the areas of concern and controversy that have yet to be clarified at the multilateral level. The current issues facing biofuels trade at the multilateral level are presented below.

Biofuels classification

When the Doha Ministerial Declaration was agreed upon, developing countries had high expectations for what had the potential to be an “accelerated trade liberalisation of environmental goods and services”. At the beginning of the Doha Round there was interest from developing countries in discussing classifications that would allow them to take advantage of this accelerated liberalisation on environmental goods, due to their comparative advantages. Nevertheless, six year later no significant progress on environmental goods has been made on the Doha Developing Agenda.

Regarding biofuels, a key issue to be addressed at the multilateral level relates to whether ‘biofuels’ should be classified as agricultural, industrial, or environmental goods under the WTO framework. Although, for purposes of tariffs, WTO members can determine the way in which they classify their products, many of these countries, including Ecuador, are members of the World Customs Organization (WCO), and as such are committed to use the Harmonised Description and Coding System (HS) for such classifications. In the HS, biodiesel is considered an industrial good⁴⁴, it falls under Chapter 38 (subheading 38 24 90), while bioethanol falls under Chapter 22 and is considered an agricultural good. Under such classifications, bioethanol, but not biodiesel, would be included within the regulations of the WTO Agreement of Agriculture (AoA), because according to Annex 1 of the WTO AoA, this agreement applies to HS Chapters 1 to 24⁴⁵.

Additionally, during the Doha Development Round, the Special Session of the WTO Committee on Trade and Environment (CTE) proposed to classify biofuels as “environmental goods”. In this case, they would be “subject to special negotiations in order to reduce trade barriers with respect to ‘Environmental Goods and Services’ (EGS)” and there would be a call for elimination of tariff and non-tariff barriers. Brazil, India and the European Union (EU) have supported this alternative; however, as this option was part of the Doha Development Agenda (DDA), it has remained unsolved. Furthermore, even classifying biofuels as an “environmental good” raises a secondary issue, as according to paragraph 31 (iii) of the Doha Declaration, which established the mandate for the EGS negotiations, some WTO members have taken the position that only products subject to NAMA could be included in the EGS negotiations and thus excluding agricultural products”⁴⁶.

⁴⁴ The HS classification of biodiesel says: “a mixture of mono-alkyl esters of long-chain [C16-18] fatty acids derived from vegetable oils or animal fats, which is a domestic renewable fuel for diesel engines and which meets the specifications of ASTM D 6751 [American Society for Testing and Materials “Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels].” Howse, Bork and Hebebrand. *WTO Disciplines and Biofuels. IPC-REIL*. October 2006. pg. 11.

⁴⁵ With some exceptions for fish products and a specified list of products with other headings, which have also been included in the AoA.

⁴⁶ Robert Howse, Petrus van Bork and Charlotte Hebebrand. *WTO Disciplines and Biofuels. IPC-REIL*. Oct, 2006. Pg. 11.

Such lack of a unique biofuels classification in the multilateral trading system and the fact that existing biofuels classification within the HS codes make no distinction between whether they are used as fuel or for other purposes, poses a myriad difficulties for biofuels trade, including:

- Causing difficulties in obtaining precise trade statistics
- Hindering efforts to liberalise tariffs on biofuels
- Complicating agreements on tariff reductions because of different effects that these products have when they are used as fuels and when they are destined to other uses⁴⁷
- Impeding resolution of government support measures as well as technical regulations.

In the case of establishing a particular HS classification for biofuels, it would be up to a consensus of the WCO members to include such classification into the WTO Agreement on Agriculture by amending Annex 1 of the AoA⁴⁸. However, attempting to change the biofuels classification within the amendment of the Harmonized System would take a great deal of time. The most recent amendment was approved by the WCO Council in June 2004 and it will be implemented on January 1, 2007. Following this pattern, any new amendments would not be implemented before 2012.

However, it is becomes crucial to identify ways to facilitate WTO discussions and solutions. In the discussion paper *WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Marketplace* an alternative solution is proposed: *"In theory, WTO members could negotiate the liberalization of tariffs on biofuels in a way that circumvented the HS classification problems.... such negotiation would not need to take place within the negotiating structure for NAMA, agricultural goods or EGS: if there were political will it would be a simple matter to launch a sui generis negotiation by a decision of the WTO Ministerial Council"*. In addition, the authors recommend that such multilateral (or plurilateral) agreements do not focus mainly on environmental parameters. From their perspective, such a focus could cause problems due to the existing controversy over defining an "environmental good" in the EGS negotiations.

Government measures to protect domestic biofuel production

Governments are endorsing policies to support biofuels production for many reasons including a desire to decrease oil import bills, maintain foreign exchange, rural support and job creation, compliance with environmental agreements (especially the Kyoto Protocol), pressure to reduce carbon dioxide emissions, and an overall desire to increase energy security through self-sufficiency.

The biofuel sector around the world is counting on a great range of governmental support measures, from direct forms such as tax exemptions on production, mandates for production of specific levels of biofuels, mandates for compulsory blending with fossil fuels, consumption and/or production subsidies, exemptions or deferrals on sale of biofuel plants and infrastructures, and others, to indirect forms such as subsidies for purchasing vehicles and infrastructure able to use biofuels, government purchases of surplus agricultural stocks for conversion to biofuel, and others.

⁴⁷ Several WTO members would agree to reduce tariffs for substances used as fuels because of environmental and energy security reasons, but they would not have the same perspective when such products have other uses and they could compete with the countries' domestic production.

⁴⁸ "Annex 1 of AoA already lists certain products that have non-agricultural HS headings but that are nevertheless specified to be within the ambit of the AoA." Howse, Bork and Hebebrand. Oct, 2006.

If biofuels are considered industrial goods, as biodiesel is, their trade support measures will be governed by the Agreement on Subsidies and Countervailing Measures (SCM). Under this agreement, export subsidies for the biofuel industry as well as subsidies contingent upon using domestic inputs over imports would be prohibited. Currently some countries, including the United States and members of the EU, are enforcing support programmes that are not in compliance with these principles⁴⁹.

The other two subsidy categories under the SCM agreement are actionable and non-actionable. Under Part III of the SCM agreement “if a subsidy exceeds five percent of a product’s value and is administered in such a way as to be trade distorting, it is an actionable subsidy”, therefore, almost every subsidy that currently exists in the biofuel industry is actionable. In addition, in order for a subsidy to be actionable, it must match the definition of subsidy provided by the SCM - it will have to be a financial contribution by a government or any public entity, within the territory of the member country, which confers a benefit to a recipient. Additionally, the subsidy must be specific, meaning that the target of the programme must be a limited group of users. It is questionable whether taxation-based measures for production of biofuels would fulfill this condition. A tax credit measure is supposed to be accepted as a “financial contribution” because the government has “foregone revenue otherwise due,” but an environmental tax might be inconsistent with the “financial contribution” concept of the SCM agreement.

Likewise, in order for subsidies related to biofuels production to comply with the SCM agreement they would have to confer a “benefit” in the sense that the recipient must get a competitive advantage in comparison to the conditions of the market with no government intervention (which theoretically is considered to be a normal or undistorted market). Answering this question is highly complex because global markets for biofuels are greatly influenced by government interventions. Solving dispute cases with such precedents would become a much more difficult task, resulting in a reluctance to rely on WTO dispute settlement panels to find solutions in these matters. In addition, subsidies on consumption of biofuels as well as subsidies on feedstocks for use as biofuel inputs fails to satisfactorily fulfill the basic characteristics of a “subsidy” under the SCM definition, both on the issue of conferring a “benefit” and specificity⁵⁰.

Additionally, subsidies on animal feedstocks for use as biofuel inputs must also conform to the Agreement on Agriculture, AoA, and the possibility of these subsidies qualifying as “green box” has become controversial. If these subsidies were defined as environmental subsidies, they would have to be limited to compensate only what is required to comply with government environmental programmes. Moreover, on the production of biofuel inputs (such as biomass on “set-aside land”) it is questionable whether they would fall under the meaning of “marketable agricultural production” which is required under the Agreement of Agriculture (paragraph 10 of Annex2). This issue is very controversial because, on the one hand, biofuel feedstocks are not used as food or animal feed and, on the other hand, they have a competitive impact in the markets of these crops. This issue is even more blurred in the case of bioethanol, in which the HS system does not distinguish its use as a biofuel or not. Also, there are concerns over tax concessions to domestically produced feedstock used in the production of biofuels as this would violate Article III: 2 of the GATT regarding giving similar treatment to

⁴⁹ Annie Dufey. *Biofuels, Production, Trade and Sustainable Development: Emerging Issues*. IIED. Sept, 2006.

⁵⁰ IPC-REIL. *WTO Disciplines and Biofuels*. October 2006

“like” imported and domestic products as well as “directly competitive or substitutable products”.

Furthermore, potential cross-subsidisation in biofuels production, when subsidies for production and consumption exist at the same time, is another area of conflict. The possibility of cross-subsidisation in addition to the subsidies to by-products created in the manufacturing of biofuels has a great potential to produce a surplus of by-products⁵¹ and meal industries causing an overtake of the domestic demand of such products and leading to a reduction of meal imports, which would conflict with the GATT “national treatment” principle.

Currently, government support programmes for biodiesel have not been under the structure of the AoA because of their HS classification (38 24 90) as an industrial product. However, because of the existing irregularities in biodiesel international trade and biofuels in general, especially with regard to inconsistencies in the SCM agreement, there are expectations of moving biofuels to fall under the AoA.

Nevertheless, many support programmes for biofuels are not structured as support for agricultural products that fall under the AoA, and there is concern about the possibility that changes for the biofuel structure at the WTO would make them fall under “amber box” measures. If a large enough number of products fall under this category of measures, the tariff ceilings to which members have agreed would be broken⁵². Additionally, the amber box requirement that the subsidising WTO members must provide notification on the subsidies has proven problematic, and generally countries do not comply with this standard. On the other hand, the option of a support programme under the green box would involve meeting various criteria⁵³, and additional requirements would be in place in order to qualify for environmental subsidies, such as the requirement that the subsidy compensate consumers or users only for the additional cost of switching from conventional fuels to biofuels.

Box 1 mentions some of the most important government support measures for biofuels in general and specifically on biodiesel. The box focuses on potential trade partners for Ecuadorian biodiesel or where the biodiesel industry is at the forefront of development.

Box 1: Biofuels Government Support Measures in Ecuador’s Potential Trade Partners

European Union

- In 2003 the Common Agricultural Policy (CAP) introduced a **payment called EC Energy Crop Premium**, which is a payment for farmers in addition to the single farm payments (or payments that are decoupled from production) and is based on the amount of land that is used to produce energy crops.⁵⁴
- A subsidy for biofuel production of about €36 cents per liter.
- Tax exemptions for biofuels consumption:
-In Sweden, tax exemption for biodiesel = EUR\$344/ m3

⁵¹ For example, the rapeseed meal industry in the EU has experienced a considerable growth as a result of biodiesel production.

⁵² IPC-REIL. *WTO Disciplines and Biofuels*. October 2006

⁵³ “The Program has to be publicly funded, not involve transfers from consumers and not have the effect of providing price support to producers,...and it has to comply with additional requirements (included in Annex 2 to the URAA) which provide *inter alia* for green box treatment of subsidies for research and development and general services and infrastructure as well as environmental subsidies, but in each case there are certain exceptions.” (IPC-REIL, 2006, pg. 18)

⁵⁴ Because of the nature of this payment the ICP-REIL report asserts that such measure would clearly fall under the AoA, but it is not clear if it should be notified as green blue or amber box.

<ul style="list-style-type: none"> -In France, biodiesel tax break of EUR\$330/ m3 -In Germany, a biodiesel tax incentive of EUR\$470/m3 - In the UK, a tax break of EUR 138/m3 - In Spain, total tax exemption (savings of EUR\$294/m3) <ul style="list-style-type: none"> ▪ Production support includes tax incentives for plants construction (Sweden), tax exemptions for production (France) and no-production quota (Germany). ▪ The European Union target for domestic consumption is to reach a transport fuel mix of 5,75% by 2010; in February of 2007, European Energy Ministers moved the target percentage to 10% of biofuels blend into fossil fuels by the year 2020.⁵⁵ <p style="text-align: center;">United States</p> <ul style="list-style-type: none"> ▪ Volumetric Tax Credit for biodiesel of US\$ 1 per gallon of biodiesel produced from virgin oils or fats and 50% from recovered oils and fats. This policy was endorsed in January of 2005. ▪ Tax incentives for alcohol and biodiesel fuels, available to blenders/retailers through the American Jobs Creation Act of 2004 (Public Law 108-357). ▪ Consumption support, such as tax credits, fuel tax exemptions, loan assistance ▪ Production support of grants and loan programs ▪ Imports protection of US\$ 0.54 gallon secondary duty to imports of cheaper biomass and more efficient technology. <p style="text-align: center;">Brazil</p> <ul style="list-style-type: none"> ▪ Tax breaks for biodiesel produced by <i>Family Agriculture</i> (this is part of the <i>Biodiesel Social Seal Program</i>). ▪ Auction participation from enterprises that have the <i>Social Seal</i>. In 2008, 80% of B2 consumed nationally will be commercialized through this system. ▪ Tax exemptions for vehicles able to run on biofuels; new legislation on biodiesel was implemented in January 2004. ▪ Mandatory provisions to use biofuels on government vehicles <p style="text-align: center;">India</p> <ul style="list-style-type: none"> ▪ Biodiesel purchasing policy, which mandates the public sector oil companies to buy oil produced from jatropha, pongamia and other oil plants and sell it in a 5% blend, rising to 20% in 2020. This policy has been in force since January 2006. ▪ Production support of subsidies for inputs, tax credits and loans. <p style="text-align: center;">Thailand</p> <ul style="list-style-type: none"> ▪ Tax exemptions for vehicles able to run on biofuels. ▪ Support for development of domestically-produced “green” vehicles

Technical and environmental standards

Several environmental standards are being assessed worldwide that could constitute technical barriers to trade, but the WTO Agreement on Technical Barriers to Trade (TBT) allows taking into account standards that accomplish environmental purposes. For instance, the Biomass Action Plan of the EU is analysing the possibility of “introducing green certificates that would certify biocrops that have grown in an environmentally sustainable manner”⁵⁶. Some of the conditions that are being analysed include “conditions that address the environmental impact of biofuels in the country of import, conditions that maximise the contribution of biofuels to

⁵⁵ German Marshall Fund Report. 2007. “EU and US Policies on Biofuels: Potential Impacts on Developing Countries.

⁵⁶ Annie Dufey. *Biofuels, Production, Trade and Sustainable Development: Emerging Issues*. IIED. Sept. 2006.

reduce carbon emissions throughout the entire life-cycle, and conditions that promote sustainable agriculture in the country producing the feedstock for biofuel”⁵⁷.

There are several key issues here. One relates to the contribution of biofuels to reduce carbon emissions throughout the entire life-cycle, while the GATT regulations⁵⁸ in its definition of ‘like products’ does not allow differential treatment of products based on their method of production; it only allows product-related barriers, meaning properties of the products for consumption. Moreover, the current major concern is over an agreement on sustainability standards and the technical regulation that must be in force in order to meet such standards. The International Organisation for Standardisation (ISO) could be used as a framework for international standards for the life-cycle approach to environmental management. However, standards are yet to be defined for the particular case of biofuel production impacts. It is important to take into account elements that would introduce more barriers to biofuels international trade and hinder its development, especially considering that North-South standards do not seem to be aligning.

It is important to mention that the WTO structure does not intend to use these technical regulations to limit trade but rather to fulfill such requirements in the least restrictive way. For example, the European Union Fuel Quality Directive, which promotes a standard EN 590 that states that diesel must contain no more than 5% biodiesel is not environmentally justifiable and might be reviewed⁵⁹. Thus, clarity on the Technical Barriers to Trade (TBT) provisions in force will also help to restrict trade barriers, but only for those that have justifiable reasons.

Biofuel preferential market access status

Countries are allowed to import biofuels, such as Ecuadorian biodiesel, at lower tariffs while retaining tariff protection for domestic non-fuel products that are under the same HS classification⁶⁰. This would be possible if the WTO member that wanted to import such a product introduced a further sub-classification in its domestic nomenclature. This process would not require permission from or negotiations with other WTO members, but would be subject to normal transparency obligations of Article X of the GATT, and obviously such tariff provisions would have to provide MFN treatment to “like products”⁶¹. However, there is still uncertainty about the extent to which environmental impacts from production methods could or could not be used as parameters for determining “unlike products”.

Ecuador, because of its position as a developing country, is a beneficiary of trade preferences from the European Union and the United States. However, currently, biodiesel from Ecuador is not a beneficiary of any tariff preference system, while bioethanol is a beneficiary under the European Union Generalized System of Preferences (GSP+).

The original US Generalized Preference Program for Developing Nations was created in 1973 and this programme granted preferential access to 4,100 Ecuadorian products. This system was renewed particularly for the Andean countries, under the ATPA (Andean Trade Promotion Act) in 1991, when 2,000 Ecuadorian products were added to the original SGP and in 2001 under the ATPDEA (Andean Trade Promotion and Drug Eradication Act) where 171

⁵⁷ Robert Howse, Petrus van Bork and Charlotte Hebebrand. *WTO Disciplines and Biofuels*. IPC-REIL. Oct, 2006. Pg.25

⁵⁸ GATT agreement 1994

⁵⁹ Robert Howse, Petrus van Bork and Charlotte Hebebrand. *WTO Disciplines and Biofuels*. IPC-REIL. Oct, 2006.

⁶⁰ Neither WCO or WTO obligations would prevent a WTO Member from applying a lower rate of tariff than that bound for a six digit or higher HS classification to some sub-set of goods within that classification, as long as it provides MFN treatment to “like products.” (IPC-REIL Report, 2006)

⁶¹ IPC-REIL Report, 2006

lists of products were included. Biofuels, however, as a relatively new product in the international market are not explicitly mentioned in the ATPDEA list⁶² for preferential treatment. Nevertheless, bioethanol exports from the Andean Pact and NAFTA are excluded from the “extra tariff” of US\$ 54 cents/gallon (which applies on top of the 2.5% standard tariff).

On the other hand, palm oil products, and other agricultural products that constitute inputs for biodiesel production, are included in the lists of ATPDEA provisions⁶³. The list of products includes: “palm oil, crude, and its fractions whether or not refined, not chemically modified”, “castor oil, whether or not refined, but not chemically modified”, “nut oils, whether or not refined, but not chemically modified”, “oil seeds and oleaginous fruits not elsewhere specified or included, whether or not broken”, among others⁶⁴. It is important to note that either palm oil or its fractions are included but with the condition that they are not chemically modified; in this case, biodiesel could not be exported to the US as a palm oil derivative, because palm crude oil passes through a chemical process of “transesterification” in order to become biodiesel.

The European Union’s GSP, discussed below, does grant preferences, but only for bioethanol. On the other hand, there are no specific EU trade preferences for biodiesel on the table. There is only a proposed amendment to the standard EN 14214 in which the use of a wider range of vegetable oils is asserted, to the extent feasible without significant ill effects on fuel performance and respecting sustainability standards⁶⁵. However, it is not clear whether this amendment applies to EU countries, to other countries or to both.

It is important for Ecuador to acknowledge that even when the WTO “Enabling Clause” tool is present in the GSP scheme, which, among other rules, advocates for non-discriminatory and non-reciprocal action, there are also conditions that the importing developed WTO member can determine for granting such preferences. In the case of biofuels, such conditions could be highly related to sustainability criteria, and such criteria could raise possible discrimination among different developing countries. There have been cases when the Appellate Body held that, “under certain circumstances, the non-discrimination requirement in the Enabling Clause would in fact permit a developed country to treat different developing countries differently in the preference scheme”⁶⁶. Consequently, Ecuador should analyse thoroughly its biodiesel programme in order for it to be implemented through feedstock and methods that meet sustainability standards in the case the product is eligible for preferential access to developed countries’ markets in the future⁶⁷. The European Commission, for instance, has asserted in its report on the EU Strategy for Biofuels that while providing support for developing countries’ biofuels sectors, they will also ensure that processes are consistent with its development policy as well as with national and sector development policies, taking into account not only environmental but also social aspects.

⁶² But they are included for example in the Free Trade Agreement that Peru and Colombia are currently negotiating with the United States.

⁶³ The ATPDEA was recently extended for an eighth month period, starting June 30th, 2007. This period relates to the timeframe for congressional approval of Colombian and Peruvian Free Trade Agreements and therefore is not yet clear whether this current regime will be further renewed for Ecuador and Bolivia.

⁶⁴ ATPDEA List of products, page 115.

⁶⁵ IPC-REIL report, 2006.

⁶⁶ Ibid

⁶⁷ However, it is important to note that the definition of sustainability standards is still a matter of concern. The Appellate Body has suggested that the meaning of development needs could be determined based on references of multilateral instruments. However, as the IPC-REIL paper suggests, this situation points out the need of developing international standards and multilateral sustainable development instruments.

4.4 Ecuador's trade policy on biodiesel

The Ecuadorian legal system is not yet capable of administering the exportation of biofuels. Ecuador uses a system of tariff classification that includes two main international agreements to which it belongs: the World Custom Organisation (WCO) and the Andean Community. This system includes ten digits of tariff classification. The first six digits belong to the WCO, through the Harmonised System; the next two digits (seven and eight) belong to the Integrated Andean Tariff system, a system called "*Nandina code*" and the two last digits (nine and ten) are currently part of a national nomenclature. These last two digits will be included and harmonized for 2007 within the Integrated Andean Tariff system and it is expected that the system will have eighteen digits by 2008, in order to be consistent with the European nomenclature-tariffs system.

Within the Ecuadorian tariff system for foreign trade, there is no specific nomenclature for biofuels and therefore there is no tariff code yet. For this reason, it is not possible to know through the Ministry of Foreign Trade or through the Ecuadorian Customs Office the exact quantities of biodiesel that Ecuador is currently exporting⁶⁸. It is not possible for these offices to know under which tariff code or classification Ecuador is exporting biodiesel⁶⁹. Although Ecuador is a member of the WCO, it has not yet adopted the classification of the Harmonized System for biodiesel under Chapter 38 (Subheading 38 24 90). Ecuador is using the fourth amendment of the WCO Harmonised System and this classification is not a part of it. Further, within the Andean Community there have not yet been discussions on the topic of biofuels trade policies.

Nevertheless, there is currently a system under which Ecuador trades palm oil and its fractions. Oils in general are organised under chapter 15, with the following tariff classifications: 15 11 10 00 for crude palm oil, 15 11 90 00 for palm oil fractions (excluding processed-ready product and including refined edible oil), 15 13 21 10 for kernel palm crude oil and 15 13 29 10 refined palm crude oil. Moreover, as explained earlier, the processed-ready derivatives from palm oil, such as butter, soaps, cosmetics, and so on do not belong to a single classification, but rather come under the classification for each one of these individual products.

Regarding Ecuador's policy framework for biodiesel national consumption, no relevant steps have been taken to set up guidelines and articulate production and trade. The interviewees could not estimate a time frame for the development of the Biofuels National Program. However, if the new government endorses the programme's implementation, it could take between two and three years⁷⁰. In addition, the lack of financing is a key issue that is preventing the development of this programme, especially regarding biodiesel. To date, the Biodiesel Program has been stalled at sample-characterisation steps.

There are no attempts from PetroEcuador to invest in agricultural resources or industrial plants in order to produce biofuels itself⁷¹. In Ecuador, there is currently a clear tendency for private companies to take the forefront in biofuels production, while the government takes a

⁶⁸ Mr. Mauro Benavidez, delegate of the Ministry of Foreign Trade.

⁶⁹ There are several options as "other oils": 15 15 90 00; "other lubricant oils 27 10 19 38 or others.

⁷⁰ Mr. Gonzalez, representative from the Ministry of Energy and member of the Biofuels Program Advisory Council.

⁷¹ Angel Sepeda, representative from PetroEcuador and Biofuel Program Technical Committee.

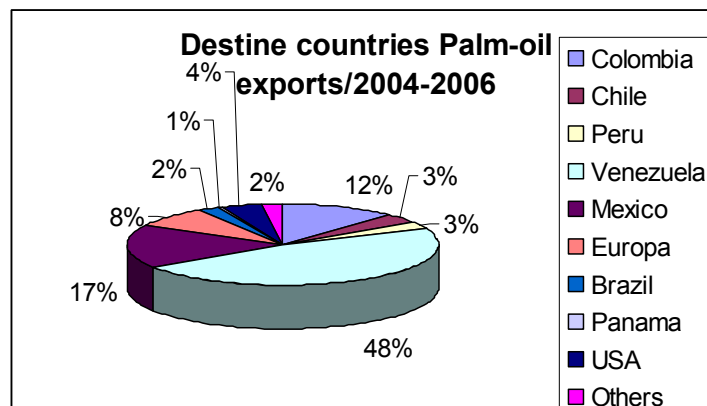
supportive role in promoting policies and technical support through the Ministries of Agriculture and Energy and through PetroEcuador.

4.5 Current main trade partners

Main trade partners for palm oil products

The main destinations for palm oil exports during last few years have been Venezuela, Mexico, Chile, European Union, Colombia, Brazil, United States and Panama⁷².

Figure 10: Destinations for palm oil exports



Graph elaborated with data from ANCUPA-FEDAPAL

Venezuela has had the largest share in the last three years. This is a direct consequence of several conflicts between Colombia and Venezuela in its palm oil trade relationship. Colombia had been selling palm oil to Venezuela at low prices, for which Venezuela imposed high trade barriers to Colombian palm oil, thus benefiting Ecuadorian palm oil exports⁷³. Mexico has also been an important destination. Additionally, it is curious that Colombia has a significant share (12% in the last three years), as it is also the first palm oil producer in South America. However, the reasons for some Colombian industries to buy palm oil (mainly RBD oil) from Ecuador are based on advantages in prices and in geography (eg the proximity of some Colombian cities to Ecuadorian distribution centers)^{74 75}. Additionally, although Europe is indicated as a destination in these years, due to its distance it is not one of the main markets for Ecuadorian palm oil product⁷⁶.

Fossil fuels trade partners

To fully understand the dynamics and development potential of the biodiesel palm oil industry it is indispensable to understand its relation to the fluctuation of international fossil fuels. Ecuador is a petroleum crude oil exporter, but at the same time, the country also imports

⁷² In Annex ## is included charts that show all the countries to which Ecuador has exported palm-oil products (crude oil, semi-processed products or processed ready products) in the last three years, as well as each country's share as destiny of Ecuadorian palm-oil exports.

⁷³ Ibid.

⁷⁴ Freddy Lopez, Department of Economics at ANCUPA

⁷⁵ Nevertheless, these price advantages largely took place because of flaws in Colombian tax laws that permitted imported products in the Nariño province to avoid paying IVA; this situation was solved in 2005, and subsequently exports from Ecuador to Colombia decreased.

⁷⁶ In the period 2004-2005 Europe appears as an important destiny because in 2005 there was a peak year of production, and consequently there had to be some exports to Europe. Carlos González-Artigas.

refined petroleum oil products. An overview of these trade partners is important in order to later analyse Ecuador's potential trade partners for biodiesel.

The following table reflects all the main countries to which Ecuador has exported petroleum crude oil during the period of 1995 to 2005. These include the United States, Peru, Korea, Central America (especially Panama), Chile and the Caribbean. In the last two years (2005 to 2006) India has also emerged as a new market, but its shares have been only 0.6% in both years⁷⁷.

Table 6: Ecuadorian Petroleum Crude Oil Export⁷⁸ (1995 to 2005)

Country	Share
CENTRAL AMERICA	10,2%
ARGENTINA	0,04%
BRAZIL	0,69%
CANADA	0,1%
CARIBBEAN COUNTRIES	3,9%
CHILE	3,9%
CHINA	0,2%
COLOMBIA	0,1%
UNITED STATES	50,8%
JAPAN	0,3%
KOREA	10,2%
NICARAGUA	0,1%
PANAMA	4,9%
PERU	14,1%
TAIWAN	0,2%
URUGUAY	0,3%
VENEZUELA	0,1%
TOTAL	100%

Biodiesel trade partners and prospects

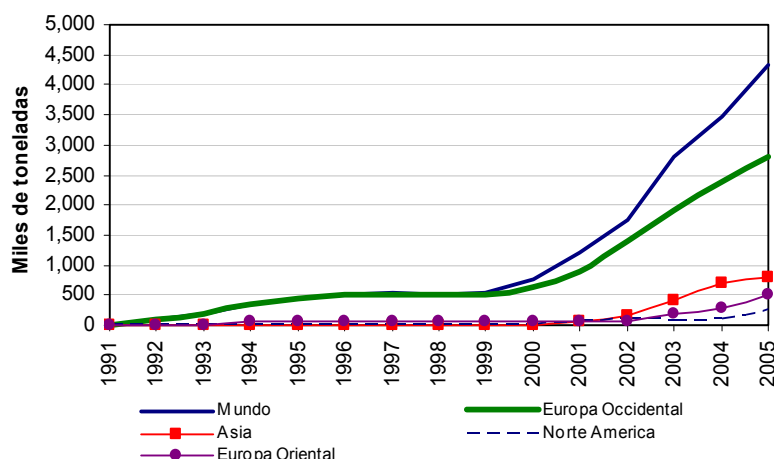
As global concerns about the environment continue to increase and international ties and communication develop further, international markets for biofuels will continue to expand. It has been calculated that around 55,000,000 tons of palm oil would be needed in order to replace 5% of the world's diesel demand. The current world production of biodiesel is approximately 4,300,000 tons and its production has been steadily increasing in the last years (see graph below)⁷⁹. There appear to be great prospects for increases palm oil production and demand as a whole, and palm oil biodiesel specifically, in the coming years.

⁷⁷ Ecuadorian National Directory of Hydrocarbons

⁷⁸ Chart elaborated with data from the Ecuadorian National Directory of Hydrocarbons.

⁷⁹ ANCUPA - FEDAPAL

Figure 11: World biodiesel production



Source: ANCUPA-FEDAPAL

Ecuador may have opportunities for exporting biodiesel. Environmental concerns and energy demand are likely to influence several countries' desires to import Ecuadorian biodiesel. The current situation in prospect partners is described below.

Brazil is currently the biofuels production pioneer, especially for bioethanol. The country also produces biodiesel, especially biodiesel based on soya and *higuerilla* (or "castor" oil); however, it has a deficit in its domestic market. The current national policy promotes the consumption of B2, which is a mixture of diesel with 2% of biodiesel. Therefore, Brazil is currently looking to import biodiesel from available markets. Moreover, the Biodiesel Program in Brazil is aiming for a biodiesel mix of 5% by 2013 and 20% by 2020. Thus, there have already been attempts from Brazil to negotiate a trade agreement on biofuels with Ecuador⁸⁰, although such negotiations have not been carried out yet.

The European Union (EU) is a *sui generis* case; even though the EU is a net importer of vegetable oils, these countries have developed their own biodiesel sector, largely out of environmental concerns. The EU is the main biodiesel producer worldwide, and accounts for 95% of biofuel global production⁸¹. Nevertheless, as biodiesel consumption in the EU increases, its capacity to satisfy its own demand will be limited. Biofuels currently account for about 1.4% of EU fuel consumption and biodiesel represents about 82% of the EU biofuel market⁸². This share of biofuels and particularly biodiesel in the fuel consumption of the EU will most likely rise, and the EU has a limited capacity of producing vegetable-oils to be used as raw materials for biodiesel production. Consequently, it is expected that the EU will increasingly be importing biodiesel from foreign markets in the long-run.

⁸⁰ Mauro Gonzalez, representative of the Ministry of Energy and member of the Biofuel Program Advisory Council.

⁸¹ Annie Dufey. *Biofuels, Production, Trade and Sustainable Development: Emerging Issues*. IIED. Sept. 2006.

⁸² Ibid.

The EU do have trade protection for biodiesel, which is subject to an *ad valorem* duty of 6.5% on biodiesel. Meanwhile the tariff on bioethanol (on undenaturated alcohol) in the EU is € 0.00192/lit which represents 63% *ad valorem*. However, currently bioethanol enters duty free to the European markets under the following preferential trade arrangements: the Everything But Arms initiative (EBA) for Least Developed Countries, the Cotonou Agreement with African, Caribbean and Pacific (ACP) countries, the new “GSP +” incentive scheme, and some bilateral preferential agreements such as the Euro-Mediterranean Agreement. Ecuador has preferential access under the “GSP+” incentive, which is a special arrangement for sustainable development and good governance.

Ecuador together with Papua New Guinea, Ivory Coast, Nigeria and Colombia also benefits from preferential access to the EU market for their palm-oil products (0% tariff on palm oil products)⁸³. This openness is necessary to feed the EU biodiesel industry, because EU has a deficit in the production of vegetable-oils. While the EU is currently the main biodiesel producer around the globe, it is still a net importer of vegetable oils. Given this, Ecuadorian exporters would have an incentive for exporting the crude palm oil rather than biodiesel, which has an *ad-valorem* duty.

The **United States** is already producing biofuels and promoting their production and consumption through taxes and other support measures. The new Energy Bill of 2005 introduced a “renewable fuels standard” (RFS). The RFS set a target increase from 4 billion gallons in 2006 to 7.5 billion gallons by 2012. In 2007 the US government called for a mandatory fuel standard that would require 35 billion gallons (132.5 billion litres) of alternative fuels to be used by 2012⁸⁴. The U.S. has concentrated on corn-based bioethanol and soya-based biodiesel. Nevertheless, its market is rapidly increasing because of its RFS target. Thus, this country is a potential market for foreign biodiesel, like palm oil biodiesel, as palm oil is a product that mainly grows in tropical areas and therefore its production could not be cultivated in northern countries such as the United States. Indeed, all the biodiesel production of La FABRIL was destined to the US.

Crude palm oil has preferential access to the North American market through a preferential system. Therefore, crude palm oil, which is used as input for biodiesel production, enters the US market with a 0% tariff. This benefit was put into force in 1991, when the ATPA (Andean Trade Promotion Act) was signed and renewed in 2001 with the ATPDEA (Andean Trade Promotion and Drugs Eradication Act). Nevertheless, due to the lack of clarity in the biodiesel classification, it is not certain if biodiesel enters this market under a chemically-modified palm oil product, in which case the preferential access treatment would not apply. On the other hand, the US government also provides subsidies for biodiesel consumption, which indirectly benefits biodiesel exporting countries, as long as the US biodiesel internal demand expands⁸⁵.

Latin American countries, like Chile and Mexico, have announced their willingness to use biofuels to meet their energy and transport fuel demand but few statistics on this are currently available.

⁸³ Jane Earley, Thomas Earley and Mathews Straub. Specific Environmental Effects of Trade Liberalization. IPC, Oct, 2005

⁸⁴ German Marshall Fund Report. 2007. “EU and US Policies on Biofuels: Potential Impacts on Developing Countries.

⁸⁵ Carlos Gonzalez Artigas Lor, General Manager of La FABRIL.

It is important to mention that although these results would probably increase imports levels in the short run, they will be exposed to several other external factors and conditions in the long-run.

5 Preliminary identification of key sustainable development impacts of biodiesel production and trade in Ecuador

Many developing countries see in biofuels production an alternative for development and are making significant efforts to promote sectoral development. Reasons for this include: (1) reduction of oil derivatives imports increasing energy security and reducing the oil bill, (2) generation of rural employment and socio-economic development, (3) promotion of production diversification and industrial capacities through raw materials transformation processes, (4) reduction of GHG emissions if the agricultural and industrial phases are attune with environmental concerns, (5) strengthening of international relations at the political and commercial levels, as environmental efforts are sustained and markets interact⁸⁶.

However, although there is a comparative advantage in some developing countries for biofuel feedstock production, there are concurrent conditions that are determinative. Some fear that a rise in biofuels feedstock might contribute to increased food insecurity and/or prove to be environmentally disruptive, especially in those countries displacing natural forest to plant soya or palm trees⁸⁷.

The biofuels industry is comparatively new in Ecuador. Currently, there is a very small production of biofuels: a small quantity of bioethanol is being produced for a pilot project of bio-gasoline for the city of Guayaquil⁸⁸ which will start this year, and small quantities of biodiesel have been produced by one large private company, “La FABRIL”, which is experimenting with this new market. Biofuels production and trade have not yet thoroughly developed in Ecuador, neither in its legal framework nor as an economic diversification strategy. No policies have been yet formulated that would govern the operation of biofuels production, meaning that regulations on trade or environment and socio-economic standards have yet to be established.

Nonetheless, the analysis and discussion on the potential of biofuels production and trade already started and some impacts on sustainable development can be identified. Further impacts are predicted on the basis of the existing experience with palm oil production and anecdotal evidence from the incipient biodiesel production.

5.1 *Economic analysis*

National savings through reduced diesel imports

In order to understand the importance and potential of the biodiesel sector for Ecuador, the fossil fuel and diesel sector needs to be understood. Ecuador is a diesel importing country. Although Ecuador is a petroleum oil producing country, its production is mainly focused on petroleum crude oil, while it has a deficit of refined products, especially of GLP (petroleum liquid gas), Nafta of Octane (NAO) and diesel.

Diesel is used in Ecuador in several sectors, the main ones being the automobile sector and the industrial sector, with 51% and 37% of the total diesel consumption, respectively. Two types of diesel are consumed internally: “Diesel#2,” which is regular diesel, and “diesel premium”

⁸⁶ Especially North-South commercial will emerge because industrialized countries do not have sufficient land availability to meet their biofuel demand entirely with domestic production; and the most energy efficient biofuel feed-stocks, such as sugarcane and oil palm trees, are primarily located in tropical and sub-tropical climates in developing countries.

⁸⁷ Patrick Barta and Jane Spencer. Wall Street Journal, December 5th, 2006.

⁸⁸ The largest City of Ecuador in terms of population.

which has improved environmental qualities in terms of its sulphur ppm content. These two kinds of diesel are produced in Ecuadorian refineries⁸⁹, however the local refineries do not produce enough to meet the national demand and PetroEcuador generally imports 40% to 45% of the national diesel demand.

In 2006, the national demand for Diesel#2 was 23,725,000 barrels per year and from this amount, 10 millions barrels were imported⁹⁰.

The following table shows NAO, diesel, and GLP imports by cost and volume (in barrels) from 1998 – 2006.

Table 7: Ecuadorian Fuel Imports 1998 to 2006⁹¹

PRODUCT	VOLUME BLS	COST CIF USD
NAO	32,719,205	1,615,303,184
DIESEL	47,328,650	2,154,453,479
GLP	51,149,597	1,714,184,049
TOTAL	131,197,452	5,483,940,711

Source: PetroEcuador / Management office of International Trade

Diesel imports have somewhat fluctuated but there is still a clear upward trend. The estimated diesel imports demand (Diesel#2 +diesel premium) of 2006 was approximately 10,000,000 barrels⁹², which represents a 13% increase with respect to the 2005 diesel demand. Additionally, projections on future supply and demand amounts of diesel show that the Ecuador supplying capacity will be fixed in a few years at 14,600,000 barrels, while the national demand will continue to increase, and is expected to reach 40,200,000 barrels by 2025.

Ecuador generates a palm oil surplus (of around 140,000 tons currently). Hence, the alternative of producing biodiesel based on palm oil presents an opportunity for reducing the national dependence on diesel imports. However, in terms of national savings, the real benefits of producing and consuming biodiesel are very much related to the biodiesel prices in the national market as the following analysis suggest.

The National Biofuels Program has carried out analyses of the cost efficiency of bioethanol in order to agree on a price for bioethanol in the internal market. The results of this show that by mixing five per cent of bioethanol with gasoline, the national savings would be approximately US\$ 28 million per year, derived from import reductions of NAO, after considering that such a calculation is exposed to variations based on petroleum oil prices. However, this amount does not correspond to net savings, as it is used to compensate sugar producers as well as to pay

⁸⁹ Ecuador counts with four refineries for the industrialization of fossil fuels, these refineries are located in Esmeraldas, La Libertad, Lago Agrio, and Shushufindi. However, this production is not enough to satisfy the national demand of fossil fuels.

⁹⁰ PetroEcuador, 2006

⁹¹ Up to the first semester of 2006.

⁹² PetroEcuador.

PetroProduccion for the increase in “nafta base” (NB) production⁹³. Thus, there would be a difference of approximately 21% reduction of NAO (which is imported) and a 16% increase of NB (which is produced here). At a cost of US\$ 0.55 per gallon, the gasoline mixed with bioethanol would still be profitable. The programme has not yet conducted such an analysis for biodiesel.

However, using the available data on diesel and biodiesel, it is possible to conduct an analysis for potential national savings. Firstly, by December 2006 diesel was imported at US\$ 82 per barrel, which corresponds to US\$ 1.95 per gallon, and the government sells it at US\$ 1 per gallon in the local market, meaning that there is a loss of approximately US\$ 40 per barrel, or 50%, which is compensated by governmental subsidies⁹⁴. In the case of diesel imports, 50% of such imports expenditures are non-refundable and come from the government budget.

In the case of promoting the use of B5 (5% biodiesel with 95% Diesel#2) the projected national demand for biodiesel for 2007 would be approximately 3,405 barrels of biodiesel per day, which corresponds to 1,242,700 barrels per year⁹⁵. This means that Ecuador would avoid importing 1,242,700 barrels of diesel for 2007, which accounts for approximately US\$ 101,901,400 (priced at US\$ 82 per barrel). Due to aforementioned subsidies, this translates to US\$ 50,950,700 non-refundable money state capital. Evidently, this is not the amount of national savings, because even if PetroEcuador would not have to buy this 5% of diesel in the international market, this public institution would have to buy that amount of biodiesel from palm oil biodiesel producers.

Furthermore, any new alternatives in the fuel sector represent an opportunity for Ecuador to redefine its national policies in relation to government support for this sector. Nowadays, Ecuador spends annually an estimate of US\$ 2,600 millions in subsidies for the LGP, diesel and gasoline⁹⁶, a very significant amount when compared to the size of the Ecuadorian economy; almost a third of the fiscal budget each year. Therefore, if the Ecuadorian government launches a national biofuel program, it would need to allocate subsidies into biofuels production so to make biofuel production profitable for domestic market, given nowadays biodiesel prices are not competitive with diesel prices. Biodiesel costs (excluding transformation factor and transportation costs) correspond to US\$ 119 per barrel (US\$ 2.8 per gallon).

For an accurate estimation of the real national savings on diesel imports, it is necessary to know the internal biodiesel prices as well as public policy to be implemented. These determinations are not ready yet. Nevertheless, there is much to be analysed on the biofuels subsidies theme and a thorough analysis must be accomplished on the scope, duration and sustainability of the sector if such measures are taken.

Technology based production and industrial development

The desirable path for Ecuador's industry is to promote technology and value-added production. Ecuador needs to develop towards more value-added and technology-based production. Biofuels could be an alternative to endorse such technology progress not only at

⁹³ Gasoline is made by two *Nafta* types: “Nafta Base”(NB) and “Naftas of Octane” (NAO). NB requires less elaboration process.

Ecuador imports only NAO, while NB are produced locally. In the case of mixing bioethanol with Naftas, the NAO imports would be reduced, but NB used for the biogasoline elaboration would increase.

⁹⁴ Mauro Gonzalez, representative of the Ministry of Energy and member of the Biofuel Program Advisory Council.

⁹⁵ Ministry of Energy.

⁹⁶ Angel Sepeda, representative from PetroEcuador and Biofuel Program Technical Committee.

the level of crude palm oil production, but even further in terms of industrial enlargement and value-added development.

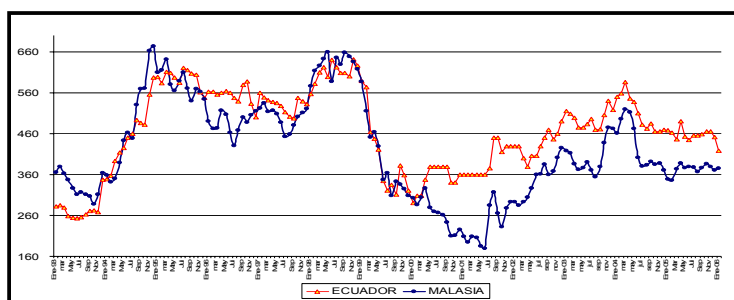
Nevertheless, the reasons why no other palm oil processing companies, besides La FABRIL, have started producing biodiesel are related to biodiesel profitability, which is currently low in relation to other palm oil processed products. For La FABRIL, the profitability of the palm oil products is approximately 3%, while the profitability of biodiesel would be only 1.5%⁹⁷.

In this sense, in spite of the opportunities that the development and dissemination of biofuels technologies may represent in terms of industrial development and value added in Ecuador, the current low profitability of biodiesel vis à vis other palm oil based products constitutes a major challenge for a wider adoption. Moreover, technology requirements have not yet been developed and disseminated.

Price vulnerability

Biodiesel prices are vulnerable to high fluctuation because they depend on two international markets whose prices are already extraordinarily sensitive: vegetable oils and petroleum oil. Palm oil prices are very volatile because of the products' interchangeability with other edible oils, such as oils from soya, rapeseed and sunflower, among others. The peak of crude palm oil (CPO) price was US\$ 719/metric ton in 1994. In January 2001 its price was US\$ 240/metric ton, and in February 2004 its price was US\$ 553/metric ton. Ecuadorian palm oil prices depend on international market prices, especially prices of Malaysia, which is the world's main palm oil producer. Despite the fact that since 2000 the price of Ecuador's crude palm oil has exceeded Malaysia's CPO prices, mainly due to the dollarisation of the Ecuadorian economy, Ecuadorian prices have followed the price trends of the Asian country. Figure 12 shows the variability of CPO prices as well as the matching trends in Ecuador and Malaysia's CPO prices.

Figure 12: Comparative prices chart between Malaysia and Ecuador



Source: Oil Word, ANCUPA-FEDAPAL

Additionally, international markets for palm oil also depend on the availability of other vegetable oils in the market, such as rapeseed and soya oils. However, it seems that such influence by other vegetable oil demand will decrease in years to come because of steadily increasing CPO production in comparison to other vegetable oils⁹⁸.

⁹⁷ Statistics taken from an interview with Carlos Gonzalez Artigas Lor, General Manager of La FABRIL.

⁹⁸ World palm oil production and exports are increasing at a higher rate than other oils as is replacing soy as the main vegetable oil source. In Ecuador this upward production trend is also evident; since 2001 the palm-oil production tendencies have been increasing, reaching 279.152 tons in 2004, 320.000 in 2005 and approximately 360.000 in 2006. Likewise, world palm oil demand is also increasing,

In addition, biodiesel prices are contingent upon petroleum oil prices, as biodiesel are substitute products for petroleum-oil derivatives. Thus, fluctuations in petroleum oil prices directly affect the biodiesel demand and production. The variability of current palm oil prices makes palm oil production unpredictable, and even if biodiesel created a new market for palm oil, it would still not decrease palm oil price volatility.

Oil prices have increased over the last three years as a result of the demands of large countries with solid economic growth, such as China, India and the US. Oil prices increased by some 30% between 2004 and 2005. Nonetheless, oil prices have not grown steadily and have fluctuated considerable since 2004⁹⁹. The unstable trend of international oil prices is caused by political and economic structures that distort this market. One example of this is the decision of the OPEC countries in October 2006 to cut back production by 1.2 million barrels daily in order to keep oil prices high.

Profitability and competitiveness

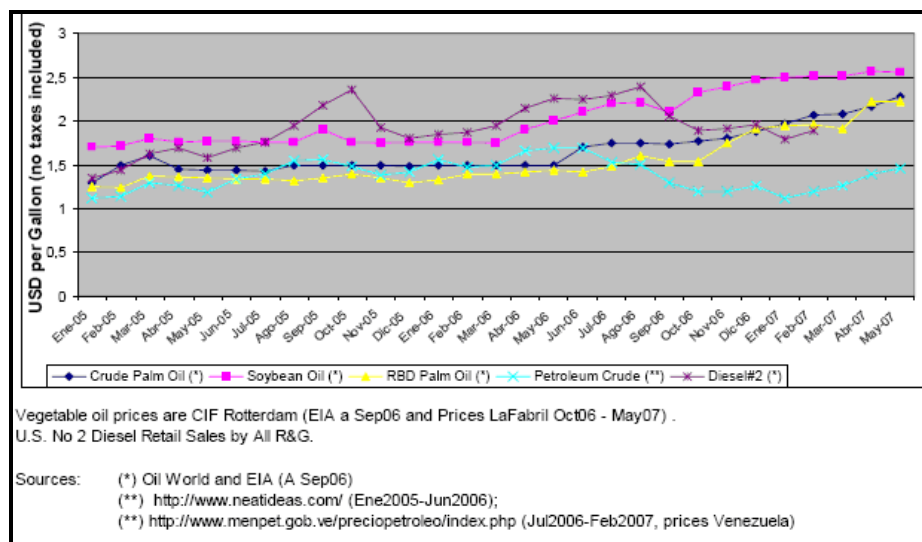
Palm oil biodiesel profitability and competitiveness are directly related to capital and production costs, as well as final product prices. Capital costs for biodiesel production is within a normal range of industrial plants prices, and, as it was explained earlier, this cost depends on the desired level of production. Nevertheless, the main variables to prove profitability will be production costs in relation to final product prices, and to this date, this relation has not proved to be the most convenient.

The main item in the production costs corresponds to vegetable oil. This item represents around 75% of the total cost. Ecuadorian palm oil prices are strongly influenced by Malaysia and Indonesia, the two main palm oil producing countries. In recent months, palm oil prices have increased due to increased global demand both for food and fuel production as well as higher oil prices, which account for a fair amount of feedstock production costs. However, although palm oil prices have increased according to oil trends, petroleum oil prices have varied continuously and diesel prices have actually decreased since mid-2006. See Figure 13.

Figure 13: Vegetable Oil versus Petroleum versus Diesel # 2 Prices

projections analyzed by "Oil World" show that palm oil will increase in 50% by 2020. Palm oil exports have been increasing exponentially and they have been overtaking world oil exports since 2000.

⁹⁹ In 2006 there was a peak of US\$ 77 per barrel in July, while in the last semester of this year oil prices have presented a downward trend. The lowest price was in November at US\$ 55 and US\$ 60 in December. Actually, only in December/2006, oil prices fluctuated between US\$ 63.43 and US\$ 55.59.



Source: La FABRIL

This instability in oil derivatives prices affects palm oil based biodiesel competitiveness vis à vis that from oil substitutes. As mentioned above, as of May 2007, biodiesel price reached US\$ 119 per barrel, while Diesel#2 price was US\$ 82 per barrel.

Price volatility and unpredictability for biodiesel is one of the main reasons why palm oil producers in Ecuador still remain doubtful about the feasibility of entering into the biodiesel business. Indeed, La FABRIL, the only company that produced biodiesel during 2005-2006, stopped its biodiesel production in 2007 because of the profitability of this business was not guaranteed¹⁰⁰.

Biodiesel production still presents risks in terms of profitability and economic stability for Ecuadorian palm oil producers that engage in this alternative business. The economic risk is even greater where there is a lack of available and secured markets for biodiesel. These facts impose important considerations for the palm oil sector in this country.

Creation of employment

According to ANCUPA, the palm oil sector currently creates 90,000 direct and 50,000 indirect jobs. This means one direct job per every 2.3 cultivated hectares and one indirect job per every 4.14 hectares cultivated¹⁰¹. Direct jobs involve employment in agriculture and the industry, including the different industrial levels of oil extraction and processing products. Indirect jobs include provision of materials, such as fertilisers, transportation, machinery rental, various services, and others. The biodiesel industrial process has the same labor requirements as other palm oil processed products elaboration¹⁰².

It is expected that the Bioethanol National Program would create 200,000 direct jobs, as it would be necessary to cultivate 50,000 additional hectares of sugarcane and four employees are needed for the cultivation of each hectare¹⁰³. The National Biodiesel Program has not analysed labour impacts because the number of hectares that would be cultivated to initiate the

¹⁰⁰ La FABRIL

¹⁰¹ Calculated based on ANCUPA statistics.

¹⁰² Romel Vargas, technician from ANCUPA

¹⁰³ Statistic from interview with Victor Camacho, representative of the Ministry of Agriculture and Biofuels Program Technical Committee.

programme has not yet been defined. However, according to La FABRIL, an additional 50,000 palm oil hectares for biodiesel production would create approximately 22,000 direct jobs and 12,000 indirect jobs.

Although this sector creates a relatively lower number of jobs in comparison to other exporting sectors, such as banana and flowers, other social considerations indicate a greater contribution of the industry to the socio-economic development. These include equal employment opportunities to communities from different ethnic backgrounds and, in some areas, a lesser pressure on forestry resources which are exploited by populations lacking economic alternatives. Various palm producing companies develop social management plans which aim to provide to the population within their area of their intervention, who mainly depend on timber activities, with an economic alternative either by creating employment or by training them in the micro-business generation¹⁰⁴.

Projections of impacts on employment and livelihoods

La FABRIL's direct industrial employments is around 1,395 employees out of which 543 are located at the general headquarter in Manta and 230 at their operations in Guayaquil. Out of these, 50 workers were involved in biodiesel operations, which accounts for 3.6% of total industrial direct employment. In January 2006 the operation started with seven workers at headquarters and ended in December with 38, while the Guayaquil plant started with 15 and finished the year with 22. However, as mentioned above, in 2007 there was no biodiesel production.

La FABRIL is developing a project for expansion that intends to forge partnerships with small rural producers. To partner La FABRIL, these producers will need to be the legal owners of, on average, 20 hectares of land. The company will encourage, and perhaps assist, small producers to legalise their land ownership and incorporate them later into the project. Small producers would supply La FABRIL with palm fruits, while the company would perform the extraction and processing of the biodiesel. The cultivation of the 20 hectares would generate profits of approximately US\$ 20,000 per year and the average number of family members expected to work those 20 hectares would be four, thus leaving profits of approximately US\$ 500 per month per family¹⁰⁵. Likewise, the La FABRIL project would provide technical advice to these small producers. The project will be financed with a loan from a multilateral financial institution.

5.2 Social impact

African palm production has had a significant social impact. In recent years, the perspective of environmentalists and other groups has viewed such impact as negative. In reaction to this, producer companies started making important changes such as monitoring and managing their impacts in rural communities and implementing corporate social responsibility programmes.

Initially, when palm oil companies offered infrastructure projects to the nearby populations with the aim of gaining their acceptance, many such offers were not carried out and the social and environmental impacts became evident. The environmentalist perspective viewed African palm cultivation as incurring great social impacts, such as the following¹⁰⁶.

¹⁰⁴ CEDA-OEA. *Evaluación de los Impactos Ambientales y Capacidad Institucional Frente al Libre Comercio*. 2006.

¹⁰⁵ Carlos Gonzalez Artigas Lor, General Manager of LA FABRIL

¹⁰⁶ Acción Ecológica.

- Land concentration among entrepreneur companies' hands, which in many cases meant the reduction and stripping of indigenous lands in the Amazon, and afro-ecuadorian lands on the Coast.
- Farmers' migration after abandoning the lands that they sold to the companies. Farmers would make their way towards close towns or to the biggest cities in the country or to forest areas which had not previously been impacted and begin to use those lands to satisfy their subsistence needs. In other cases, farmers also arrived at the territories of afro-ecuadorian and indigenous communities, such as the Awa and Chachi in the province of Esmeraldas or in the Quichuas territories in the Amazon, a situation that caused several social conflicts.
- Loss of forest leading to a shortage of construction material for houses, canoes and other things. Harvesting and hunting activities, as well as practices of habitual medicine and traditional agriculture, disappeared.
- In the areas that were not used for agriculture and that were mainly primary forests there was a reduction of mammals and fish species, which reduced resources and limited opportunities for the inhabitant communities to continue living in their traditional environment.

It is important to mention that, in general, national and international NGOs, with few exceptions, have never favored palm oil cultivation. The other impacts they cite include increased land prices, market dependence, an increased need for money (especially among small producers, farmers, indigenous peoples, and afro-ecuadorians), capital and technology dependence, and advance payments and indebteding processes¹⁰⁷.

One of the main fears that many NGOs have had is that palm oil plantations would be positioned on primary native forest sites. However, it is important to note that the environmental authority in Ecuador has created a system of environmental licenses that are granted only to companies that follow legal environmental norms and that have presented their respective environmental impact studies as well as their mitigation plans. Despite such processes, the level of acceptance of this activity is not yet entirely positive. There is still a strong sentiment that the palm oil sector could cause negative social and environmental impacts. Some of this opposition is even stronger than that stated against other types of plantations on the Ecuadorian coast, such as the banana cultivations.

Consequently, some enterprises have turned to a more comprehensive social policy, defining strategic lines to collaborate with nearby communities, and working to avoid negative environmental impacts. Some companies have decided to implement social programs as part of a corporate strategy. As it is evident in the partnership plan between La FABRIL and small producers, companies are trying to adjust their policies to develop friendly standards and goals in order to comply with social requirements and to develop their projects according to the guidelines of corporate responsibility. La FABRIL's policy for extending its palm oil production involves assisting farmers with technical assistance, helping them to legalise land ownership, assisting them with the processing of credit lines, regulating incorporation of small producers' lands and respecting limitations based on relevant environmental protection laws¹⁰⁸.

Moreover, La FABRIL has learned from previous experiences the importance of establishing good social policies. This includes partnering with landowning farmers, thereby creating an

¹⁰⁸ Carlos Gonzalez Artigas Lloor, General Manager of LA FABRIL

incentive for profitable business for small farmers. Moreover, La FABRIL is also promoting the cultivation of other crops among small producers to reduce their dependence on one only product. La FABRIL itself has implemented this policy growing several crops and generating different products to avoid being exposed to such vulnerability¹⁰⁹.

However, this vision of corporate social responsibility is not yet widespread among all palm oil producers whose work is yet to be accomplished.

Programmes covering areas such as education and public health are also expected to be promoted not only through palm-oil companies but also through tax resources that the palm oil sector generates. Various companies are already implementing campaigns to inform the population about their operations in rural sectors.

Undoubtedly, these types of social plans must also integrate related State entities such as the Ministry of Industry, Ministry of Labor and the Ministry of Social Welfare, in order for them to work together with the Ministry of Environment to create development plans and policies to support socio-economic and environmental sustainability¹¹⁰.

Labour standards: rural income (livelihoods) and workers' health

One important standard to set is salary. The salary of palm oil workers is regulated by law. The National Commission on Salaries establishes the increase for agrarian workers each year. Due to migration, that removed more than 500,000 workers from the workforce in the last five years, agrarian workers now constitute a scarce human resource and are being paid better than before.

Nevertheless, living conditions in palm oil cultivated areas still need to be improved. Most plantations are located in rural areas with conditions, according to social indicators from the integrated social indicators census, below the national average¹¹¹.

On the other hand, the above mentioned plan of La FABRIL's to partner small producers would have a positive impact on their livelihoods.

Automation does not play an important role in agricultural and harvesting activities for palm oil production. Manual performance is needed in these stages and activities are constant because African palm is a perennial crop.

Fundacion Natura¹¹² along with other national and international organizations has commented on the use of agrochemicals and their impact on farmers, workers and families who live in the plantations and are affected by agrochemical pollution. Such contamination can occur directly from contact with the product or indirectly through ingestion of polluted water. In 1998 Fundacion Natura reported that 58% of agriculture workers from the palm oil plantations exhibited, in different levels, hepatic and skin illnesses symptoms due to exposure to pesticides, carbonates and phosphoric-organic materials. There have even been cases of poisoning. These impacts are still occurring, although their frequency has declined, especially in the last couple of years. Companies are currently trying to align their processes to appropriate usage of agrochemicals to avoid these issues.

¹⁰⁹ Carlos Gonzalez Artigas Lor, General Manager of LA FABRIL

¹¹⁰ CEDA-OEA. *Evaluación de los Impactos Ambientales y Capacidad Institucional Frente al Libre Comercio*. 2006

¹¹¹ See ANNEX # 2 for socio-economic indicators from traditional palm oil jurisdictions.

¹¹² Fundacion Natura is one of the leading environmental NGOs in Ecuador.

Food security

Regarding food security, palm oil does not represent a threat to food security in Ecuador in nutritional terms for human feeding. This is because palm oil domestic supply in Ecuador completely covers the national demand and there is a high surplus, which is used for industrial manufacturing of non-food products such as soaps, detergents, and others. Nevertheless, there are two aspects in which biodiesel production may threaten food security, affecting palm oil prices and land use.

In terms of land use, food security issues may arise if lands for palm oil cultivation were extended to areas designated for food crops. In Ecuador some oil palm hectares are being cultivated on lands with former agricultural use but that became less profitable (eg banana, soya, rice and corn). Research studies carried out by La FABRIL indicated that palm oil plantations would be three times more profitable than soya and twice as profitable as corn.

A key issue therefore is finding the right balance between lands used for food purposes and those for fuel uses. There are no studies currently available, nor any existing legal framework, that could protect and differentiate those lands that should be kept for food crops and those where new palm oil plantations for biodiesel purposes could be cultivated without creating a threat to food security.

5.3 Environmental analysis

Ecuadorian environmental landscape policy

In the last decade, and especially since the Rio Summit of 1992, Ecuador has faced increasing institutional development in the environmental field. Initially, the Environmental Cooperation Commission, CAAM (acronym in Spanish), was created and approved by the office of the President. This institution initiated an evaluation and diagnosed a process regarding the environmental needs of the country, which in 1997 concluded with the creation of the Ministry of Environment, to which other institutions were later added, including forestry organisms like the Ecuadorian Institution for Forests and Protected Areas (INEFAN).

The following years saw intense growth in the creation of new legal standards and policies. Various legal frameworks were implemented by the new Ministry, most notably the Environmental Management Act (1998) and the Special Regime Law for the Galapagos Province (1999), which initiated a new planning period. During this period, important efforts were carried out to integrate international strategies of development, sustainable management and conservation policies, such as the Biodiversity National Strategy of 2001, among others. Afterwards, the legal framework was modernized (the one in use dated back to the 1970s), and there were attempts to generate a consensual process with the private sector, which was not very successful, in order to reformulate criteria and parameters on industrial environmental pollution. These parameters are included in a Secondary Environmental Normative, and are currently in force for productive activities¹¹³.

Accordingly, there are now several regulating and planning instruments in force, although the young institutional structure has not always been considered a national priority, and often lacks the budget necessary to strengthen environmental control and monitoring. In this context, these activities have not been consolidated, especially under the Decentralization Law currently in force, that commands different municipalities and districts to enforce

¹¹³ Ibid

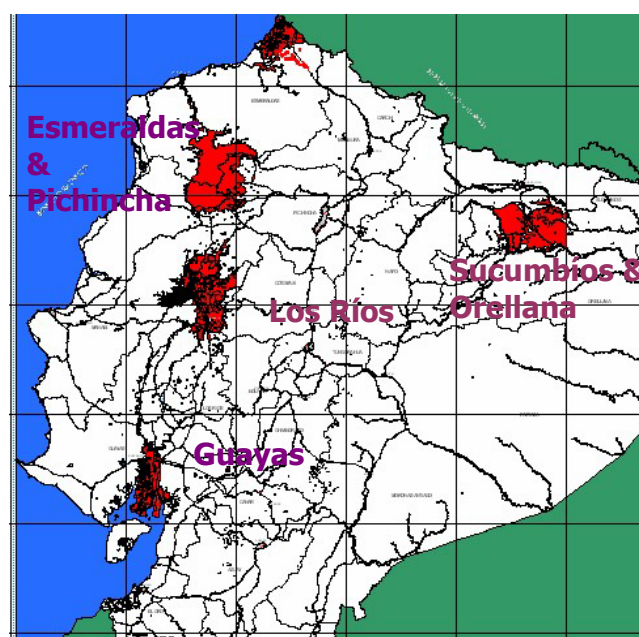
environmental norms. Consequently, even though Ecuador's environmental policy landscape has seen significant advances in the last few years, it still has loopholes especially in the implementation of monitoring and control systems and in the lack of a national framework that would require discussion and integration from all productive activities in order to reach consensus in setting environmental goals.

Environmental impacts/effects of palm oil

➤ Land Use and Forests

Currently, there are 207,000 hectares of palm oil cultivation in Ecuador. The cultivated areas have been mainly located in the following provinces: Esmeraldas (39%); Pichincha (16%); Los Rios (15%); Sucumbios (5%); Orellana (2%); Guayas (2%); others (21%)¹¹⁴.

Figure 14: Main Palm Oil Cultivated Areas 2005



Source: ANCUPA

The department within the Ministry of the Environment that oversees forestry activity is the National Forestry Directory. This department has carried out general studies on deforestation in Ecuador through satellite images that are used to create maps. Two maps have been created for 1990 and 2000 and determine that in this period 1,782,832 hectares have been deforested. The Ecuadorian Center of Integrated Indicators for Natural Resources (CLIRSEN) indicated that the annual deforestation during the decade 1990 to 2000 corresponded to 198,092 hectares¹¹⁵. Yearly deforestation rates have fluctuated between 0.5% and 2.4% during 1980 to 1990, with an average of 1.5% for the decade of 1991 to 2000¹¹⁶. The deforestation rate for tropical forests for that period (1991 to 2000) is 1.5%¹¹⁷. According to the Food and Agriculture Organization (FAO) Ecuador currently ranks as the country with the ninth highest deforestation rate¹¹⁸. According to the same source, the 10

¹¹⁴ Agriculture National Census, 2005

¹¹⁵ CLIRSEN. December 2005.

¹¹⁶ CLIRSEN. *La Deforestación en el Ecuador*. 2006

¹¹⁷ Ibid.

¹¹⁸ CLIRSEN. *La Deforestación en el Ecuador*. 2006

countries with the highest deforestation rates account for 50% of annual global deforestation, which corresponds to 7.4 millions hectares of tropical forests lost per year¹¹⁹.

Although there is no formal data on deforestation levels caused by the palm oil sector in Ecuador, it has been identified as one of the causes. Key causes include the expansion of the agricultural frontier, colonisation processes, and the increase of productive activities at large scale, especially oil and mines, and cultivation of shrimp, bananas, African palm and flowers¹²⁰. Moreover, there have been cases brought by Acción Ecológica, an environmental NGO, which in 2001 alleged that 4,550 hectares of forests had been cut down in the areas of San Lorenzo and Eloy Alfaro (areas of palm oil plantations), of which 2,500 had been primary forests, and some of which were part of the pristine “Chocó – Manabí Corridor”. Primary forest deforestation due to palm oil plantations have mainly occurred in the Provinces of Pichincha and Esmeraldas, in an area known as Santo Domingo de los Colorados, in the provinces of Sucumbios and Orellana, in the Amazon region, and a few other areas in Guayas. If we compare the previous map (Figure 14) of the main palm oil cultivated areas with the map prepared by CLIRSEN and National Forestry Directory for the study on deforestation in Ecuador for the period 1991-2000¹²¹, we can distinguish that some areas used for palm oil cultivation coincide with deforestation, mainly in the provinces mentioned above. These are tropical areas where climate and soil are favorable for palm plantations, and therefore their forests are the most vulnerable to deforestation.

According to agronomic conditions, Ecuador has 2,5 million hectares of land favorable for oil-palm cultivation, including some hectares that have previously been used for agriculture. However, 1 million of these hectares are primary forests and therefore palm cultivation in these areas is banned by the environmental law. For new companies to engage in palm oil production, they must present an environmental impact study and obtain an environmental license, which among other requirements, supervise that primary forests be conserved. However, as discussed above, the institutionalization and implementation of environmental laws is still in its incipient stage in Ecuador, especially regarding activities of control and monitoring. Most of the palm oil producers that are already operating do not have such a license.¹²² To combat this problem, ANCUPA has created a new department to provide technical support for the eco-friendly operations of members.

Projections for cultivated areas with African palms indicate they will reach 240.000 hectares by 2009.¹²³ ANCUPA is asking the Ministry of Agriculture to conduct studies to determine potential zones where African palm could be cultivated, especially due to increases in demand for palm-oil for biodiesel.¹²⁴ La FABRIL predicts an expansion of palm oil cultivation of several hectares for its biodiesel project.¹²⁵ The company’s new plantations would be located in the provinces of Guayas, Los Rios and El Oro, because these provinces are less environmentally sensitive than Esmeraldas or the Amazon¹²⁶. On the other hand, ANCUPA

¹¹⁹ Ibid.

¹²⁰ Universidad Politecnica Salesiana.

¹²¹ map shown in the Annex 3 of this document – deforestation zones marked in red

¹²² Interview with Mateo Ponce. Environmental Department at ANCUPA.

¹²³ ANCUPA

¹²⁴ Romel Vargas, ANCUPA

¹²⁵ The Company has preferred to keep the data (# hectares) of this project off the record.

¹²⁶ Carlos Gonzalez Artigas Lor, Gneral Manager of LA FABRIL

has not ruled out the possibility for future plantations in Esmeraldas¹²⁷ and the Amazon basin, where there are already a large number of palm oil plantations in place¹²⁸.

Environmental impacts on the air, water, soils, geomorphology and terrestrial and aquatic ecosystems

This section largely draws from CEDA-OEA (2006).

➤ Air

Air quality is affected by various factors during palm oil cultivation, the main ones being opening ways and cutting down existing vegetation, chemical treatments needed for palm oil cultivation, and the polluting emissions that are the product of machinery combustion, vehicles, and, most notably, emissions from chimneys during the processing of crude oil.

➤ Water

Water is exposed to the greatest negative effects during palm oil production. Some of the main impacts include modification of the natural drainage regimes, which has important effects on fauna and vegetation; pollution, because of the application of chemical products, such as fertilizers, pesticides and herbicides; water quality deterioration because of industrial processes of the crude oil extraction and pollution of groundwater.

➤ Soils

The activities that most affect soil during palm oil production are related to the changes caused by the establishment of new cultivation. This is a major problem when there is a replacement of primary forests. In cases where the cultivated area corresponds to previously occupied land, the negative effect is reduced. However, the extension of a mono-cultivation still causes an impact. Moreover, branches cut down through mechanical processes cause land compacting. During the industrial steps, spills of fuels and lubricants cause soil pollution, and the disposal of solid wastes during building construction produce negative effects as well.

➤ Geomorphology

Major effects on geomorphology are caused by drainage construction. Nevertheless, such impacts depend on the extension of the drains that are artificially built. Other effects result from changes in the landscape, generally caused by the construction of buildings.

➤ Terrestrial Ecosystems

Major effects on the existent fauna and vegetation are caused when cultivations are placed in lands that have not been previously used for agriculture. Populations of insects, reptiles, birds and mammals, and plants such as gramiceas and herbaceas have been vulnerable to negative effects. The negative effects in these ecosystems are mainly caused by agrochemicals and solid wastes.

➤ Aquatic Ecosystems

The negative effects on the aquatic ecosystems can be very diverse depending on the location of the projects. In areas that have already been used for agriculture the impacts are fewer. Chemical product effluents are responsible for the major damages.

ANNEX 4 presents a categorisation of the environmental impact of palm oil cultivation

Carbon Uptake & Green House Gas Emissions

The carbon uptake potential of palm oil cultivations is “as much as 15 metric tons of carbon per hectare per year.”¹²⁹ However, this amount of carbon uptake would only represent a

¹²⁷ Esmeraldas is located in the northwest of Ecuador and is part of the Chocó Manabí ecosystem, a very sensitive and pristine area.

¹²⁸ Interview with Romel Vargas, ANCUPA

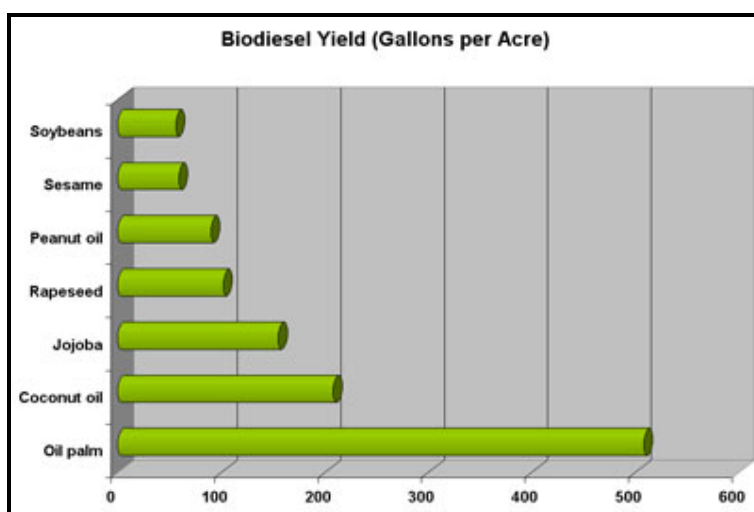
¹²⁹ WWF Report

“significant contribution toward reducing global CO₂ emissions” if palm oil plantations are established “without destroying forest or releasing carbon already in the soil.” Even when palm oil plantations have a carbon uptake potential, these plantations will not have the same capacity of carbon uptake as a natural primary forest.

Indeed, according to studies made in Brazil¹³⁰, secondary forests do not have the same level of carbon uptake as primary forests and they would have to be allowed to accumulate carbon for several years and would require larger areas of growth before being able to compensate for the greater carbon uptake of a primary forest. In this case, any potential for carbon uptake from oil-palms would not be significant in comparison to the natural forests that had been cut down for such plantations. Moreover, the measures on the amounts of carbon uptake that a plantation would have depend on several variables because “carbon stored in live or dead trees or in upper soil layers is “fragile”: it can quickly reenter the atmosphere at any time,” through, for example, wildfires, human-set conflagrations, plantations decays, or respiration rates¹³¹. Thus, when palm oil plantations replace native forests there is a direct negative impact on GHG emissions.

Consequently, the impact of biodiesel production on GHG emissions is directly related to its impacts on land use. However, from a yield point of view, African palm is one of the most efficient crops for biodiesel production and consequently the one that would have less impact on occupation of natural or agricultural areas (per liter of biodiesel production). The following graph shows the biodiesel yield for different oil crops.

Figure 15: Biodiesel yield (gallons per acre) of various crops



Source: Journal Chemistry & Industry¹³²

However, carbon uptake is not the only factor to be considered in the equation. For scientists such as Will Steffen from Sweden's Royal Academy of Sciences and Chair of the International Geosphere-Biosphere Program, relying on carbon uptake is an "insecure way of storing carbon out of harm's way". Environmental studies show that African palm carbon dioxide emissions

¹³⁰ Secondary Forests in Western Amazonian: Significant Sinks for Carbon Released From Deforestation? (2000)

¹³¹ “The process by which trees release CO₂ back into the air when they break down the sugars made during photosynthesis or soil microorganisms break down plant matter.” (World Rainforest Movement)

¹³² Eric Johnson and Russell Heinen (2007). Petroleum diesel vs biodiesel: The race is on. Chemistry & Industry — 23 22 April 2007.

are not only a result of nocturnal plant-respiration process, but also of petroleum based pesticides, herbicides, and fertilisers liberally used in palm oil plantations, which are a source not only of pollution at the local level but also of GHG emissions¹³³.

In addition to carbon dioxide, an analysis of oil palm nitrous oxide during its lifecycle is also required. Nitrous oxide is another green house gas with a noteworthy impact on the environment. Oil palm cultivation with industrial fertilizers is expected to release nitrous oxide unintentionally as part of nitrogen fertilisation. The significant negative impact of nitrous oxide on global warming relies on its long lifetime in the atmosphere and its 100 year global warming potential (GWP) of 296 (while carbon dioxide's GWP is 1). Eric Johnson, a scientist who has studied the impact of rapeseed biodiesel production, is now looking at the lifecycle climate impact of other sources of biodiesel, including oil palm. Although, he has not yet published any results on oil palm, he agrees that nitrous oxide emissions during palm cultivation will be a key factor in this analysis.

To this date, there are no specific studies on palm oil biodiesel GHG emissions throughout the production and distributions stages in Ecuador or the Andean region. Neither La FABRIL in Ecuador, nor another palm oil Colombian company, have conducted such studies. Nevertheless, data obtained through secondary sources by these companies advocate reduction of general biodiesel emissions in relation to petroleum diesel, especially of nitrous oxide, formaldehyde, and acetaldehyde. The expected reduction of nitrous oxide is of 15% to 20%¹³⁴.

Awaited studies on GHG emissions from palm oil biodiesel production show that research and debate on this topic should carry on to the point of asserting important conclusions on the relation between biofuels and fossil fuels GHG emissions. However, it is very important such environmental studies take into account the entire life-cycle of biodiesel production and even distribution. In various European countries, this is becoming a requirement for decisions and policymaking for the biofuels sector. According to Swiss law, biofuels are required a positive overall environmental score, including GHG emissions, to qualify for preferential tax treatment. Thus, environmental life-cycle assessments will be a key factor determining the viability of biofuels.

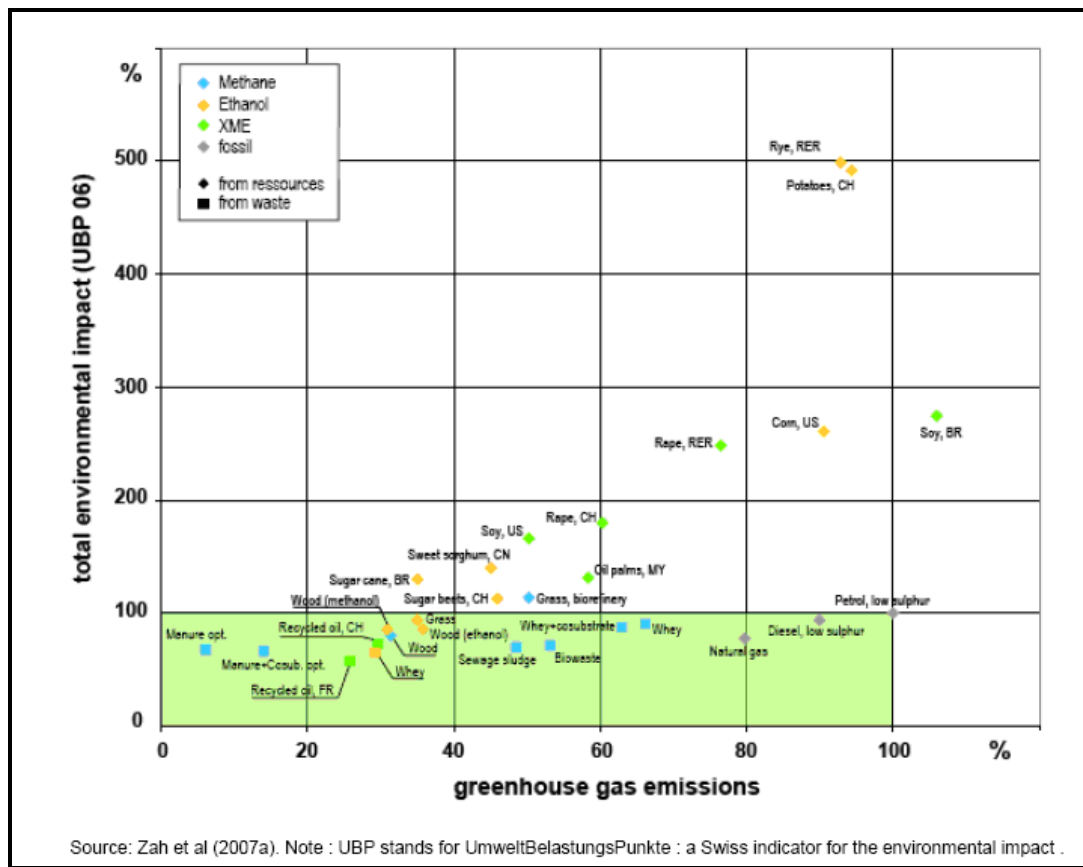
The Swiss Federal Institute for Material Testing and Research (EMPA) accomplished a GHG emissions and overall environmental assessment for the different biofuels currently available and compared them with the impacts of petrol fuels. The following chart shows this analysis. In this analysis, “the green (shaded) area means a particular fuel has both lower GHG emissions and a lower overall environmental impact than petrol”¹³⁵.

¹³³ Butler, 2006.

¹³⁴ Fedepalma

¹³⁵ Richard Doornbosch and Ron Steenblik (2007). Biofuels: Is the Cure Worse Than the Disease?. Organization for Economic Cooperation and Development -OECD. Round Table on Sustainable Development. September 2007.

Figure 16: GHG emissions related to their gasoline or diesel alternatives and overall environmental impact assessment



According to this chart, palm oil biodiesel would not have a better overall environmental performance and GHG emissions assessment than petrol diesel. The palm oil biodiesel sample used for this analysis however is from Malaysia. It is also noteworthy that the results

for Malaysian palm oil biodiesel are better than the scores for US soya, Chinese rape, and much better than RER¹³⁶ rapeseed and Brazilian soya.

Other air emissions associated with biodiesel

There is no specific legal framework in place for environmental standards for biodiesel production. However, the Ministry of Environment requests an environmental impact assessment before any biofuel project is carried out. As discussed earlier, the Biofuels Program Technical Committee started its analysis for a programme of biodiesel by testing biodiesel samples for physical-chemical characterisation. PetroEcuador has sent the samples provided by ANCUPA to laboratories and the samples have been proved in mixtures of 2%, 3%, 5%, 7%, 10%, 12%, 15% and 20% with regular Diesel#2. Although there is no official data yet available, preliminary results show that the mixtures with biodiesel provide a major reduction of sulphur content and other contaminants in relation to regular diesel.

In Ecuador, Diesel#2 has a content of 5,000 to 6,000 ppm sulphur, while the diesel premium's sulphur content is approximately 500 ppm¹³⁷. The global aim is to reduce sulphur contents in diesel to 0 ppm. This is almost entirely possible in fuel of 100% biodiesel¹³⁸.

However, it would not be possible to use 100% biodiesel because of lack of production availability and technological restrictions¹³⁹. The vehicles' engines would need to be modified and the production of biofuel would have to increase considerably. The biodiesel mixtures' characterizations, which were ordered by PetroEcuador, are being carried out with both types of diesel -Diesel#2 and diesel premium.

Clean development mechanism projects and carbon sequestration

Carbon sequestration, along with other mechanisms analysed and developed at the international level to reduce negative environmental impacts, could provide a pragmatic means of combating the negative effects of climate change. Nevertheless, there is still much to do, in terms of developing research and implementation, for these mechanisms to have a significant effect. In the case of biofuels, there are yet no biofuels production practices in Ecuador that could be accepted as Clean Development Mechanism (CDM), nor it is clear what the requirements would be. Evidently, much progress is still needed in order to create a legal framework that establishes guidelines and fosters effective results to cope with the effects of climate change.

The Kyoto Protocol¹⁴⁰ and Multilateral Environmental Agreements (MEAs)¹⁴¹ have served as international conventions to determine guidelines and goals for GHG emissions reductions.

¹³⁶ Ecoinvent country code for Europe. EMPA.

¹³⁷ In places such as Europe, diesel premium is of much better quality, reaching as low as 30-50 ppm of sulfur content)

¹³⁸ Mauro Gonzalez, representative of the Ministry of Energy and member of the biofuels Program Advisory Council.

¹³⁹ The results presented up to this moment show that until 5% there would not be a problem for automobile sector. The palm oil has certain chemical components, which at temperatures of less than 15 °Celsius it solidifies and they would generate a problem in vehicles, specifically in the pipes and combustion systems.¹³⁹ Interestingly, in the coastal region there would not be such problem because the regular temperature is higher. However, in this region no testing has been done yet. The testing that has already been done in the highlands region show that with more than 5% a solidification problem could start; however, it is necessary to wait for final results to reach conclusions. (Mauro Gonzalez).

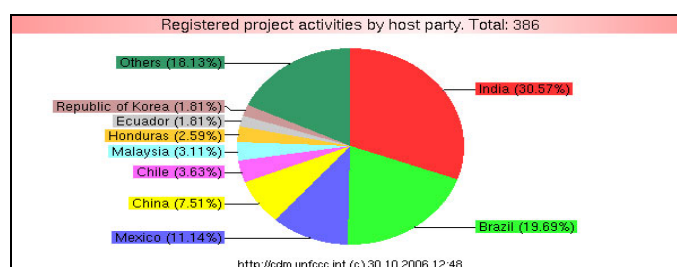
¹⁴⁰ The Kyoto Protocol operates under the UN framework for climate change and has the objective to reduce emission of six gasses that cause global warming. These gasses are: Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), and three industrial fluorine gasses : hidrofluorocarbonos (HFC), perfluorocarbonos (PFC) and sulfur hexafluoruro (SF₆). The goal of the Kyoto agreement is to reduce globally 5% of the emission of these gasses in the period from 2008-2012 in comparison to the emission levels of 1990. However, this does not mean that every country will reduce its emissions by 5%, but every country has its own commitments under the Protocol.

¹⁴¹ Ecuador is trying to implement several Multilateral Agreements that has signed and ratified during the last decades. See ANNEX # 1 Some of these MEA's include trade measures.

The CDM, under the Kyoto Protocol, has become an instrument to combat climate change. Ecuador signed and ratified the Kyoto Protocol, and created Cordelim in 2001¹⁴², the national authority for CDMs, which is the National Office for the Promotion of the CDM in Ecuador.

Cordelim performed an assessment of the CDM, its challenges and opportunities, and has been promoting different “Clean Energy Projects”. Since last November, Ecuador increased the number of projects registered for the CDM Board at the United Nations Framework Convention on Climate Change. The current projects cover areas such as hydroelectricity, biomass energy generation, better practices for animal disposals, and others activities that are currently accessing carbon certificates markets worldwide and helping to mitigate the green house effect.

Figure 17: Projects Registered at UNFCCC



Source: Ecuadorian Ministry of Environment

Although legal frameworks for sustainable development, such as the Kyoto Protocol and the CDM, have been helpful in making countries acknowledge the need for development patterns change, there is still much to do in terms of research and implementation of mechanisms that could have the best results to cope with these environmental challenges. No biofuel projects have been registered at Cordelim yet, and in the specific case of palm oil biodiesel production it is not clear whether they will be accepted as CDM projects.

On the other hand, a WWF report suggests that oil palm companies, by a voluntary commitment to contribute to issues of climate change, could buy the ecosystem services of artificial carbon sequestration, which is an option that is currently under deep analysis, especially in the developed countries. Carbon sequestration is a procedure that uses technology for creating carbon sinks by capturing carbon dioxide from industrial processes, such as power plants, and transporting it to appropriate places in order to inject the captured carbon dioxide into aquifers or fossil fuel deposits underground.

Countries like Japan and the United States, along with several NGOs and stakeholder organizations, are at the vanguard of this new alternative. For example, the World Resources Institute is directing a project called *Carbon Capture and Storage CCS* which aims to develop the aforementioned process of injecting captured carbon dioxide into “deep underground geological formations”.

¹⁴² This institution is being financed and supported by some multilateral agencies Programs and currently is working under UNDP support.

Although, the possibility for Ecuadorian companies to participate in such new alternatives is low due to economic and technological disadvantages, there are international companies that have already come forward to offer such services to palm oil producers in Ecuador¹⁴³. Moreover, ANCUPA is already analysing new alternatives for carbon dioxide sequestration from palm oil extractors, such as utilising oxidation pools and managing effluents instead of releasing them into the atmosphere. Currently, carbon markets are being created globally; these markets evaluate, register, verify and trade carbon credits. In this trade system utilities are exchanged for offsetting greenhouse gas emissions. The current cost of such certificates is approximately between US\$ 13 and US\$ 15¹⁴⁴.

Another initiative that could be more affordable to manage the carbon emissions generated from oil palm industries in Ecuador is based on the waste and palm trunks to produce plywood. This would be a way to create lasting products to be used in the building industry and thus “locking the carbon that would” be emitted to the ground by the palm trunks decay. Moreover this would also reduce the need for plywood production from forest-derived trees. The government agency Malaysian Palm Oil Board (MPOB), together with some companies such as Federal Land Development Authority (FELDA), the world’s biggest oil palm producer, and Business Esprit Sdn Bhd, are at the forefront of this initiative.

Palm oil producers in Ecuador are already analysing these options¹⁴⁵, as it is probable that artificial carbon sequestration and waste management during biofuel production could be considered as CDM projects. However, it is important to have in mind that in Ecuador, these ecologically friendly practices could be carried out by large industrial producers and to a lesser extent by medium producers. For small producers, who represent up to 60% of palm oil producers in Ecuador, such goals would be more difficult to attain, although not impossible, as ANCUPA or other associations through corporations or cooperatives, could foster ecologically friendly practices, for example through ecosystem services¹⁴⁶.

Nevertheless, it is well known that Ecuador needs to improve its capacity for implementing national and international environmental legislation. Especially with regard to forestry, Ecuador is one of the countries with the highest deforestation rate, and national monitoring and controls are still weak. It is most likely that in the coming years the Ecuadorian government will issue a legal framework that values the services provided by ecosystems and allows the country to realize the economic benefits involved while ensuring the preservation of natural forests. Moreover, these practices may become mandatory to obtain certificates, which would be issued by multilateral bodies and sold on the international market. This legal framework will be an important factor in promoting the benefits from biodiesel as a new energy alternative in Ecuador. However, as it becomes evident from this report, there is much to be done yet in this regard.

¹⁴³ Ibid

¹⁴⁴ Rommel Vargas, ANCUPA

¹⁴⁵ Mateo Ponce, Environmental Management Department ANCUPA

¹⁴⁶ An ecosystem service of carbon sequestration consists on services on consulting and training services to help clients to understand the current regulatory environment and opportunities presented by carbon markets, and accessing those markets; Assist clients in capturing financial returns for forest investments associated with sequestered carbon from managed forest offset projects by developing and implementing strategies for evaluating, registering, verifying, reporting, and trading forestry offset carbon credits; conducts cost-benefit and sensitivity analyses to determine when and where clients should register carbon stocks, among others (FORECON)

6 Conclusions and recommendations

General conclusions:

- ✓ The potential of palm-oil biodiesel exports in Ecuador will need to be analysed for economic feasibility and achievement of sustainability requirements. La FABRIL exported 2,000 tons of biodiesel in 2005 and 35,000 in 2006, but the company stopped its production in 2007. This is mainly due to price vulnerability, profitability uncertainties and the absence of a regulatory system and a national policy framework to guide the sector. Nevertheless, La FABRIL and other palm oil companies are interested in further exploring this market for palm oil by-products. The main concerns are price and economic feasibility. Nowadays, palm oil prices are more reliable than new industrial biodiesel, whose price is tied to that of fossil fuels and other oleaginous products.
- ✓ Trade barriers often affect exports from developing countries. So far subsidies and other governmental support measures from developed countries do not represent a serious threat to Ecuador's biofuels exports. Nonetheless, the challenge for Ecuador will be to find new markets and to comply with technical/environmental standards and regulations.
- ✓ Ecuador's natural conditions and geographical location are ideal for the development of palm oil plantations. But this development in some of the most pristine natural areas of the country has caused distrust especially among the environmental community. It is not clear therefore whether biodiesel production will bring environmental benefits if this takes place in sensitive areas.
- ✓ Along with environmental concerns, social and labour issues also raise questions such as to what extent new plantations and investment will benefit rural communities close to plantations. There is a need to promote responsible social standards among companies operating in the sector.
- ✓ One of the challenges that biodiesel production entails is the uncertain situation at the WTO. Ecuador has yet not defined a HS classification. At the WTO level, a clarification on biodiesel and bioethanol classification, as agricultural, industrial or environmental good would be helpful for the biofuels trade. Each one of these classifications currently presents particular problems. Most of the countries that trade biodiesel, do not comply with the Agreement on Subsidies and Countervailing Measures (SCM), while the classification of bioethanol as an agricultural product raises several questions for its appropriateness within the AoA. These and many other issues demonstrate the complexity of this topic and the need for further analysis. One option to be evaluated is a separate HS classification. Biofuels are indeed a *sui generis* case, they are a merger of the agricultural and energy sector and for this reason they cannot be treated simply as either one or the other. A separate classification would help such a distinction, although this option would need thorough evaluation.
- ✓ The political and scientific interest that has arisen from the worldwide debate over climate change has brought about the political will to deal with the effects of climate change. This political attitude in both industrialized and developing countries is likely to result in the promotion of a more sustainable development path. In the case of developing countries, and specifically in the case of Ecuador, it is essential that the

action is taken through the creation of a legal framework for biofuels that not only fosters biodiesel and bioethanol production, but also encourages sustainability throughout the production and commercialisation processes.

- ✓ Technical and environmental standards are to become key requirements for biofuels at the international level. Thus the strengthening and building of national capacities on standards and certification in tandem with the development of the biodiesel industry will become a key element for a successful development of an export-oriented industry. International political will to curb carbon emissions might be brought into play through support for such sustainability efforts, especially in trade, technological development, and consumption and trade guidelines.
- ✓ The capacity of public institutions in Ecuador to respond to the expansion of the biodiesel market is still deficient. Three years ago a Council and a national programme were created to promote biofuel production. However, no significant progress has been made because of a lack of information on optimal feedstocks, suitable geographical areas, impacts, profitability, among other themes. Research and analysis on these topics is needed for policymaking and entrepreneurial decisions.
- ✓ Lack of funding and current political instability have made it difficult for the National Biofuels Program to work hand in hand with private and public institutions. Much work is still to be done in planning and, more importantly, discussing the new policy and legal framework necessary to set guidelines for a sustainable Ecuadorian production, trade and use of biofuels.

Recommendations:

- ✓ Ecuadorian biofuels production and its commercialisation will depend not only on the national market, but also on the international market. Therefore analysis of national and international market prospects, as well as on international commercial trends are needed to make accurate projections on prices, investment risks, and destination markets. Moreover, such data is needed to evaluate Ecuador's potential to supply biodiesel in a sustainable way.
- ✓ Because of fluctuating oil prices, biodiesel production will require some form of policy incentives. These may take the form of production/consumption mandates, tax exemptions or direct subsidies if the production of biodiesel is going to be absorbed by national demand. Certification for sustainable management of palm oil plantations would also stimulate good practice in palm oil cultivation and gain markets. However, we recommend a careful analysis of the long term implications of these policies *vis à vis* the policy goals set for biodiesel development before policy decisions are made. These include impacts on government revenues and assurance that the overall economic, social and environmental benefits of these policies outweigh their costs. The distribution of state resources in Ecuador in particular is a sensitive issue that warrants careful appraisal and evaluation.
- ✓ As biofuels production and trade increases in Ecuador, environmental and sustainability criteria will need to be taken into account in the different production and market analyses. It is important for Ecuador - with its incipient Biofuels Program - to carefully assess and study international standards and possible trade barriers, both current and future, that will be enforced and take them into account when developing

and promoting its Biofuels Program. Thus, creation of local capacities on standards and certification will be key.

- ✓ Even though there is ostensibly land available for palm oil cultivation, it is imperative to create parameters and geographical determinations that define the territories to which palm oil cultivations could extend, taking into consideration the location of natural forests, agricultural frontier extension, food security, and other relevant socio-economic and environmental impacts. Territorial determinations will not only guarantee sustainability, but will also provide clear opportunities and guidelines for palm oil producers, thus reducing conflicts among sectors.
- ✓ Ecuador needs to regulate and enforce more strictly palm oil plantation management near natural forests and also encourage palm oil producers to join the Roundtable on Sustainable Palm Oil (RSPO). It is important that palm oil producer companies and organisations, such as ANCUPA, take part in this forum which advocates the development of “a globally acceptable definition of sustainable palm oil production when implementing better management practices that comply with this definition.” This convention started its work in 2001 and was officially constituted in 2004, and its most recent achievement is the creation of a system of Principles & Criteria for Sustainable Palm Oil Production, which includes a code of measures that support sustainability¹⁴⁷. Currently, the RSPO addresses palm oil production, but not biodiesel production *per se*. Nevertheless, in April 2007, the “Round Table on Sustainable Biofuels” (RSB) was launched. This Roundtable is coordinated by the Energy Center at the Swiss Federal Institute of Technology of University of Lausanne. It expects to develop a draft on global standards for sustainable biofuels production and processing by 2008. It is recommended that current and future Ecuadorian biofuel producers and policymakers take note of and, if possible, participate in this evaluative convention.
- ✓ With regard to Kyoto Protocol implementation, Ecuador needs to promote research on alternatives for carbon sequestration that could be implemented by palm oil and biodiesel producers. Moreover, it must evaluate the possibility of creating market-based mechanisms to generate opportunities on returns, investments and credits to those companies supporting GHG emissions reduction. Currently, carbon markets are being created globally; these markets evaluate, register, verify and trade carbon credits. At present no biodiesel projects have been approved as CDM nor have been registered at Cordelim, but the activities and methodologies to develop clean development mechanisms should be further analysed.
- ✓ Since the majority (60%) of palm oil producers in Ecuador are small farmers, most social benefits of biodiesel production will accrue from a proper inclusion of these small producers in the value chain. On the other hand, are the large producers, who represent a small percentage of palm oil production, who have the capability to foster ecologically friendly systems through technology and specialised services. Hence, an efficient way to attain sustainability goals without undermining positive environmental

¹⁴⁷ This code has been divided in eight sections, and each of those comprises several criteria to follow. These eight principles are: Principle 1: Commitment to transparency, Principle 2: Compliance with applicable laws and regulations, Principle 3: Commitment to long-term economic and financial viability, Principle 4: Use of appropriate best practices by growers and millers, Principle 5: Environmental responsibility and conservation of natural resources and biodiversity, Principle 6: Responsible consideration of employees and of individuals and communities affected by growers and mills, Principle 7: Responsible development of new plantings, Principle 8: Commitment to continuous improvement in key areas of activity.

or socio-economic impacts would be to enforce a legal framework that promotes organised and fair participation of small and large producers. The option of providing tax incentives to those companies whose supply comes from small producers (implemented in Brazil through the Social Seal) is an alternative that should be carefully analysed for the Ecuadorian context.

- ✓ Despite the fact that palm oil seems to be the most efficient feedstock in terms of biodiesel production, as explained earlier, the Biofuels Program Council is also analysing other alternatives to further support socio-economic development, notably *Higuerillas* (ricino) and *Jatropha curcas*. The promotion of alternative crops, in principle, would promote product diversification, and at the same time, it would provide jobs for another segment of farmers in Ecuador, located in unattended rural areas. Moreover, *Jatropha curcas* and *Higuerillas* are alternatives that do not directly compete with food production. However, a thorough analysis of the sustainable development impacts of these alternative feedstocks is crucial. This effort should be supported and funded by public and private institutions.

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