WP4: Sustainability of biofuels production in Latin America

Oswaldo Lucon (SMA/CENBIO)

SUMMARY

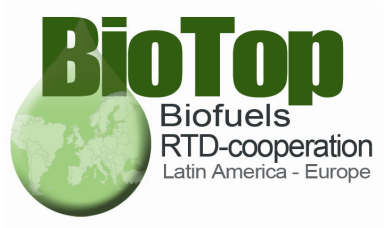
The BioTop Project

The overall objective of BioTop is to identify technical opportunities and research needs for Latin America (LA) and to create and support specific RTD cooperation activities between Latin America and the European Union (EU). Specific objectives are:

- Overview of the existing biofuel sectors in LA
- Identification of RTD priorities, needs and opportunities
- Collaboration between European and Latin American stakeholders
- Harmonization of EU and LA research agendas
- Knowledge and technology transfer
- Recommendations on RTD priorities and biofuel policies

BioTop provides a broad overview of the existing biofuels sector in Latin American counties. Key focus of the project is the identification and assessment of improved 1st and 2nd generation biofuel conversion technologies. Sustainability, standardization and trade aspects of future large-scale biofuel production are investigated, and scenarios, roadmaps and recommendations are developed. Exchanges between stakeholders active in RTD of biofuel conversion technologies are promoted and BioTop activities are effectively linked with existing networks. Outcome of the BioTop project is increased awareness about EU-LA opportunities for collaboration in the area of biofuels and the identification of suitable areas for biofuels RTD cooperation.

BioTop Website: **www.top-biofuel.org**



WP4: Sustainability of biofuels production in Latin America

Oswaldo Lucon (SMA/CENBIO)

4.1. Overview of sustainability assessment tools for biomass production

This chapter presents an overview of operable tools for sustainability assessment in the biofuels sector. The focus lies on standards and certification schemes already available or under development by the relevant international, regional and governmental bodies, companies, roundtables and NGOs.

4.1.1. Introduction

Biofuels and other forms of bioenergy are important options for addressing the threats posed by climate change, substituting fossil fuels in the next decades. They can also reduce local pollution problems and create long-term jobs. Two main types of biofuels for transport, bioethanol and biodiesel, have particularly large potentials to replace gasoline and diesel, increasing energy security through a diversified supply. The choice for an alternative biofuel to a conventional fossil fuel was primarily driven by costs, which have declined when production has grown – an effect that can be verified through their learning curves. Moreover there are promising possibilities with second generation bioduels under development. This is the case of cellullosic ethanol, a fuel obtained from wood residues, leaves, straws and many other types of waste, which can be produced virtually anywhere in the world and has the potential of changing the global patterns of energy supply, trade and technological competitiveness.

International trade rules have opened to biofuels the possibility of being considered environmentally preferable product. Trade rules must be, as much as possible, equitable and global. However, with the recent flaw of the World Trade Organization Doha Round, international trade is re-adjusting from multilateral to more bilateral initiatives, as well as more intensive use of dispute settlement mechanisms. Such movements may have significant influence on the development of sustainability assessments and criteria for biofuels. Voluntary certification schemes are powerful tools to inform consumers, enable biofuel sustainability schemes in national policies and, in some cases, to be considered technical trade barriers.

There are many methodological gaps to be filled, due to the complex biofuel supply chains. A given biofuel such as ethanol (C_2H_6O) can come from a vast diversity of feedstocks, be produced in many different paths in different locations and scales. There are, thus, several different impacts to assess. A difficulty in assessments resides exactly in the heterogeneity in impacts, feedstock types, scale and technologies (for production, conversion and end-use), geographical specificities (soils, climate, water availability), land ownership and local arrangements. This is far more complex than considering the petroleum supply chain[1]. Even for GHG emissions from a given feedstock, study boundaries and premises vary a lot, sometimes considering as an evidence reported facts (e.g. deforestation in Indonesia to plant palm trees to produce oil for biodiesel), sometimes extrapolating situations for future scenarios (e.g. sugarcane in Southeastern Brazil pushing soybean to the Midwest pushing cattle up North towards the Amazon rainforest).

In many countries, new legislation started requiring biofuel blended with fossil fuels, like bioethanol in gasoline or biodiesel in conventional diesel oil. The IADB (year) foresees that given such aggressive blend mandates, a conservative projection of the potential share of biofuels in global transport energy consumption in 2020 is 5%, up from just over 1% today. This would require an investment of over $200 billion in the next 14 years only in capacity expansion, compared to $7 billion announced in new projects through 2008.

In a second moment were questioned by many the environmental impacts of biofuels. Greenhouse gas (GHG) emissions – mainly carbon dioxide (CO2) are the most visible criteria for analyses. Usually comparisons with the business-as-usual impacts from fossil fuels provide an advantage for bioenergy, considering a life cycle, well-to-wheel approach. Some other works consider also indirect GHG emissions from, for example, induced deforestation.

Many reports and pilot projects[2] were conducted, considering commercial and pre-commercial technologies and, in some cases, technologies still under research and

[1] Jeremy Woods, Rocio Diaz-Chavez (2007). The Environmental Certification of Biofuels. OECD and International Transport Forum. Joint Transport Research Centre. Imperial College, Faculty of Natural Sciences, London, United Kingdom
http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DiscussionPaper6.pdf

[2] e.g. CO2Star (Carbon labeling initiative, http://www.co2star.eu/project_scope/project_scope.html)

development. From the existing options, ethanol made from sugarcane has shown the best energy and GHG mitigation performance[3]. The new developments promise comparable positive results with other feedstocks, an option for countries that cannot produce cane but want to produce locally their biofuels. Although may seem strange that the same countries that require bioenergy to be produced locally practice imports of oil coming from geopolitically instable regions, it can be explained, however, by other driving forces, such as incentives and protection of local farmers. Public opinion still does not pay much attention to some environmental impacts of biofuels, e.g. water consumption or use of pesticides. There are some exceptions, for example in the case of particulates emitted by sugarcane harvest burning practices, causing considerable nuisances to the population living in the vicinities of plantations.

Social impacts of biofuel production, negative in general, are often presented by the press media. Although in many cases these examples cannot be considered as a general rule, such news have contributed positively to raising the standards of workforce protection. The fact is that when technology scales up the need of manpower per unit produced decreases. If there is expansion of overall production part of the workers is utilized in other tasks, case for example of sugarcane mechanized harvest in Brazil. Many cultures require intensive labor during some months in each year – and in the rest of the time workers are available for other activities or even to stay at home with the earnings obtained - sometimes hundreds or thousand of kilometers away from the biofuel culture sites.

More recently, concerns about food scarcity have brought to the discussion of biofuel sustainability the issues of competition for land. Several effects – synergistic and antagonistic – are being considered, without however any sign of consensus. The food crisis witnessed recently has many causes: emerging markets requiring more commodities, poor food distribution and international trade distortions, increased demand for protein, extreme climatic events affecting production, financial speculation in commodities futures, lack of strategic grain stocks, high petroleum prices affecting fuels for transport and agricultural equipments, increasing prices of fertilizers made from oil and grains derived to fuel production.

The U.S. corn ethanol production has raised the price of these grains. Corn exporting countries like Mexico and Peru faced scarcity of this basic food and popular protests occurred. International reaction was immediate. Fears of more famine in places like Africa gained the news headlines. Policymakers considering postponing the expansion – and even proposed a halt in biofuel use. Large food processing companies expressed preoccupation

[3] IEA(2005) Biofuels for transport. International Energy Agency

with the price of their basic material input. Academics tried to reach a consensus on sustainability criteria for biofuels and several methodologies are being debated.

4.1.2. Criteria and methodologies

Several initiatives seek to establish certification and sustainability standards for biofuels. Some of these initiatives overlap heavily, but they are all broadly consistent in their principles. As of yet, none of these has established itself as the leading forum for this activity, and none is backed by the force of law[4].

There are publicly respected sustainability certification schemes but these have not been developed to provide assurance for biofuels. Some to mention are:

- Forest Stewardship Council – FSC[5]
- European Retailers Produce Working Group - EUREPGAP[6]
- UK Assured Combinable Crops Scheme - ACCS[7]
- LEAF Marque certification for farmers[8]

Not withstanding, there are schemes with stronger interfaces with bioenergy:

- Round Table on Sustainable Palm Oil - RSPO[9]
- WWF Roundtable on Responsible Soy Oil RRSO[10] and
- The Sao Paulo State Green Ethanol Program[11]

National policies in the UK[12], Netherlands and Germany are supporting the assessment of sustainability and certification systems for biofuels, which should be viable and valid. The

[4] WRI (2008) Plants at the Pump: Biofuels, Climate Change, and Sustainability. World Resources Institute http://pdf.wri.org/plants_at_the_pump.pdf
[5] http://www.fsc.org/
[6] http://www.eurepgap.org/Languages/English/about.html
[7] http://www.assuredcrops.co.uk/ACCS2/
[8] http://www.leafmarque.com/leafuk/producers/join.asp
[9] http://www.rspo.org/
[10] http://www.responsiblesoy.org/
[11] www.ambiente.sp.gov.br/etanolverde
[12] ECOFYS (2006) Draft Technical Guidance for sustainability reporting under the Renewable Transport Fuel's Obligation. Low Carbon Vehicle Partnership, London, UK.

Swiss Government is supporting an inititative conducted by the Lauzanne University[13]. Some of these initiatives will be further discussed.

There are different systems and methods aiming at ensuring sustainability of bioenergy, but in overall terms these can be synthesized in the following categories:

a. Demand-side, voluntary, consumer oriented, bottom-up (pulverized) a green label for "better products", appealing for individual perceptions and usually covering good social practices (e.g. fair labor, small producers, from poorer regions) and organic / environmental standards (e.g. products less carbon-intensive, no deforestation in the production process etc.);

b. Demand-side, mandatory top-down, usually sanitary measures and/or other requirements used generally to imports; covering some key topics and products (e.g. absence of genetically-modified organisms or prescribed substances, quality standards for a given biofuel commodity);

c. Demand-side sustainability criteria, top-down general principles applied to a category of goods and services, such as biofuels, covering a broad range of topics, in many cases aspirational but also with the intention of becoming mandatory by law;

d. Supply-side sustainability criteria, producer oriented, generally voluntary schemes promoted by producer associations and/or governments, applied to main (in most cases few) topics of higher socio-environmental concern beyond law enforcement (e.g. life-cycle GHG assessments);

e. Supply-side, voluntary, recognized Environmental Management Systems based on continuous improvement spirals, case of ISO 14000 series of quality standards.

[13] Roundtable on Sustainable Biofuels' E25 Supporters' Circle, http://cgse.epfl.ch/page70345.html . **Second version of global principles for sustainable biofuels production, October 23, 2007** at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/Home%20Page/RSB-Second%20version%20of%20Principles.pdf

4.2. Ongoing initiatives

There are several ongoing initiatives on defining and suggesting sustainability assessment criteria for biofuels. In some cases, these are restricted to a geographical coverage. In other, to a given feedstock or end product. This section will describe some of the more important identified.

4.2.1. The FAO Sustainable Bioenergy Report and the Global Bioenergy Partnership

The United Nations´ Food and Agriculture Organization (FAO) issued a report on bioenergy[14], drafted collectively by UN-Energy members, intending to contribute to international discussions on the strategies and policies needed to ensure economic, sustainable and equitable development of these sources in the future. The objective is not to be prescriptive, but to raise priority attention in key areas. The report recognizes that the issues raised by bioenergy development are complex and highly dependent on local circumstances, so sweeping generalizations about the efficacy of particular approaches are rarely valid. Nine key sustainability issues were identified (Table 1).

In the environmental side, key sustainability issues include impact assessments, emissions monitoring and reduction, biodiversity protection, water use management and soil health maintenance. Key land use issues are due assessments of potential expansions in cultures, protection of small-scale farmers from loss of land due to large scale producers, respect to land tenure rights, informed decision making and full stakeholder participation in land use change processes. Also recommended are further assessments on the effects of expanded bioenergy development in agriculture, industry, health, environment and trade. There should be additional technology research, sound development and coordination of current information systems, as well as more interactions of bioenergy and sustainable energy crops with the Conventions of Biodiversity and to Combat Desertification, in order to identify opportunities.

On rural development, it considers new opportunities (e.g. integration with other development policies, jobs), but highlights that the cost of food security or environmental damage can undermine the benefits. Baselines and indicators are here necessary. Industry (both agricultural, forestry, energy and small-medium enterprises) and R&D will play a central role in this development.

On food security, four dimensions require policy attention: availability, access, stability and utilization. Key issues include, among others, the risks to food security under different scenarios, positive impacts of expanded bioenergy (diversification, new rural infrastructure,

[14] FAO (2008) Sustainable Bioenergy: A Framework for Decision Makers. Food and Agriculture Organization. Available at http://www.fao.org/docrep/010/a1094e/a1094e00.htm

jobs), potential benefits or harms to affected populations, impacts of second-generation systems on agricultural structure, cooperation opportunities in bioenergy production and trade.

Table 1. Sustainability issues from FAO (2008)

Issue	Local context issues	Implementation issues
1: Ability of Modern Bioenergy to Provide Energy Services fo the Poor	Resource availability and competing uses Economic access, reliability and accessibility	Financing
2: Implications for Agro-Industrial Development and Job Creation	Types of agro-industry to be developed in short and long terms Scale of agro-industrial chains Large vs. small companies Type, quality and distribution of employment Infrastructure consideration Powering or fuelling other industries	Why and how to encourage small-scale, local plants Whether and how to encourage job creation Testing new Fuels, technologies and capacities Whether and how to create distribution channels Whether and how to encourage international investment
3: Health and Gender Implications of Modern Bioenergy	Ability to reduce indoor air pollution, lower infant mortality and raise life expectancy Ability to reduce time, effort and injury associated with traditional fuel gathering and cooking Ability to minimize public health risks from oxygenate use in transport fuels	Fiance Human capital development
4: Implications for the Structure of Agriculture	Crops that are more promising Structural implications of various crops Historical land tenure, production chain ownership, credit availability	Should public policy favour small-scale bioenergy production? Role of cooperatives, agriculture extension services and capacity building
5: Implications for Food Security	Who are the hungry? Impact on food availability Impact on food access	Develop an analytical framework for food security and bioenergy Enhance agricultural productivity and sustainability Understand the policy nexus for liquid biofuels
6: Implications for Government Budget	Tax reductions for liquid biofuels Size of subsidies and tax reductions When fiscal support might be appropriate	Transparent and solid regulatory framework for commercial biofuels Trade-offs for biofuels under development
7: Implications for Trade, Foreign Exchange Balances and Energy Security	Ramifications for foreign exchange balances Impacts on agricultural trade policy	Substantial governmental intervention in the development of biofuel industries Biofuel subsidies Blending requirements Capacity building
8: Impacts on Biodiversity and Natural Resource Management	Feedstock choice, land use and soil health Impact on grasslands, tropical forests and other biodiverse ecosystems Impact on water quality and availability Impact on air quality Impact on second generation technologies	Effectiveness of land use controls Need for further research Potential for voluntary or mandatory certification
9: Implications for Climate Change	Factors affecting net GHG emissions (full life cycle) GHG reduction potential Trade-offs: costs and limited resources	Improving production efficiency Cellullosic ethanol production and other advanced technologies Carbon capture and storage potential

At global level, proposals include, among many other, to establish internationally agreed standards and other certification models for production, conversion, use, use and trade of bioenergy systems, to protect both society and the environment.

The Global Bioenergy Partnership (GBEP[15]) is a forum coordinated by the FAO headquarters to promote sustainable bioenergy, particularly in developing countries. The program of work includes (i) to facilitate the sustainable development of bioenergy and collaboration on bioenergy field projects, (ii) to formulate a harmonized methodological framework on GHG emission reduction measurement from the use of biofuels for transportation and form the use of solid biomass and (iii) to raise awareness and facilitate information exchange on bioenergy. Three task forces were designated for this program.

4.2.2. IEA initiatives

The International Energy Agency (IEA) supports several initiatives; among these could be mentioned:

- Bioenergy Task 38[16] analyzes information on bioenergy, land use, and GHG mitigation to support policy and industry decision makers in selecting efficient and effective mitigation strategies that optimize GHG benefits. Task 38 provides methodologies for greenhouse gas balances of biomass and bioenergy systems.
- Task 40[17] focuses on sustainable international bioenergy trade and has issued a paper in 2006 on existing certification schemes18. Countries involved are Belgium, Canada, Finland, Germany, Netherlands, Norway, Sweden and the UK.

4.2.3. The IADB´s Study for Latin America

The Inter-American Development Bank (IADB) has commissioned a report[19] analyzing Latin America's global competitive position looking forward to 2020. It includes an extensive study on the global biofuels market, including 50 countries. The identified opportunities in the emerging global biofuels industry offer a strategic blueprint for the Bank´s activities in the region and serve as the basis for even more focused and policy-oriented studies in the future.

---

[15] http://www.globalbioenergy.org/
[16] http://www.ieabioenergy-task38.org/
[17] http://bioenergytrade.org/
[18] Jinke van Dam, Martin Junginger, André Faaij, Ingmar Jürgens, Gustavo Best and Uwe Fritsche (2006) Overview of recent developments in sustainable biomass certification. Paper written within the frame of IEA Bioenergy Task 40, http://bioenergytrade.org/downloads/ieatask40certificationpaperdraftforcomments22..pdf
[19] IADB (2007). A Blueprint for Green Energy in the Americas. Strategic Analysis of Opportunities for Brazil and the Hemisphere. Featuring: The Global Biofuels Outlook 2007. Prepared for the Inter-American Development Bank by Garten Rothkopf. Available at http://www.iadb.org/biofuels/

Although with an economic objective, the report brings also important considerations on environmental sustainability. Its starting point is the fact that biofuels are not the solution but one important choice in an increasing array of energy options.

An extensive survey of global biofuels (both ethanol and biodiesel) recognizes that Brazil has a unique and leading position in the emerging global biofuels industry, also being one of the few countries with the available arable land to expand production enough to become a major exporter. These factors have made Brazilian advice and expertise on biofuels highly sought after commodities. According to the study, the growth of biofuels will favor countries with long growing seasons, tropical climates, high precipitation levels, low labor costs, low land costs, as well as the planning, human resources, and technological know-how to take advantage of them. Latin America and Caribbean, led by Brazil, already produces 40% of the world's biofuels and is uniquely positioned to take advantage of this growing industry.

A strategic blueprint for green energy in the Americas is organized around the four pillars that will drive and shape competition and demand: innovation, capacity expansion, infrastructure, and building global markets. Innovation creates value added technology exports, but it also drives production efficiencies and decreases the land requirements of agroenergy, major factors in national competitiveness. Likewise, infrastructure allows for both the expansion of production and its connection, both physically and virtually, to local and global markets. It is in these markets that the true promise of biofuels lies – in creating a globally traded commodity with diverse producers and consumers that offers a clean and secure alternative to fossil fuels. Innovation, the expansion of production, and the construction of infrastructure cannot wait for markets, but nor should markets be expected to form naturally. What is necessary is an aggressive marketing campaign to change the perception of biofuels as solely "home-grown" energy, promote the liberalization of trade, the proliferation of producers and consumers, and the development of the mechanisms of that trade: international standards and liquid futures markets. To build global markets, the IADB suggests and offers support to an initiative to develop, promote, and foster the adoption of global standards in biofuels production, processing and transportation.

4.2.4. The Brazilian Biofuel Certification Initiative (INMETRO) and the International Biofuels Forum

Believing that the current market for biofuels is viable, that the market will continue to grow within regions and that international trade in biofuels would increase significantly by the end of the decade, a task force from the Governments of Brazil, the European Commission and the Government of the United States of America produced a document[20] for bioethanol quality standards. The aim is free circulation of biofuels among the three regions. This is applicable to the ethanol and biodiesel fuel specifications, but not to the production processes.

[20] White Paper on Internationally Compatible Biofuel Standards. Tripartite Task Force Brazil, European Union & United States of America. December 31 2007
http://www.inmetro.gov.br/painelsetorial/biocombustiveis/whitepaper.pdf

The International Biofuels Forum[21] – a governmental initiative among Brazil, China, the European Commission, India, South Africa, and the United States – was launched in March, 2007 to to support the international trading of biofuels as a commodity and to promote the sustained use and production of biofuels around the globe. So far, however, there is no certification or sustainability assessment in progress under this Forum.

4.2.5. The São Paulo State Green Ethanol Program – Agro-environmental Protocol (Brazil)

In Brazil, the São Paulo State[22] has established a voluntary scheme in May 2007 for the sugarcane sector: the agro-environmental protocol, under the São Paulo State Green Ethanol Program[23]. Sugarcane is an important energy source for the Brazilian São Paulo State: 30% of primary energy demand and 71% of primary energy produced. The State alone produced 22% of the world´s ethanol in 2007 (11 billion litres, 62% of national output)[24]. Forecasts indicate that in 2008 São Paulo will produce 16 billion liters out of the world´s 61 billion liters output.

Ethanol production is a key matter of local concern in São Paulo. There is still enough land for food, feed and fuel. Sugarcane expansion is happening mostly over pasture land and there are still good potentials to intensify cattle raising, without deforestation.

Table 2. Sugarcane and land use in Sao Paulo (2007)

	Million hectares		
Sugar cane	4,34		
other cultures	3,57		
Cultivated areas		7,91	
Natural forests and “cerrado" grasslands		3,20	
Reforestation		1,14	
Pasture land		9,78	

[21] http://www.un.org/News/briefings/docs/2007/070302_Biofuels.doc.htm

[22] The São Paulo State has 40 million inhabitants and is responsible for 30% of national GDP. Electricity cogeneration from sugarcane bagasse (a by-product in the sugar and ethanol production) achieved in 2006 an installed capacity of 1700 MWe, projected to grow at least more 1800 MW until 2013 (or up to 4900 MW if straws and leaves are utilized). In blends varying in the range of 20%-25% in volume, ethanol is added to all gasoline used in the state. Ethanol is also used in dedicated cars and in flexile fuel vehicles (FFVs), replacing today more than 40% of all gasoline needs. Today FFVs are responsible for more than 12% of the total 10 million cars. At the pump, ethanol costs less than 70% than gasoline, what makes the renewable fuel attractive to the end-user. Thanks to the modern vehicle technology, ethanol use in vehicles overall pollutes less than gasoline today. Bioethanol technology is well developed and the experience can be a benchmark to almost one hundred countries in the world already produce sugarcane, the vast majority developing nations.

[23] http://www.ambiente.sp.gov.br/etanolverde/

[24] *Sources: Market Research Analyst, January 26, 2008 http://www.marketresearchanalyst.com/2008/01/26/world-ethanol-production-forecast-2008-2012 and UNICA, 2008 http://www.portalunica.com.br/portalunica/files/referencia_palestraseapresentacoes_coletivas-16-Arquivo.pdf*

TOTAL SÃO PAULO STATE			22,03

The local Environment Secretariat is paying close attention to the expansion of the sugarcane culture; area grew 4.8% in the period 2000-2006 on average and 9.4% only in 2006. To ensure sustainability, some points to be addressed are:

(i) accelerated phasing-out of sugarcane crop burning practices;

(ii) water conservation and protections of water bodies;

(iii) protection of remaining forests, recovery of riparian areas, biodiversity corridors;

(iv) minimization of emissions to air, water and soil;

(v) combatting erosion;

(vi) the adequate management of agrochemicals;

(vii) fair labour practices and

(viii) environmental education and public awareness.

In most cases such chalenges require an adequate management and strong law enforcement. Another instrument to explore are voluntary agreements and certification. With this view, the Agro-environmental Protocol was launched in May 2007 to promote best practices and, with a pedagogical approach, to prepare producers for other certification schemes. Signed by the State Governor, the Secretaries of Environment and Agriculture and the President of the Sugarcane Producers Union – UNICA[25] the text has a set of measures to be followed (Box 1).

[25] www.unica.com.br

Box 1

Environmental Directives of SP Sugar Cane Sector Protocol.(Guidelines)

Directive a: to anticipate, in the lands with declivity lower than 12%, the final period for the elimination of sugar cane harvest burning, from 2021 to 2014. Anticipate the percentage of not burrned sugar cane in 2010, from 30% to 70%.

Directive b: to anticipate, in the lands with declivity higher than 12%, the final period for the elimination of sugar cane harvest burning, from 2031 to 2017. Anticipate the percentage of not burned sugar cane in 2010, from 10% to 30%.

Directive c: do not burn any sugar cane harvest in expansion areas.

Directive d: do not burn any sub-product of sugar cane without a control system.

Directive e: protect the Riparian Forest of the sugar cane farms due to it´s relevance for the environment and biodiversity protection.

Directive f: protect the watersprings of rural areas of sugar cane farms, recovering it´s vegetation.

Directive g: implement a Technical Plan of Soil Conservation, including the erosion control and the contention of water runoffs on intern roads.

Directive h: implement a Technical Plan of Water Resources Conservation, respecting the hydrological cycle, including a Water Quality Program and Water Reuse Program

Directive i: adopt good practices for agrochemicals packaging waste, promoting the triple washing practices and storing it accordingly. Train the operators correctly and certificate the use of individual workforce protections equipment.

Directive j: adopt good practices to minimize air pollution from industrial process and optimize the recycling and reuse of industrial process solid waste.

There are formal commitments to fulfill guidelines. All adherents must present detailed plans and a simplified table with baselines and action targets, as exemplified in the next figures.

Table 3. Harvest burning phase-out plan, Sao Martinho plant in Pradopolis, Sao Paulo

Parameters	2007	2008		2014		2017
Sugarcane burning phase-out						
1.1 - Basic info						
Cane crushing (1000 t)	6.770.000					
Cane from external (1000 t)	2.570.000					
Land, total cultivated (ha)	49.458					
Harvest, mechanized area (ha)	44.916					
Harvest, non-mechanized area (ha)	4.542					
Harvest, expansion area (ha)	-					
1.2 - Targets proposed						
mechanized area without burning %	98	100		100		100
non-mechanized area without burning %	0	1		30		100
expansion area without burning %	-	100		100		100
1.3 - Follow-up						
mechanized area without burning %	-					
non-mechanized area without burning %	-					
expansion area without burning %	-					

Table 4. Forest protection plan, Sao Martinho plant in Pradopolis, Sao Paulo

Parameters	2007	2008		2014		2017
2 - Riparian Forests						
2.1 - Basic info						
Area, own forests (ha)	3377					
Area, suppliers forests (ha)	1994					
Area, watersprings (ha)	305					
2.2 - Targets proposed						
Protection, own forests (%)	100	100		100		100
Protection, suppliers forests (%)	100	100		100		100
Recovery, own forests (%)	23	52				
Recovery, suppliers forests (%)	48	86				
Recovery, waterspring areas (%)	82	87		-		-
2.3 - Follow-up						
Protection, own forests (ha)	3377					
Protection, suppliers forests (ha)	1994					
Recovery, own forests (ha)	711	798				
Recovery, suppliers forests (ha)	485	497				
Recovery, waterspring areas (ha)	29	31				

Table 5. Water usage plan, Sao Martinho plant in Pradopolis, Sao Paulo

Parameters	2007	2008		2014		2017
3 - Water usage						
3.1 - Basic info						
Water usage in industry (m3/ t cane)	2,85	-		-		-
3.2 - Targets proposed						
Proposed water usage	2,85	2,85		2,00		2,00
3.3 - Follow-up						
Reported water usage						

Table 6. Air pollution plan, Sao Martinho plant in Pradopolis, Sao Paulo

Parameters	2007	2008		2014		2017
4 - Boiler air emissions						
4.1 - Basic info						
New boilers (fromr 01/01/2007)	0	0		0		0
Old boilers (prior to 01/01/2007)	8	8		8		8
4.2 - Targets proposed						
Monitored new boilers	0	0		0		0
Older boilers with emissions control equipment	8	8		8		8
4.3 - Follow-up						
Monitored new boilers	0	0		0		0
Older boilers with emissions control equipment	0	6		8		8

Protection of natural species and biodiversity is a special chapter in the Protocol. All defined in a detailed plan, it covers: (i) definition and recovery of riparian forests next to plantations (425,000 hectares estimated in the State); (ii) improved protection of conservation units; (iii) rigorous enforcement against deforestation and; (iv) protection of water springs. Detailed plans include maps with location of forests, watersprings and cultures (Figure 1, a,b).

Compliant adherents receive a Certificate of Conformity from the Government – and lose it if directives are not followed. Verification is made by government (environmental bodies), producers and civil society. As of June 2008, 145 out of the 177 ethanol plants in the State had adhered to the Protocol. These represent 89% of total cane crushing (377 million tonnes). From the 145 plants , 132 have finished and delivered their Action Plans (2007-2017), establishing how they will follow the Protocol´s Directives. The other 32 non-adherent plants are being focused by environmental inspections. and satellite images are verifying the land use throughout the State. Proxy information like sales of agricultural equipment and fertilizers are also being utilized by environmental bodies to follow-up the implementation of the Protocol, as well as law enforcement.

Further actions include the signature of the protocol with cane suppliers. This second phase was signed in March.2008 with 21 associations, representing ~13.000 suppliers. For the cane producers are applied basically the same guidelines of ethanol plants.

Practical results were already observed. Comparing the figures of the year 2008 versus 2007, more 548 thousand hectares harvested (3790 ha in 2008), but less 109 thousand hectares burned (2023 ha in 2008); less 33 tonnes of particulate matter were emitted; in mechanizable land, expected phase-out by 2012, prior to agreed date 2014.

Preliminary results obtained estimate that by 2012 all mechanizable areas will phase-out harvest burning, anticipating the legal deadline of 2021. For non-mechanizable areas the legal deadline of 2031 will be anticipated to 2017. Will be prevented releases of 3.9 thousand tonnes of particulates (~28% of emissions from diesel vehicles in the Sao Paulo Metropolitan Region – SPMR); 45.3 thousand tonnes of carbon monoxide (12% of diesel emissions in SPMR) and 6.5 thousand tonnes of hydrocarbons (11% of diesel in SPMR). Riparian forests defined to be protected were around 400 thousand hectares (~10% of cultivated land). Results are verifiable through satellite images (Figure 2, a, b).

The counterpart of the Agro-environmental Protocol is governmental support in topics like (i) R&D on cellullosic ethanol, recovery of leaves and straws, bagasse cogeneration, genetic improvements etc.; (ii) Infrastructure, logistics, exports: transport optimization (pipeline, waterways, railways, ports, roads); (iii) Electricity cogeneration: regulation, grid connection; (iv) Certification to Agro-environmental Protocol conformities; (v) Incentives to adequate transition from manual to mechanized harvesting, especially small and medium enterprises (up to 150 hectares).

Figure 1. Example from the São Martinho plant: protection of watersprings and riparian forests - plant (a) and detail (b)

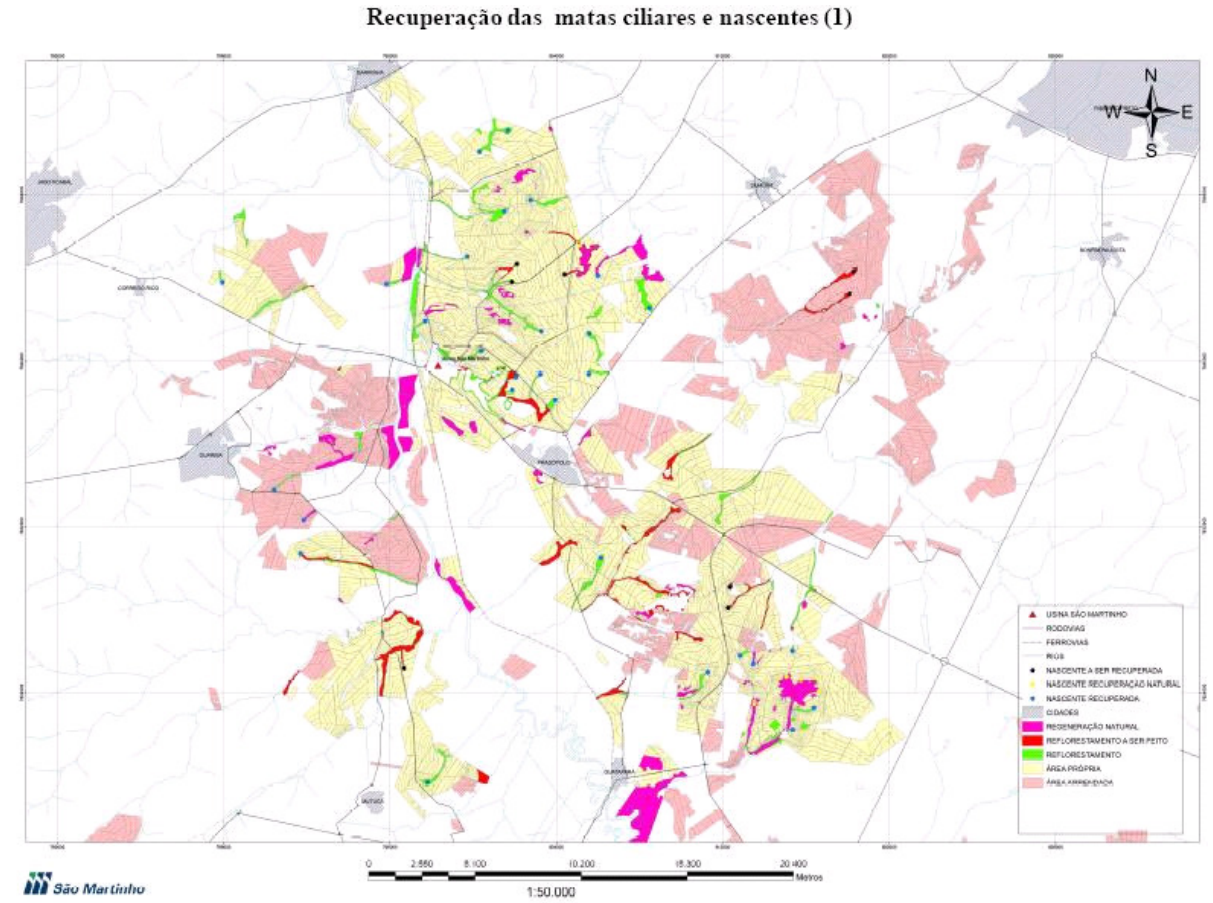
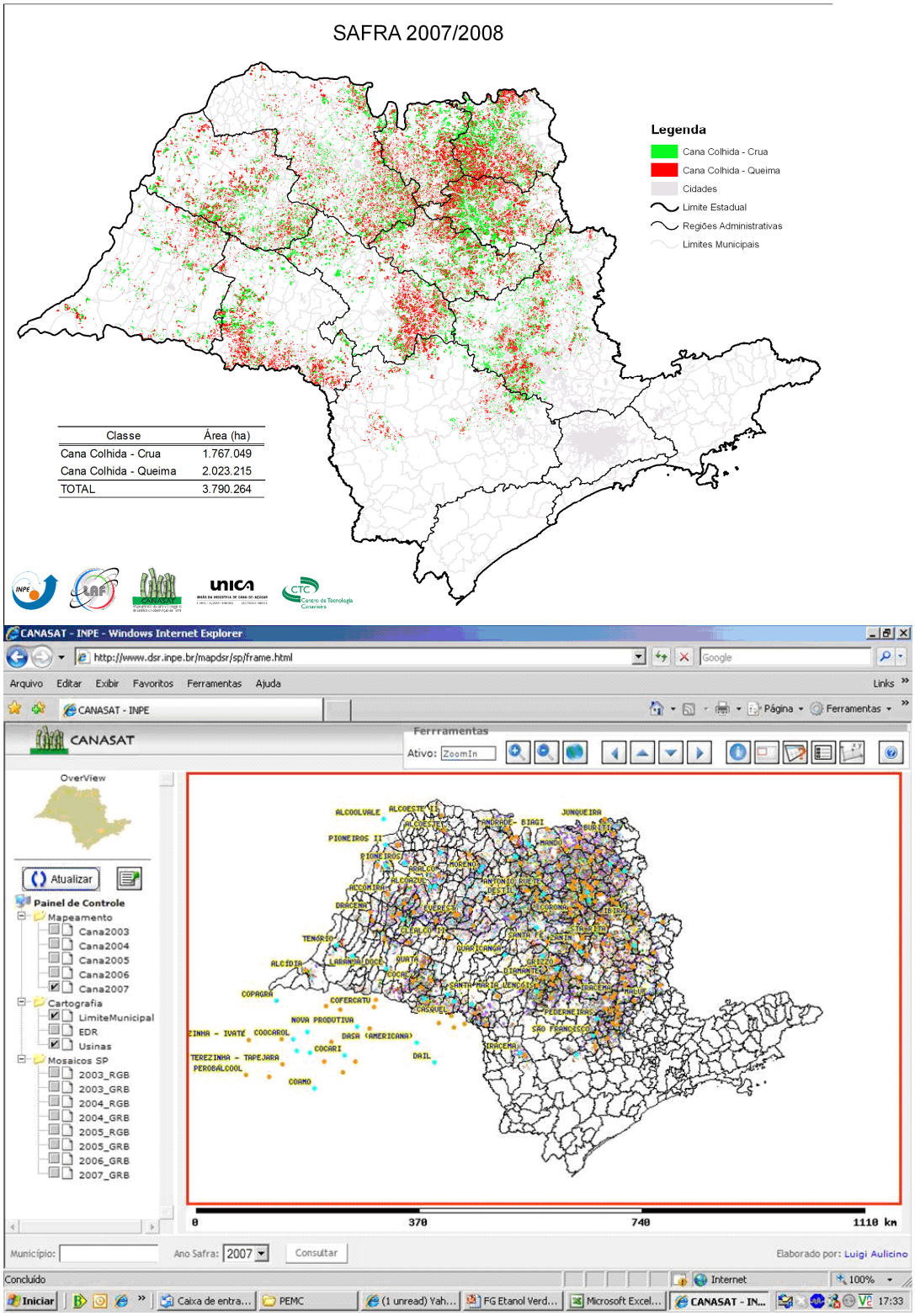


Figure 2. Satellite images of sugarcane cultivated land, 2007-2008 harvest in Sao Paulo: summary and details[26]



[26] CANASAT – INPE, http://www.dsr.inpe.br/mapdsr/sp/frame.html

4.2.6. Sustainable Palm Oil (RSPO), Sustainable Soy, Better Sugar Initiative

The Roundtable for Sustainable Palm Oil (RSPO) is a multi-stakeholder group of organizations, producers, and industries that represent the entire supply chain of palm oil and biofuel production. The group developed a set of 8 principles and 48 criteria for sustainable palm oil production, including ecological, social, economic, and more general criteria. Its being now studied the supply chain in order to establish whether a track-and-trace standard would be a viable option for the industry. RSPO principles are:

- Commitment to transparency
- Compliance with applicable laws and regulations
- Commitment to long-term economic and financial viability
- Use of appropriate best practices by growers and millers
- Environmental responsibility and conservation of natural resources and biodiversity
- Responsible consideration of employees and of individuals and communities affected by growers and mills
- Responsible development of new plantings
- Commitment to continuous improvement in key areas of activity

The Roundtable on Sustainable Soy (RTRS[27]) has as one of its objectives to develop and promote criteria for the production of soy on an economically viable, socially equitable and environmentally sustainable basis. The latest (3rd) version of the principles under consultation[28] covers:

(i) Responsible Business Practices (Compliance with applicable legal requirements, openness and transparency, continuous improvement, long-term economic viability);
(ii) Responsible labor conditions (recognition and respect for labor rights and individual human rights; adequate training; adequate handling of health and safety issues; recognition of and respect for workers' freedom of association; provision of fair salaries);
(iii) Respect for Land Rights (compliance with the law in the process of land acquisition; demonstrable, legal tenure or use rights are held, which are not contested by local communities or indigenous peoples with formal and/or customary tenure or use rights; also, activities should not diminish the legal or customary rights of use and/or access of other land users without their free, prior, informed and documented consent.)
(iv) Small scale and traditional land use (responsibility toward smallholders)
(v) Responsible Community Relations (contribution to sustainable development of local communities, prevention or minimization

[27] http://www.responsiblesoy.org/eng/index.htm
[28] Draft RTRS Principles and Criteria: Second Public Consultation Document DG2-OUT-02.1-ENG Draft RTRS Principles and Criteria for Consultation, 27 March 2008. Produced by The RTRS Principles, Criteria and Verification Working Group (DG) as an output of their second meeting (Rosario, Argentina) 11-15 February 2008 http://www.responsiblesoy.org/documents/3conference/eng_principles_and_criteria.pdf

and mitigation of negative social impacts, constructive dialogue and addressing of grievances, compensation for loss or damage)

(vi) Environmental responsibility (prevention, minimization and mitigation of negative environmental impacts; minimization of pollution and waste and greenhouse gas emissions; restoration; raising environmental awareness)

(vii) Responsible Water Management (maintain or improve the quality and availability of surface and ground water and maximise water use efficiency; maintain or re-establish natural vegetation areas around springs and along natural watercourses);

(viii) Responsible Soil Management (control of erosion or other negative impacts on the biological and ecological sustainability of the soil system; maintain or improve soil quality with a view to increasing yields and land-use intensity)

(ix) Protection of biodiversity (native vegetation; areas of High Conservation Value; restoration of natural ecosystems)

(x) Crop protection and responsible use of chemicals (monitoring and control of pests, diseases, weeds and invasive introduced species; responsible handling of chemicals; responsible use of chemicals; responsible use of biological control agents; origins of seeds as measure of prevention of introduction of new diseases)

(xi) Responsible establishment of infrastructure and new areas of cultivation (assessment of social and environmental impacts prior to establishment of new major infrastructure; prioritization of degraded and already-cleared lands as areas for expansion soy cultivation; assessment of social and environmental impacts prior to expansion of soy cultivation onto non degraded land or native vegetation; consent and compensation prior to expansion of soy cultivation on traditional and indigenous communities lands; high Conservation Value Areas)

The Better Sugarcane Initiative (BSI[29]) aims to determine principles and to define globally applicable performance-based standards for sugarcane products (including bioethanol) with respect to its environmental and social impacts. Technical working groups (TWGs) – global teams of technical and scientific experts will assess sugarcane management practices considering three categories:

(i) Environment and agronomy;
(ii) Social and community;
(iii) Milling and co-products.

Based on good practice achievements around the world, the TWGs will develop a set of universally-applicable guidelines for consideration by the BSI membership. The guidelines will follow the Quadruple Bottom Line approach which seeks to:

(a) Minimise the effects of sugarcane cultivation and processing on the off-site environment;

[29] http://www.bettersugarcane.org/

(b) Maintain the value and quality of resources used for production, such as soil, health and water;
(c) Ensure production is profitable.
(d) Ensure that production takes place in a socially equitable environment.

Guidelines requiring further consideration will be tested in different cane-growing scenarios around the world to ensure that they are practical and achievable, and have the desired effect of improving the economic, environmental and social sustainability of sugarcane farming.

4.2.7. European Commission tender "Sustainability Criteria and Certification Systems for Biomass Production"

A report prepared by the authors (M.W. Vis, J. Vos, D. van den Berg) and BTG Biomass Technology Group BV[30] . The study´s objective was to provide a basis upon which the Commission Services could decide which actions to undertake in view of proposing minimum sustainability criteria and certification systems for the production of biomass in the EU and for imported biomass (to the EU) [31]. The model used considers in the international environment:

- the context of sustainability criteria: acceptance (mainly under the WTO), coherence with CEN/ISO standards, interface with Kyoto obligations, availability of land, energy and food security
- operation and management structure of the certification system: scope and goal, principles, criteria, indicators and verifiers
- costs and benefits for the environment and society
- costs and benefits for biomass producers and users and
- an assessment of the application and impact of certification schemes.

[30] a private company of consultants on biomass, which does not necessarily represent the opinion and the position of the European Commission on the issue of sustainability criteria and certification systems for biomass production. The company has several projects throughout the world, mostly on thechnology developments, with few projects on forestry certification and the Clean Development Mechanism (http://www.btgworld.com/)
[31] DG TREN (2008) "Sustainability Criteria and Certification Systems for Biomass Production" Final Report, February 2008
http://ec.europa.eu/energy/res/sectors/doc/bioenergy/sustainability_criteria_and_certification_systems.pdf
http://ec.europa.eu/energy/res/legislation/biofuels_sustainability_criteria_en.htm

4.2.8. Renewable Transport Fuel Obligation and the Gallagher Review (UK)

The U.K.'s Renewable Transport Fuel Obligation (RTFO)[32] was introduced in 2005 with the intent to ensure inclusion of biofuels and other renewable fuels in the U.K. fuel mix, providing that producers report the GHG balance and environmental impact of their biofuels. It is one of the most advanced initiatives to develop operational standards for biofuels. Reporting guidelines for biofuels sustainability benchmark criteria for qualifying standards of sustainability against the following "meta-standards":

- Biomass production will not destroy or damage large above or below ground carbon stocks.
- Biomass production will not lead to the destruction of or damage to high biodiversity areas.
- Biomass production does not lead to soil degradation.
- Biomass production does not lead to the contamination or depletion of water resources.
- Biomass production does not lead to air pollution.
- Biomass production does not adversely affect worker's rights and working relationships.
- Biomass production does not adversely affect existing land rights and community relations.

Seeking for scientific evidence to underpin biofuel targets and support policies - including in particular proposed EU targets for future biofuel consumption - The UK Government has commissioned in 2007 a review of work on the environmental sustainability of international biofuels production and use. An initial report was issued in July 2008, with outcomes of stakeholder consultation, literature review and workshops. Led by the Professor Ed Gallagher, Chairman of the UK's Renewable Fuels Agency (RFA) the work was intended to draw upon knowledge and expertise globally. Several studies were commissioned for the Report and their findings were presented to a stakeholder workshop and to a group of energy and science counsellors from the embassies of several countries at the Foreign and Commonwealth Office. These workshops would provide an opportunity for a wide range of views to be heard. This review of the fast-emerging new evidence of displacement effects of biofuels on land-use and impacts upon GHG-savings intended to focus on recent evidence on the indirect or "displacement" impacts of biofuel production, both within the EU and internationally, and evaluate, for current and future demand and production scenarios: (i) the extent to which the production of biofuel feedstocks leads to land-conversion and (ii) GHG-emissions arising from changes in land-use change and cultivation practices. The period considered was from present to 2020, quantifying the extent to which the demand for biofuels is likely to pressure on available land resources and in international food commodity prices. Also, it was proposed to consider the extent to which these impacts would be reduced if advanced biofuel technologies became commercially viable in the medium term.

[32] UK DfT (2007). UK Renewable Transport Fuels Obligation. United Kingdom Department for Transport website, http://www.dft.gov.uk/pgr/roads/environment/rtfo/

The Gallagher Report concludes that[33]:

- there is a future for a sustainable biofuels industry but that feedstock production must avoid agricultural land that would otherwise be used for food production
- the displacement of existing agricultural production, due to biofuel demand, is accelerating land-use change and, if left unchecked, will reduce biodiversity and may even cause greenhouse gas emissions rather than savings;
- the introduction of biofuels should be significantly slowed until adequate controls to address displacement effects are implemented and are demonstrated to be effective
- a slowdown will also reduce the impact of biofuels on food commodity prices, notably oil seeds, which have a detrimental effect upon the poorest people;
- however, there is probably sufficient land for food, feed and biofuels to meet the demand by 2020; better datasets for land use will become available later in 2008 and should help further to inform this question;
- the long-term potential of bioenergy using land suited for agricultural production beyond 2020 requires further consideration;
- biofuels production must target idle and marginal land and use of wastes and residues, reducing as much as possible net greenhouse gas emissions and loss of biodiversity through habitat destruction – including effects arising from the conversion of grassland for cropland;
- specific incentives must stimulate market penetration of advanced technology, which are today immature and expensive; some feedstocks for advanced technologies have the potential to induce more indirect land-use change;
- biofuels contribute to rising food prices that adversely affect **the poorest**, notably for oil seeds, but the scale of effects is complex and uncertain to model; shorter-term effects on the poor are likely to be significantly greater and require interventions by governments for alleviation;
- there is some potential for the poor to benefit from biofuel production in some areas where land is available and the necessary infrastructural investment is forthcoming;
- stronger, enforced global policies are needed to prevent deforestation and lower targets for biofuels will reduce pressure for land change and on food price increases
- biofuels are only part of the problem causing damaging land-use change and the measures proposed can therefore only form part of the solution;
- a genuinely sustainable industry is possible, provided that robust, comprehensive and mandatory sustainability standards are developed and implemented;
- a framework for such policies is proposed, but significant challenges remain in the detailed design, implementation and enforcement; these are complex and will take time to overcome;
- if all subsidies and other support for biofuels were removed entirely, this would reduce the capacity of the industry to respond to the challenges of transforming its supply chain and investing in advanced technologies;
- even so, the rate of introduction of biofuels should be slowed until adequate controls are established.

The Report proposes that:

[33] RFA (2008) The Gallagher Review of the indirect effects of biofuels production. UK's Renewable Fuels Agency, July

- the current UK´s Renewable Transport Fuel Obligation (RTFO) target for 2008/09 (2.5% by volume) should be retained, but the proposed rate of increase in biofuels be reduced to 0.5% (by volume) per annum rising to a maximum of 5% by volume by 2013/14, instead of the RTFO's current target trajectory of 5% by 2010
- the RTFO is further reviewed in 2011/12 to complement and coincide with the 2011/12 EU review of member states' progress on biofuels targets
- during the period to 2011/12, comprehensive, mandatory sustainability criteria within the EU Renewable Energy Directive should be implemented for biofuels and bio-energy, including requiring feedstock that avoids indirect land-use change.
- both at EU and UK levels, targets higher than 5% by volume (4% by energy) should only be implemented beyond 2013/14 if biofuels are shown to be demonstrably sustainable (including avoiding indirect land-use change)
- if the industry fails to deliver demonstrably sustainable biofuels by 2013/14 the level of the target could also be reduced for subsequent years
- part of the growth beyond 2020 would arise from the proposed new obligation for feedstock to be used by advanced technologies, to be implemented in 2015/16 and rise to 1-2% by 2020.
- the immediate focus for policy should be on implementing the necessary controls and conditions that will enable the industry to develop sustainably;
- based on judgement, targets for renewable transport fuels should be between 5% and 8% (by energy) for the EU for 2020 (including 1-2% from advanced technologies);
- only in the event that sufficient controls are enforced globally and new evidence provides further confidence, a higher aspirational trajectory starting in 2016 and rising to 10% by energy in 2020 could be possible; the proposed EU Fuel Quality Directive should not imply a higher level of biofuels, or faster rate of introduction, than that indicated by this review.
- a replacement of volume or energy based targets with comparable greenhouse gas saving targets as soon as practicable to incentivise the supply of fuels with a lower carbon intensity (although the same report recognizes that current greenhouse gas lifecycle analysis fails to take account of either indirect land change or avoided land use from co-products);

Such conclusions are very strong and objective – although in some cases based on weak premises and unbalanced references:

- many conclusions taken from the case of U.S. corn ethanol were extrapolated to other cultures
- the only reference taken from Brazil, producer of nearly half of the global biofuels and with extensive academic bibliography, was written by a sole author (Volpi[34])
- some other papers were rather overweighed - the case of Fehrenbach et al[35] , Searchinger et al[36] and Plevin et al[37] on indirect emissions based on scenarios;

[34] Volpi G (2008) *Brazilian case study for RFA review of indirect effects of biofuels*, submission to the RFA review on Indirect effects of biofuels, published on RFA website http://www.renewablefuelsagency.org, Renewable Fuels Agency

- many inputs were not considered, for example those proposed at workshop held in the Sao Paulo (when were extensively discussed the findings and scenarios of Fehrenbach´s work).

4.2.9. The Commission Cramer Report (Netherlands)

Concerns from social organizations about macro effects of large scale biofuel producing put a special responsibility with the Dutch government to undertake action. If the negative effects prove to be too great, the Dutch government – and not an individual company– can exert its influence to talk with these local authorities about responsible land use. If the producing country should not comply with this, the Netherlands, whether on an EU level or not, can consider discouraging the use of biomass from that country.

The Commission Cramer Report[38] was chaired by Prof. Dr. Jacqueline Cramer , now the responsible minister in Holland. It aims to advise criteria that indicate whether biomass has been produced in a sustainable and responsible manner. On this basis was drawn up a framework for the testing of the sustainability of biomass production. This testing framework puts the emphasis on biomass for electricity and heat production and as transportation fuel, but the framework can also be applied to biomass as raw material in chemistry. The framework is applicable to biomass of all origins, so coming from the Netherlands, from the EU or from outside the EU. Where possible was made use of existing standards for specific biomass flows, seeking to achieve maximum consistency with similar initiatives and to improve the desired framework´s practical feasibility, e.g. in verification and enforcement. Six relevant themes define the sustainability of large-scale production of biomass. For each of the themes criteria are formulated, in order to guide certification of producers (similarly to the Forest Stewardship Council – FSC - for wood). Criteria and indicators are applicable to the whole chain inclusive of the end use - and not only to the production. The report recognizes that sometimes it is (still) impossible to use quantitative indicators as yardsticks. In these cases the advice confines itself to the requirement of reporting on a certain aspect of a theme, such as on the local prosperity effects of the large-scale production of biomass. On the basis of such a report the government will gain an insight into the sustainability of biomass with regard to this theme.

---

[35] Fehrenbach, H., Fritsche, U., Giegrich, J. (2008) Greenhouse Gas Balances for Biomass: Issues for further discussion Issue paper for the informal workshop, January 25, 2008 in Brussels www.oeko.de/service/bio/dateien/en/ghg_balance_bioenergy.pdf

[36] Searchinger, R. Heimlich, R.A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, T. Yu, (2008) Use of U.S. Croplands for Biofuels Increased Greenhouse Gases Through Land-use change, Science Express (Feb. 7, 2008)

[37] Plevin R, Jones A & O'Hare M, (2008), Uncertainty analysis of land-use change carbon releases, EEA Expert Meeting, Copenhagen

[38] http://www.mvo.nl/biobrandstoffen/download/070427-Cramer-FinalReport_EN.pdf

Table 7. The Commission Cramer´s criteria

Greenhouse gas emissions	savings on emissions by the use of biomass, calculated for a specific producer from the source to use and in comparison to fossil fuels	Calculated over the whole chain, the use of biomass must produce fewer emissions of greenhouse gases net than on average with fossil fuel. Minimum requirements: for electricity production the emission reduction must now amount to at least 50-70%; for the application in transportation fuels at least 30%; these percentages must increase further by innovation in the future. Desirable to achieve, in about ten years' time, at least 80 to 90% emission reduction in relation to the current fossil reference. This aim can be achieved when innovative biofuels are applied and a much more efficient cultivation for the production of energy. Development of new acreage for the planting of biomass for energy must not lead in the longer term to the release of large quantities of carbon that had been stored there (in soil or vegetation).
Competition with food and other local applications	if the production of biomass pushes other use of the available land aside, such as the production of food or wood as building material - and what are the consequences	Production of biomass for energy must not endanger the food supply and other local applications, such as for medicines or building materials. Criteria for this have not been determined yet; reporting on changes in land use in the region and in prices for food and land is of great importance here.
Biodiversity	if the local ecological system of land and water lose variation by the mass cultivation of crops for fuel	Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity. Often local laws and regulations have already been grafted on international agreements about biodiversity. Vulnerable areas and areas with a high value for biodiversity must be spared, where possible restoration of biodiversity is desirable.
Environment	effects of the use of pesticides and fertilizer, as well as the other effects on the earth	In the production and processing of biomass, the quality of soil, surface and ground water and air must be retained or even increased. This makes demands, for example, on the use of fertilizers and pesticides, but it also requires the application of the 'best practices' for instance to prevent erosion or additional emission of harmful substances.
Wealth	if the production of biomass contributes to the local economy	Production of biomass must contribute towards local prosperity. Criteria for this have not yet been developed. Reports that fit in with descriptions according to the Global Reporting Initiative can indicate if, for instance, the economic value of the biomass production will directly benefit the local community.
Wellbeing	if the production of biomass contributes to the social living conditions of employees and local community	Production of biomass must contribute towards the social well-being of the employees and the local population. The production of biomass must at least comply with international principles that have been laid down by the International Labour Organisation, in the UN Universal Declaration or Human Rights and in other treaties. Reports must also bring to light any violations of property rights or corruption.

These criteria should be tested at the macro level, what has not yet been worked out. The testing framework makes a distinction between two levels where consequences of large-scale production are felt:

- company level: elements like the effect of the use of biomass for the emission reduction of greenhouse gases, conservation of soil quality

and biodiversity, local social impacts, clean production and processing of the biomass. Responsibility for sustainable biomass production lies with the businesses in question;

- authority level: effects that cannot be directly attributed to one company, but are only visible on a national or regional scale, e.g. crowding out of agrarian production, indirect effects due to changes in land use (such as rise of land and food prices, leakages in greenhouse gas emissions, losses of biodiversity, competition with food and local applications of biomass).

Great importance is given to the monitoring of land prices, food prices, property relations, availability of food, relocation of food production and cattle breeding, deforestation and change in the type of vegetation. Such monitoring require cooperation with the producing countries and companies.

Certification of biomass flows is considered the only way to determine the sustainability of global biomass flows properly. Companies would need to to prove with certificates that they are complying with the testing framework. This idea is not generally accepted yet for energy crops, although there are analog systems ongoing – case of the Forest Stewardship Council (FSC) for wood products. The report recommends to keep in line as much as possible with existing systems, which already comply with a large part of the criteria of the testing framework and can lead to a declaration of equivalence. Emission reduction of greenhouse gases by a specific source for biomass does not form a part of any certification system, so this will always have to be tested additionally.

The report suggests to the Dutch Government to follow these macro effects and an evaluation of the minimum requirements in 2010, so that adjustments, if any, can be adopted in 2011. In the years to come it will also be necessary to work further on formulating testable indicators where these are still lacking. For this the reportings will serve as a basis. These indicators can be included in the testing framework in 2011.

4.2.10. Mineral Fuel Tax guidelines on sustainable biofuels - Lauzanne University´s Roundtable on Sustainable Biofuels – RSB (Switzerland)

The Roundtable on Sustainable Biofuels[39] is a stakeholder initiative led by the Swiss EPFL (École Polytechnique Fédérale de Lausanne) Energy Center, seeking to develop simple, generic, adaptable, efficient and as much as possible globally agreed sustainability standards for biofuels. The initiative is published for global stakeholder comment, through a series of meetings, teleconferences and online discussions. Comments were synthesized and discussed in working groups, who made recommendations to the Steering Board, for a second round of stakeholder consultation. Industry members of the Roundtable's Steering Board include companies like BP, Shell and Toyota.

[39] EPFL RSB website http://cgse.epfl.ch/page65660-en.html

The aim is achieving global, multistakeholder consensus around the principles and criteria of sustainable biofuels production[40]. These principles are recognized as highly aspirational, representing an ideal performance of biofuels fulfilled today by very few biofuel supply chains, but showing a long term view to be pursued.

The principles are general and broad tenets of sustainable production, to be followed by criteria – conditions to be met to achieve these tenets, and indicators – elements which enable evaluation as to whether a farm, producer, or company is meeting a particular criterion.

4.2.11. Biomass Sustainability Ordinance – BioNach V (Germany)

There are two requirements established for biofuels in the draft of the "German Biomass Sustainability Ordinance" (BioNachV):

(a) comply with requirements for sustainable cultivation and protection of natural habitats, considering the life-cycle assessment (LCA) method defined in international ISO 14040 and 14044 standards, with comprehensive system boundaries;

(b) have a determined greenhouse gas (GHG)-reduction potential, following the IPCC Guidelines and including land use change in face of the practice used so far.

Although the concept seems to be clear, there are many doubts from the producers about the BioNach V allocation methods and default values to be recommended[41].

4.2.12. The EUGENE Standard

EUGENE[42]**,** an independent network that promotes green electricity labelling, has defined criteria to support possible biomass certification schemes, subdivided in two groups:

- Criteria that can easily become operational and monitored / verified:
    - Eligibility of sources (including e.g. woody, herbaceous and fruit biomass)
    - Requirements on the origin of wood fuel (sustainable forest management, certification for plantations)
    - Use of Genetically Modified Organisms (GMO) is not permitted
    - Energy crops and SRC crops shall not be produced on converted land
    - Emissions of CH4, N2O and NH3 by usage of manure have to be reduced

[40] EPFL (2007) Second version of global principles for sustainable biofuels production, October 23, 2007. Roundtable on Sustainable Biofuels. École Politechnique Fédérale de Lausanne, Energy Center, http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/Home%20Page/RSB-Second%20version%20of%20Principles.pdf

[41] UFOP (2007) Commentary paper on the German Biomass Sustainability Ordinance. Union For the Promotion of Oilseeds and Protein Plants Registered Association http://www.ufop.de/downloads/Commentary_paper_Feb2008(1).pdf

[42] http://www.eugenestandard.org/index.cfm?inc=news&id=32

- In the annual average, the plant need to met an overall efficiency of at least 60%
- Co-firing of solid biomass is permitted under conditions (e.g. required efficiency of 70%)

- Criteria for which further elaboration is needed to become operational:
  - Wood fuel from non-certified forest has to meet a set of criteria
  - Maintenance of soil fertility
  - Biomass from dedicated cultivation on arable land needs to comply with guidelines for integrated crop protection, livestock waste should comply with principles of integrated farming
  - The non-renewable proportion of the energy that is used for extraction, transportation and processing, and also balancing, is not permitted to be greater than 10% of the electricity supplied with the label.

4.2.13. The SENSOR Project for land use

SENSOR[43] is an integrated project in the 6th Framework Research Programme of the European Commission. There are 39 research partners (from 15 European countries, plus China, Brazil, Argentina and Uruguay) developing science based forecasting instruments to support decision making on policies related to land use in European regions. This initiative, however, could be extended to Latin America. The operational criteria is based on:

1. Policy scenarios: criteria are based on global economic and societal trends for a given target year, allowing to formulate and analyse, with respect to their implications on land use sectors, optional policy decisions on land use and rural development.

2. Land use models: simulations of land use changes to reflect possible driving force changes

3. Impact indicators: changes on social, economic and environmental land use functions.

4. Spatial reference framework: social, economic and environmental characteristics integrated towards regional profiles and clusters.

5. Thresholds and targets: expert judgements and participatory tools employed to identify and evaluate sustainability problems, thresholds and targets related to land use impacts.

6. Sensitivity analysis. Critical sustainability issues in sensitive regions such as mountains, coastal zones, islands and post-

[43] SENSOR (2008) Sustainability Impact Assessment: Tools for Environmental, Social Multifunctional Land Use in European Regions http://www.zalf.de/home_ip-sensor/images/final_seite1_2_04-03-2008.pdf

industrialised areas identified and analysed in the light of driving force changes.

7. Data and indicator management. GIS based, GMES/GEO compatible data and indicator management systems developed for land use impact analysis at regional scale.

8. Sustainability Impact Assessment Tools. Above steps transferred into decision support instruments to analyse the impacts of land use policy options on regional sustainability issues.

9. Transferability: approaches to impact assessment adaptable to regions in other continents

It is important to stress that sustainability of land use is contextual and narrows sustainability standards[44].

4.3. Comparing Sustainability Principles

There is a clear need to harmonize criteria and activities, providing basis for a single (or at least fewer) standards and methodologies. A common ground can be found in Table 8, which compares the sustainability principles developed for biofuels in the UK[45], the Netherlands[46] and Switzerland.

An advantage of principles is that they are easier to understand, to apply in the upstream. Not withstanding, they become just an abstract *wishing list* in the downstream, if not accompanied by concrete rules.

Since no existing certification scheme has sufficient coverage to be adopted for biofuel certification, meta-standard approaches were proposed as a basis for the current developments in the application of 'sustainability' assurance for biofuels.

Providing answers on the effectiveness of biofuels in meeting each of these drivers has required the careful and parallel development of policy, the meta-standard methodology and the meaningful interaction of the main stakeholders that are likely to be involved in delivering significant volumes of biofuels into the UK and The Netherlands. The balance of representation in the stakeholder group is an important component of the validity, and therefore public acceptability, of the approach.

---

[44] from the comments of Kristian Borch

[45] Woods and Diaz-Chavez, *op. cit.*. UK's Low Carbon Vehicle Partnership, anticipating the the Renewable Transport Fuels Obligation (RTFO), issued in February 2007.

46 Cramer Commission. Testing framework for sustainable biomass. Final report from the project group 'Sustainable production of biomass.' IPM, March 2007, The Netherlands.
http://www.mvo.nl/biobrandstoffen/download/070427-Cramer-FinalReport_EN.pdf

Table 8. Compared principles applied to biofuels

Topic	UK	Netherlands	Lausanne (Switzerland)
Climate Change and Greenhouse Gases.	**1** Biomass production will not destroy or damage large above or below ground carbon stocks	1 The greenhouse gas balance of the production chain and application of the biomass must be positive. 2 Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.	**3.** Biofuels shall contribute to climate stabilization by reducing GHG emissions as compared to fossil fuels. Emissions shall be estimated via a consistent approach to lifecycle assessment, with system boundaries from "root to tank". This shall include direct and indirect GHG emissions, for instance from fossil energy used in growing, transporting and processing biofuels. It shall also include GHG emissions resulting from land use changes as land is converted to biofuel crop production, or as other production is displaced.
Food security, other biomass uses		3 The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials).	**6.** Biofuel production shall not impair food security.
Biodiversity and Conservation	**2** Biomass production will not lead to the destruction or damage to high biodiversity areas	4 Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity.	**7.** Biofuel production shall not directly or indirectly endanger wildlife species or areas of high conservation value.
Soil	**3** Biomass production does not lead to soil degradation	5 In the production and processing of biomass the soil and the soil quality are retained or improved.	**8.** Biofuel production shall not directly or indirectly degrade or damage soils.
Water	**4** Biomass production does not lead to the contamination or depletion of water sources	6 In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved.	**9.** Biofuel production shall not directly or indirectly contaminate or deplete water resources.
Air	**5** Biomass production does not lead to air pollution	7 In the production and processing of biomass the air quality must be maintained or improved.	**10.** Biofuel production shall not directly or indirectly lead to air pollution.

Table 8 (cont)

Topic	UK	Netherlands	Lausanne (Switzerland)
Socio-economic development		8 The production of biomass must contribute towards local prosperity.	**5.** Biofuel production shall not violate land or water rights, and shall contribute to the social and economic development of local, rural and indigenous peoples and communities
Human and labor rights	**6** Biomass production does adversely effect workers rights and working relationships	9 The production of biomass must contribute towards the social well-being of the employees and the local population	**4.** Biofuel production shall not violate human rights or labor rights, and shall ensure decent work and the well-being of workers..
	7 Biomass production does not adversely affect existing land rights and community relations.	.	
Legality			**1.** Biofuel production shall respect all applicable laws of the country in which they occur, and all international treaties and agreements to which the country is a signatory.
Consultation			**2.** Biofuel projects shall arise through fully transparent, consultative and participatory processes that involve all relevant stakeholders.
Biotechnology			11. If biotechnologies are used in biofuels production, they shall improve the social and/or environmental performance of biofuels, and always be consistent with national and international biosafety and transparency

4.4. Applying Sustainability Principles: Sekab´s Guidelines

The Swedish company SEKAB presents an interesting benchmark on the application of sustainability criteria in the real world.

The company delivers about 90% of all ethanol in Sweden for E85 and ED95 (ethanol for heavy vehicles). Sekab announced in 27 June 2008 that it would buy certified sustainable ethanol from four Brazilian groups, in what the company says is the first deal of its kind. Cosan, Guarani, NovAmerica and Alcoeste will sell 115 million liters of anhydrous ethanol made from sugarcane for import to Sweden. SEKAB said it worked with the Brazilian producers to develop a sustainable and verifiable criteria for the entire lifecycle of the ethanol, taking into consideration environmental, climate and social perspectives. SEKAB said the criteria are in line with demands highlighted in the ongoing processes being led by organisations like the UN, EU, ILO and a number of NGOs. The requirements have zero tolerance for child labour, non-organised working conditions (slave labour) and the destruction of rain forests. There are also requirements concerning working conditions,

labour laws and wages. Harvesting is to be at least 30% mechanised today, increasing to 100% by 2014, and an independent international verification company will audit all production units twice a year to ensure the established criteria are met. Criteria will gradually be developed over the coming years and synchronised with international regulations when these are in place[47].

Sekab announced its requirements for sustainable ethanol: "what we are doing now has not been done before. It should therefore be regarded as an initial step on which to build. Further criteria can be added later, the scope can be broadened and the requirements of the criteria can be increased." Criteria are the following:

Table 9. Sekab´s criteria for sustainable ethanol[48]

At least 85 % reduction in fossil carbon dioxide compared with petrol, from a well to-wheel perspective	Field-to-wheel perspective, including cultivation, production, transportation and total CO2 emissions from Brazil to Sweden. Calculations according to the UK RTFO principles. Fossil inputs include fertilizers, pesticides, fossil energy. Renewable output includes ethanol, energy (steam, electricity)
At least 30 % mechanisation of the harvest now, plus a planned increase in the degree of mechanisation to 100 %	Benefits of mechanized harvesting include lower local particle emissions, better work environment, improved reduction of CO2. Disadvantages are risk of unemployment. Around 30 % of mechanized harvest will be in first year, but there is an implementation plan for 100% mechanization.
Zero tolerance for felling of rain forest	No deforestation of rainforest is permitted. Deforestation of other forests should be according to national laws, with permits required and if cut down 1 tree, should replant 25 new. Must preserve biodiversity and take into account land use change.
Zero tolerance for child labour	Banned child labor below 16 years of age, defined according to Brazilian law. Apprentice from 14 years of age. In compliance with article 1 and 2 in ILO convention 138.
Rights and safety measures for all employees in accordance with UN guidelines	Zero tolerance to forced labor ("slave labor"). Workers have right to organize in unions etc. All employees must be registered and paid at least minimum wages. Health & safety policies shall be in place and followed
Ecological consideration in accordance with UNICAs environmental initiative (i.e., São Paulo State Agro-environmental Protocol, Green Ethanol Program)	Guidelines of the Sao Paulo Protocol: • Protection of forests close to water areas • Protection of water resources • Program for reuse of water in industrial processes and for conservation of water quality • Implementation plan for soil conservation Plan for reduction of environmental impacts from production
Continuous monitoring that the criteria are being met	Monitoring and verification of the criteria's shall be done through audits by an independent third party. Cases of non compliance are: (i) Observation: suggestions of improvement; (ii) Minor Non Compliance shall be corrected within 3 months; (iii) Major Non Compliance requires that a plan for mitigation shall be submitted within 14 days, plus always followed by an extra audit. There should be full traceability of all physical flows

[47] Sustainable Business.com (2008) http://www.sustainablebusiness.com/index.cfm/go/news.printerfriendly/id/16298

[48] http://www.sustainableethanolinitiative.com/default.asp?id=1173

4.3. Conclusions

A selection of sustainable assessment tools was examined and compared for the depth and transparency with which environmental, economic and social key issues are addressed by application to best-practice examples of biofuels production in Latin America. There are several aspects to cover when brainstorming the sustainability of biofuels. Some to mention are:

- investment in science and research, technological development and supply
- production costs
- sustained economic growth, macroeconomic impacts, local development and income distribution
- public health, food security
- social well-being and equity, community engagement, safety and amenity of the public environment, community services, cultural heritage, gender issues, social inclusion
- job opportunities, labour rights, quality of jobs
- land use, land tenure rights
- effects on energy matrix (renewable and non-renewable energy consumption)
- total emission of greenhouse gases, application of fertilizer and pesticides, water and soil conservation, biodiversity issues, atmospheric emissions (both in agricultural and industrial phases), liquid emissions, solid residues
- water consumption and resource competition
- infrastructure, investments

There are many desirable issues to have in an assessment, e.g. policy scenarios, land use models, impact indicators, spatial references for regional profiles and clusters, thresholds and targets, sensitivity analysis, data and indicator management, sustainability impact assessment tools and transferability.

However, assessments can be endless and it´s necessary to draw lines beyond which these are considered acceptable. Practical experience shows that requiring such topics in a licensing process causes unnecessary delays and the Environmental Impact Assessment work looks more like an academic thesis.

Analysis should be made focusing a determined region and culture (e.g. sugarcane in Sao Paulo, Brazil), not in individual projects. It is important also to stress that some developments are fast (e.g. mechanized harvesting) and soon assessments are outdated, possibly creating hurdles to alternatives to the business-as-usual fossil economy. The kind of analysis from this work is aimed at the regional/country level and not as part of the EIA of individual projetcs. In fact, this is precisely what gives relevance to these issues, since they offer an overall picture that complements more specific aspects at lower levels. It also means that they are beyond the scope a certification scheme for specific enterprises and should be assessed by other sustainability tools and actors.

This chapter has presented several ongoing initiatives. One of these, from the Swedish Sekab, possibly shows a reasonable path to follow, based on a constructive process and considering real-world economic transactions.