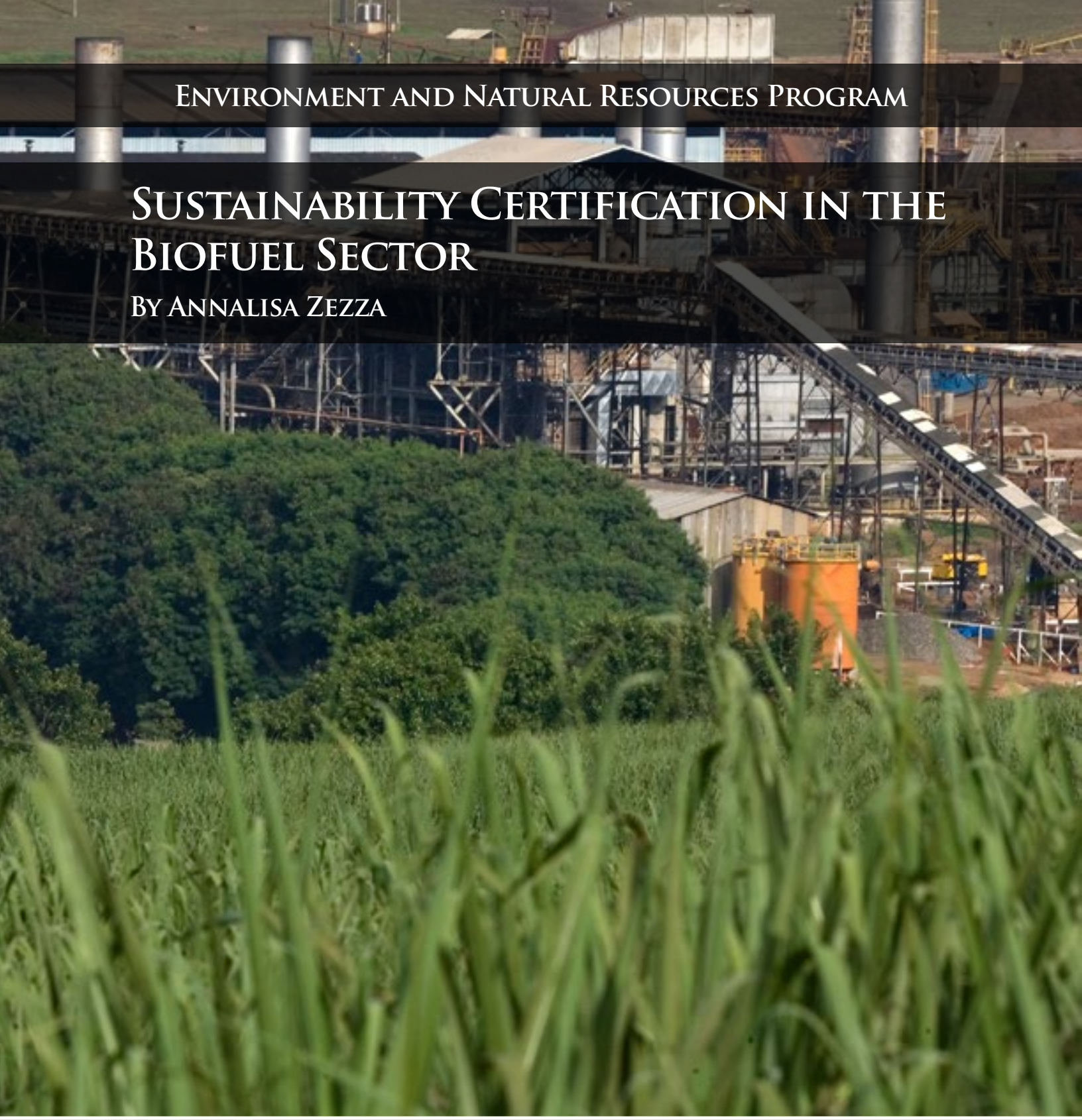
Environment and Natural Resources Program

Sustainability Certification in the Biofuel Sector

By Annalisa Zezza



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Executive Summary

The European Union (EU) and the United States have adopted aggressive programs to promote the greater use of biofuels. One of the goals is to reduce carbon emissions by replacing gasoline with low carbon fuels. Individual EU countries have adopted certification programs to ensure that imported biofuel meets its goals for lower carbon emissions as well as broader goals of enhancing the sustainable use of natural resources. This paper assesses how these certificate programs have affected biofuel production in one developing country – Brazil – and identifies some of the lessons learned in designing future certification programs.

Certification programs have been used in many industries, such as timber and fishing to influence the manner in which these commodities are produced. When global supply chains exist, such programs can improve the environmental and social impacts of production and promote better practices along the entire supply chain. The success of these programs relies on their ability to build trust between the participants along the chain, since one link easily observes the action of the others. Third party certification programs – which rely on non-corporate governing bodies and involve NGOs – can create greater levels of trust given their independence and, in many cases, their legitimacy.

The report challenges the idea of the central importance of market benefits as the driving force behind private regimes for environmental and social governance. Sustainability certification is seen as a polycentric institution that facilitates interactions between many actors, and where the involvement of large scale purchasers and of environmental and social NGO's are essential supplements to government institutions in setting and enforcing the legal framework.

Results confirm this assumption. Many factors affect the effectiveness of certification processes including the governance structure of the partnerships, the demand for certified production, the legislation and policy in place, the level of enforcement, land tenure and ownership patterns and, finally, the structure of the industry.

Main evidences from the study show that:

- The European regime on sustainable biofuels has contributed to advancing the process toward sustainability in Brazil by creating a favorable environment for policy reforms and company consolidation, but it has not delivered its full potential because of two main factors: the size of competing markets and the limitations due to the Directive's definition of sustainability.
- Responding to pressures from buyers, Brazilian sugarcane producers have made considerable efforts to defend their reputation as a sustainable industry. Most of the certified mills belong to export-oriented, vertically-integrated companies that use certification in order to respond to the requirements of multinational buyers operating in sensitive markets. The demand for certified sugarcane in Brazil derives primarily from large-scale sugar buyers.
- The first Brazilian mills to comply with certification protocols are usually characterized by an already-existing high level of compliance with social and environmental regulations.
- Although demand for certified sugarcane is growing, the development of environmentally-sensitive markets is still insufficient to promote certification on a large scale. Additional

demand could derive from the growth of new industries such as green chemistry.

- The size of the market would benefit from the removal of existing trade barriers, especially in the EU, and this would contribute to enhancing sustainability.
- The "Bonsucro" certification partnership has acted in Brazil as an important forum for consensus formation between actors. In order to facilitate compliance the industry and NGO's have collaborated in offering technical and financial assistance to producers.
- Increasing economies of scale and land concentration have meant that to date the benefits of sugarcane ethanol production for small landowners have been limited, and large farmers and industrialists have benefited more from the industry's expansion.
- Balancing growth and sustainability still faces a number of challenges. These concerns include soil degradation, erosion and compaction, and social impacts such as the distribution of benefits among the various actors in the supply chain.
- The omission of social sustainability concerns from the EU RED may lower the bar on sustainability rather than complement the commercial and civil society actors that are demanding voluntary sustainability certifications.

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INTRODUCTION

The European Union (EU) and the United States have adopted aggressive programs to promote the greater use of biofuels. One of their goals is to reduce carbon emissions by replacing gasoline with low carbon fuels. Individual EU countries have adopted certification programs to ensure that imported biofuel meet both its goals for lower carbon emissions, as well as its broader goals of enhancing the sustainable use of natural resources. This paper assesses how these certificate programs have affected biofuel production in one developing country - Brazil - and identifies some of the lessons learned in designing future certification programs.

Certification programs have been used in many industries, such as timber and fishing to influence the manner in which these commodities are produced. When global supply chains exist, such programs can improve the environmental and social impacts of production and promote better practices along the entire supply chain. The success of these programs relies on their ability to build trust between the participants along the chain, since one link easily observes the action of the others. Third party certification programs – which rely on non-corporate governing bodies and involve NGOs – can create greater levels of trust given their independence and, in many cases, their legitimacy.

Certification can be considered a hybrid system of governance between private corporations and representatives of civil society (Pattberg, 2005). Voluntary standards and certification initiatives are building a system of hybrid transnational governance where the regulatory power does not derive from the State. The success of these schemes relies, instead, on the ability of private agents to build trust between actors whose actions cannot be directly observed because of their distance or other information asymmetries and consumers. Often the success of this trust results in market benefits such as price premium or better market access.

There are four types of certification. First-party certifications represent forms of internal corporate self-regulation. Second-party certifications involve industry associations which establish standards and verify compliance. These efforts enhance the rigor and the transparency of first party certification, but in both cases there are legitimacy concerns given the self-interested nature of the initiatives. Third-party certifications rely on non-corporate governing bodies. They are characterized by participatory structures that usually involve NGO's. Given their corporate independence, these systems have the greatest legitimacy (Raynolds et al., 2007). NGO's involved in third-party certifications can be nature conservation organizations, such as Rainforest Alliance, Conservation International or WWF, and development organization such as Oxfam or Solidaridad. When governments or multilateral agencies coordinate such initiatives, they are classified as fourth-party certifications.

Commodities are increasingly evaluated by process standards that relate to the environmental and social conditions under which they are produced or traded. Since buyers or consumers cannot directly verify process standards, certification and labels are used to validate compliance and to provide

information. Voluntary certification schemes for timber, coffee, fisheries, and recently for biofuel feedstock, are examples of this pattern. When global supply chains exist, certification schemes embed quality attributes in commodity production and promote connectivity between producers and consumers. Such schemes facilitate communication among different actors and with final users, from the local community level to the higher levels of social and political organizations. It may thus generate closer cooperation in the management of supply chains and of common resources. The institutional structure of certification partnerships can facilitate learning within the organization as a result of processes of self-evaluation and organizational restructuring and through the creation of inter-organizational networks (Pattberg, 2005).

But how realistic is it to rely on this response to the challenge of governance at a global level? Certification programs are not 'panaceas' because their outcome depends upon the interaction of several variables, internal and external to the regulated supply chain, which affect the action of the actors involved in the governance system. Identifying these factors can help in predicting the likely success of a certification programs, evaluate its realistic potential, and provide insights useful for designing such schemes in the future.

In order to answer these questions a case study was carried out to assess how international markets, national policies, and local factors interact to induce Brazilian sugar cane farmers and biofuel producers to adopt sustainable production practices as defined in certification schemes adopted by EU member countries. The case study was conducted in the state of Sao Paulo and involved semi-structured interviews with key stakeholders, NGOs, government and external experts. It was complemented with an extensive literature review and visits to sugarcane mills that had achieved certification.

Biofuel sustainability certification processes are adopted to regulate the impact of biofuel production on GHG emissions and on the sustainable use of natural resources. A large share of the world's agriculture and other natural resources based production is located in developing countries and exported to developed countries. Examples are the coffee industry where almost all world's coffee is produced in tropical regions while worlds' wealthiest economies accounts for more than 80% of total imports; fisheries where nearly two-thirds of world's production comes from developing countries who export 77% of their production (in value) to developed country or forestry where nearly three-quarters of world's import comes from tropical countries and it is directed towards North America and Europe. Sustainability certification has arisen together with increasing concerns about the impact of large-scale production. These concerns mainly focus on the efficiency in mitigating greenhouse gas emissions, on the one hand, and other environmental and social issues linked to the change in land use, such as the clearing of forests and food security, on the other. Further concerns include labor goals such as compliance with International Labor Organization (ILO) standards on minimum wage or child labor, and land rights. Land rights can be affected through acquisition of land by biofuel investors or by restricting existing local land rights. For example the certification process adopted by Forest Stewardship Council (FSC) strongly emphasizes the rights of indigenous people and forest communities.

As in other industries like forestry, fishing and coffee, voluntary standards have emerged in response to public policy failure to negotiate multilateral agreements.[1] Inter-governmental organizations, NGOs, and other public or private stakeholders are participating in various international initiatives on sustainable biofuels or biofuels feedstock.

1 Efforts to achieve a multilateral agreement on a binding global forest convection failed by leading countries defending their national sovereignty failed at the 1992 Rio Earth Summit. Since then forestry governance has proceeded on two main paths, national forest certification schemes that can be endorsed by the Programme for the Endorsement of Forest Certification (PEFC) or, alternatively, the Forest Stewardship Program (FSC). Analogously the International Coffee Agreement (ICA) broke down in 1989 followed by deep restructuring in the supply chain with higher power in the hands of consuming countries-based operators and lower and more volatile coffee prices. After coffee price crashing in real terms in December 2001, by the lower level in the previous 100 years as a result of oversupply, small specialty roasting companies pioneered the introduction of Organic and Fair Trade coffees in the US and helped the specialty coffee market become the most active space for eco-labelling in the food sector (Bacon, 2008).

THE EUROPEAN UNION BIOFUEL CERTIFICATION REGIME

The EU Renewable Energy Directive (RED)[2] is a clear example of the Commission's use of market access to drive improvements in global environmental governance through raising the environmental standards of its trading partners. Considering the EU biofuel market as a politically instituted market – given that it would not exist without extensive policy interventions such as mandatory blending and subsidies – the EU biofuels sustainability regulation seeks to ensure that biofuels use in the international market results in reduced GHG emissions and does not have adverse environmental impacts. The European Union sets a mandatory national target of 20 percent of a country's gross final consumption of energy in 2020 be achieved through renewable sources. At the same time, each member state is required to ensure that the share of energy from renewable sources used in all forms of transport in 2020 is at least 10 percent.

Irrespective of the provenance of the raw materials, energy from biofuels will be taken into account when measuring compliance with national targets. Biodiesel and ethanol will only be eligible for financial support provided by member states, if it fulfills the sustainability criteria set by the RED. These criteria include GHG emission savings (estimated through life cycle analysis) from the production and use of biofuels, which should be at least 35 percent less than the corresponding emissions from the fossil fuels that they displace. In addition, biofuels should not be made from raw material grown on land with a high biodiversity value or with a large carbon stock. The European Union does not directly verify compliance, but relies on private voluntary schemes consistent with its own standard. These schemes must be transparent and developed independent of the industry. The EU approach creates a transnational governance regime that includes states, non-governmental organizations and businesses in a hybrid regulatory model combining elements of private certification and public authority (Lin, 2011).

While this approach has some positive features, such as compatibility with WTO rules, it raises serious concerns about the legitimacy of the private standard schemes that are recognized. Potential rent seeking behavior by those implementing a certification scheme can undermine the capacity of such schemes to pursue credible standards. The relationship between the EC and biofuel producers who adopt voluntary sustainability standards is similar to the principal agent framework developed within delegation theory. Delegation is defined as a conditional grant of authority by a principal to an agent that empowers the latter to act on behalf of the former (Hawkins et al., 2006). Typical command-and-control regulation becomes less operative when regulatory goals are complex and specific rules cannot reflect the large number of variables involved in achieving a regulatory goal. When regulatory requirements are established, a firm can either comply or fail to do so. In this case outcomes are easy to monitor and to enforce (Bamberger, 2006). When the regulatory task involves monitoring and verifying complex and highly technical processes, specific rules cannot reproduce multifaceted regulatory goals and thus

2 Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

national regulatory processes become much less effective. To deal with these issues, national governments are willing to explore alternatives. There are several reasons why a government may choose to delegate regulatory responsibility: it can use the expertise that agents possess without incurring the costs of developing the expertise itself; it can rely on the potential higher efficiency of private actors in carrying out governance; and it can benefit from the lower costs of cooperation by facilitating collective decision-making.

In the case of biofuel sustainability standards, the need for the European Commission to delegate authority to external operators arises from the technical complexity of setting uniform rules, the difficulty and cost of monitoring the internal behavior of suppliers, and WTO compatibility concerns. Bioenergy can be produced from a large variety of feedstocks, and the number of market actors that have to be consulted is large. This production system demands a governance system that is broad in scope and stringent in ensuring compliance with the standards. Because bio-energy can be produced and traded anywhere in the world, trading patterns may become extremely complicated. Many differentiated standards may be required in order to accommodate the varying and unique ecological and socio-economic conditions of producing countries.

There are two levels of delegation in the EU biofuel regulatory regime: the first is from the Commission to the partnerships[3] engaged in recognized schemes such as Bonsucro, Roundtable on Sustainable Soy (RTRS) or Greenenergy among others[4]; the second is from these partnerships to third-party auditors. The approach of delegating from the state to private parties is gaining ground particularly in the field of environmental protection and food safety, where regulators have enlisted the expertise and judgment of regulated parties (Coglianese and Lazer, 2003). These management-based strategies are attempts to require or encourage firms to use practices in ways that align their actions and outcomes with broader social objectives. Specifically, regulators can mandate that private firms adopt internal assessment procedures, constraining their behavior during the production process. This approach can be especially useful when dealing with imported goods for which direct production regulation is not possible because of the goods produced in foreign countries. For example USDA uses a management-based strategy to improve the safety of juice, seafood, and meat by requiring firms to implement a system called Hazards Analysis and Critical Control Point (HAACP) to identify and control pathogens.

In other cases, companies require that suppliers become certified by an environmental management system standard such as ISO 14001. They find this strategy less costly and more efficient than developing their own standards. Adopting standards produced by NGOs or other multi-stakeholder initiatives, firms might gain access to lucrative new niche markets and create consensus on their actions (Daviron, Vagneron 2011). Creating or participating in voluntary certification schemes might also be seen by

3 Partnerships are collaborative arrangements in which actors from two or more spheres of society are involves in a non-hierarchical process through which these actors strive for a sustainability goal (Glasbergen et al., 2007). NGO's are normally involved in third party certifications that, generally, are characterized by clear standards, participatory structure and credible verification systems.

4 Since July 2011, the EC has recognised 12 voluntary schemes.

industries as a mean to avoid the development of new environmental or labor laws and to avoid stringent and sometimes contradictory regulations between different countries.

The efficiency of the delegation approach is reduced by agents' rent seeking behavior. Rent seeking occurs when the agent pursues his own interests because of large asymmetries of information between the agent and the principal. The principal can minimize the risks from such asymmetry and rent seeking behavior by two different means:

1. By withdrawing the grant of authority to the agent at any time, if the agent's behavior diverges from the principal's preferences and objectives. A certification scheme should maintain its moral and pragmatic legitimacy[5]. Moral legitimacy depends upon several factors as corporate independence, presence of participatory structures, clear standards and credible verification systems. The development and implementation of the standards must include all stakeholders and the process must be transparent. These elements are essential if the standards are to be recognized as legitimate and match external expectations.
2. The credibility of a certification scheme can be undermined by potential conflicts of interest. For example, the Marine Stewardship Council (MSC) has gone through a revision of its governance structure after having been criticized for the dominant position of Unilever on the council. The presence of NGOs is considered necessary, but not sufficient to establish and maintain the effectiveness and legitimacy of a certification scheme. For example, between major coffee certifications only Organic and Fair Trade are found to integrate systematically consumer and producer representatives in their coordinating bodies (Raynolds, 2003). Credible standards must be based on sound scientific knowledge in order to measure progress towards the goals of the program. Assessments can be run on a performance basis when the resource itself, such as a forest or a fishery, is evaluated as it is for FSC or MSC. Alternatively, it can be based on system-based standards where management system elements are evaluated, as in the case of more generic environmental management systems standards as ISO 14001. In the case of biofuels, many indicators – from GHG emissions to indirect land use changes (ILUC) are based on model estimations, which are sensitive to data, assumptions and methods of calculations. Assessment can be difficult to achieve in natural resource systems were large geographic areas are involved and the number of participants is relatively small. For example, monitoring is extremely difficult for fisheries because of issues such as the non selective nature of many fishery harvest techniques, the inability to observe non-compliance and the presence of multiple access rights to shared fish resources that often are also migratory (Kaiser, Joes, 2005). Pragmatic legitimacy requires that the benefits of participating in a scheme outweigh the costs, since firms make decisions on whether to accept certification on the basis of their self-interest. Benefits derive mainly from

5 As in Cashore et al. (2002), *moral legitimacy* reflects a ''positive normative evaluation of the organization and its activities. It rests not on judgments about whether a given activity promotes the goals of the evaluator, but rather on judgments about whether the activity is 'the right thing to do...'' while *pragmatic legitimacy* rests on the 'self-interested calculations of an organization's most immediate audiences', in which the material 'well being' of the legitimacy grantor is enhanced" (Suchman, 1995).

increased product prices, better market access and the defense of market shares, while the costs of compliance are represented by certification costs[6] (direct costs) and other additional costs as increased labor costs, reduction of yields, (indirect costs) linked to compliance with the standard[7].

3. Certification schemes can set detailed rules that prescribe the agent's action (rule-based delegation) or they lay down broad principles and allow the agent to decide on the details. The former option requires the development of significant expertise and introduces inflexibility into the system. The latter option requires accountability mechanisms with which to control the discretionary power of the agent. Indeed, when regulators attempt to reflect an uncertain context by writing precise regulations, the ensuing proliferation of rules leads to uncertain and inconsistent application (Bamberger, 2006).

In regard to this framework, there are two questions that this paper seeks to answer in the context of the case of Brazilian ethanol:

- Are the broad principles – as they are defined in the EU directive – consistent with the policy objective of pursuing the sustainable development of biofuel production in exporting countries?
- Are private certification mechanisms effective in pursuing sustainable biofuel production in those countries?

These questions will be answered in the remainder of the paper.

6 According to interviews, certification costs are paid by the mills and are considered quite high as in the first years up to five visits from the auditor might be needed.

7 Relatively few systematic studies have been carried out on the indirect costs of certification and much of the available information is anecdotal. First-year costs tend to represent at least about 50% of the total costs related to forest certification. Thereafter, the costs are usually relatively stable over the rest of the 5-year period, from about 4 to 15 % of the total costs. The direct costs represent from 8 to 41% of the total costs.

IMPLICATION OF THE DEFINITION OF SUSTAINABILITY IN THE EU RED FOR BRAZIL

In order to answer the first question, we briefly analyze the EU's RED requirements that must be taken into account to comply with the renewable energy obligations and remain eligible for financial support by member states. These criteria concern two main points:

- Reduced greenhouse gas emissions;
- Protection of lands with a high biodiversity value, a large carbon stock, or a high percentage of peat.

The greenhouse gas savings criterion does not raise problems for Brazilian ethanol, which is given a default value of GHG saving of 71%. This value exceeds both the actual request of 35% minimum savings and the 60% level that will apply to facilities that start production in 2017 or later. It should be noted that all sugarcane mills and distilleries in Brazil are self-sufficient in electricity because processing plants generate their power from bagasse, which is the cellulosic residue left after sugarcane is crushed. In many case the surplus energy produced is sold to distribution grids, allowing for the substitution of clean power for more carbon-intensive electricity. Sugarcane residues may become one of the main feedstock options when the biochemical conversion of ligno-cellulosic materials into ethanol will become an important alternative to the present conventional steam cycles option (Seabra and Macedo, 2011).

With regard to the second point, the EU directive identifies three types of land as having a high biodiversity value:

- Primary forest and other wooded land with native species;
- Land designated for the protection of nature;
- Highly biodiverse grassland, with a distinction between natural and non-natural grassland.

The directive defines lands with high carbon stocks and peatlands and leaves the task of defining "natural grassland" to future regulatory action by the Commission, which has initiated a public consultation with stakeholders and experts on this definition. [8]

Within this context, the Brazilian authorities and stakeholders have strongly opposed the EU approach to defining grassland on the grounds that it lacks clear scientific evidence and international agreement. The main criticism of the definition concerns the unclear boundary between grassland and forest ecosystem, especially savannas, and the fact that many areas with limited human intervention would not be considered natural. On the contrary, in Brazil, an area with native grasses is considered natural grassland even if there are cattle grazing on it. Moreover, natural and non-natural grasslands are difficult to distinguish, since mixed grasses grow throughout the country. The identification of highly biodiverse

8 http://ec.europa.eu/energy/renewables/consultations/2010_02_08_biodiverse_grassland_en.htm

grassland would be very difficult in countries like Brazil where huge territories are used to graze animals and the mere presence of human activity on an area of grassland should not be used as a proxy for determining whether a specific grassland is natural or non-natural (Bowyer, 2010).

Indeed the EU, rather than limiting its role to setting general goals concerning biodiversity and land conservation, furnishes a detailed definition of highly biodiverse grassland close to the one proposed in the Convention for Biological Diversity (CBD) but this definition has not been formally agreed upon by most countries, and hence it is not recognized as an international standard. Both Brazil and the EU are parties to the CBD and each has implemented its own protected areas. Therefore, in the absence of sound scientific support, the use by the EU of different criteria could be challenged under article XX of GATT as discriminatory. In this regard, Brazilian authorities and stakeholders are seeking the recognition by the EU of national initiatives developed with the same intent of protecting biodiversity such as the Agro-Ecological Zones (UNICA, 2010; Brazil, 2010).[9]

The methodology used to identify highly biodiverse grasslands is also controversial. While it is not possible to define highly biodiverse grasslands in a way that would permit their identification through remote sensing data, on-site assessment, however, can be prohibitively expensive for producers. Adopting definitions and maps already in place at national level may be a reasonable and effective alternative.

A last point concerns the incompleteness of the EU definition of sustainability. International efforts to define social sustainability cover a large set of components, including labor and human rights, land and resource rights, food security, livelihood impact and rural development (ILO, FAO, UNCTAD). Some schemes developed prior to the EU RED, by nonprofit multi-stakeholder associations, such as RSB or Bonsucro, cover social sustainability concerns. These schemes require compliance with both national laws and regulations, as well as international agreements. Other industry-based schemes, recognized by the EC, such as Albengoa and 2Bsvs, which are global in scope, take a minimum compliance approach and do not include any commitment to social sustainability. Greenenergy, an industry-based standard that is also adopted in Brazil, has watered down its requirements, requiring legal compliance only with laws relating to the sustainability criteria governed by the standard (German, 2011). The omission of social sustainability concerns from the EU RED could may lower the bar rather than complement the efforts by commercial and civil society actors who are demanding voluntary sustainability certifications.

9 ibid.

ARE PRIVATE CERTIFICATION MECHANISMS EFFECTIVE IN PURSUING SUSTAINABLE PRODUCTION?

To the extent that many actors make decisions that are formally independent of each other, third party certification can be analyzed as a polycentric system. Interactions occurring within and across different scales and levels. For example, the interaction between spatial, institutional, jurisdictional and management domains can be addressed by boundary organizations that play an intermediary role between different arenas, levels or scales and facilitate the co-production of knowledge and solutions (Cash et al., 2006). Based on previous work on sustainability certifications for bio-based industries such as forestry, coffee or fisheries (Cashore et al., 2004, Cubbage et al., 2010; Ebeling et al., 2009; Raynolds et al., 2007; Gulbransen, 2009; Giovannucci et al., 2008), it is possible to state that the success of sustainability certifications depends upon a set of micro, macro and policy conditions that affect the size and distribution of benefits and costs. The economic benefits of certification can take a variety of forms: price premiums, increased market access, contract stability or lower price volatility. Besides real economic gains there are other reasons why firms choose to participate in voluntary regulations: anticipating future regulation, protecting their reputation, gaining exposure to practices that improve operations, signaling to consumers and partners (Matus, 2009).

There are few empirical studies that have evaluated how these factors promote or hinder the implementation of sustainability certifications. The complexity of the systems that are regulated makes it very difficult to evaluate how they respond. For example, socio-economic and ecologic systems need to be analyzed at different levels of scale and with a multiplicity of perspectives in order to incorporate their complexity. Theories, published empirical research, and results from this specific field study have permitted to identify factors that may affect the outcome of sustainability policies with regard to biofuel. These factors have been classified in the following five categories:

- Governance
- Demand
- Laws in place and the capacity to enforce those laws
- Land tenure and ownership
- Structure of the industry

In the following sections I examine the respective roles of market factors and institutional conditions. From these factors, I explore their impact on the success of existing sugarcane sustainability certification schemes.

Governance

Ethanol sustainability certification began in Brazil in September 2007, when a bilateral agreement was signed with Sweden to boost ethanol trade and to foster collaboration between researchers and companies to develop better and more efficient technologies for sustainable ethanol production. The agreement gave rise to the SEKAB Verified Sustainable Ethanol Initiative, which was developed by the Swedish bioenergy company, SEKAB, together with Brazilian ethanol producers. By means of this initiative, SEKAB intended to import verified sustainable ethanol from the Sao Paulo region of Brazil to the Swedish market. SEKAB set various goals including a minimum 85% reduction in fossil carbon dioxide compared with petrol; these included the increased mechanization of the harvest; zero tolerance of both rain-forest destruction and child labor; respect of rights and safety measures for all employees in accordance with UN guidelines.

Considering the costs that could arise from the adoption of different sustainability standards,[10] the Brazilian sugar cane industry has concentrated its efforts into one voluntary scheme: Bonsucro (Better Sugar Cane Initiative. Bonsucro aims to define globally applicable performance-based principles, criteria, indicators and standards for sugarcane production, promoting improvements in the key economic, environmental and social impacts of sugarcane production and primary processing. In order to achieve compliance with the Bonsucro Standard, 80% of the indicators, plus 80% of the criteria contained in its 'chain of custody' provision must be fulfilled. In addition, there are a number of core criteria which must also be fully satisfied, such as compliance with relevant applicable laws and ILO labor conventions, payment of at least the national minimum wage protection and promotion of biodiversity and ecosystems services, and transparent, consultative and participatory processes that address those cumulative and induced land use effects identified by an environmental and social impact assessment (ESIA) for new sugarcane projects. The "Bonsucro EU" certificate requires full compliance with the additional requirements of the EU directives. "Bonsucro EU" is one of the seven voluntary biofuel sustainability standards recognized by the EU Commission in the framework of the EU RED. Since 2011, Bonsucro has only certified 15 sugarcane mills in Brazil belonging to five groups, corresponding to 3.4% of the Brazilian sugarcane area and 1.4% of the world area. These numbers are increasing. Companies that have started to comply with the certification standards have expressed their intention to do so for their entire production as opposed to only a potential amount.

Bonsucro is a global multi-stakeholder partnership that involves three types of actors. The first type is represented by NGO's, with WWF representing nature conservation interests and Solidaridad social development issues. The second type includes sugarcane, sugar and ethanol producers both directly and through their association UNICA. The third consists of large buyers in the agro-food, energy and green chemistry sector including Cargill, British Sugar, Bacardi, Cadbury Schweppes, Shell, British Petroleum, and Coca-Cola. Developed country governments are involved in the partnership only in the context of

10 These initiatives include regulatory frameworks, voluntary standards, certification schemes and scorecards. Some of them cover the entire supply chain, while others deal only with parts of it. The FAO has reviewed twenty-one of these initiatives (FAO, 2012).

their financial support to NGOs. The partnership is contributing to sustainable production by creating an arena to work on this issue, working directly with producers to design production codes and standards regarding social and environmental issues and, finally, by creating a market for sustainable products. The NGOs are often very active participants facilitating the relationship between participating businesses and farmers (Bitzer et al, 2008).

During the last few years, the certification partnership has helped foresee a consensus between the three stakeholders. To enhance compliance, the partnership has offered technical and financial assistance to producers. UNICA and Solidaridad, for example, have worked together in a program of retraining sugarcane cutters who have lost their jobs due to greater mechanization. Another example is represented by WWF, collaborating with the ethanol company ETH in a biodiversity preservation project linked to the expansion of sugarcane plantations in the Cerrado.

Demand

The demand for certified sugarcane largely derives from two sources: large-scale sugar buyers like Coca Cola, Nestlé, and Unilever who are increasingly requiring certification with the purpose of protecting their reputation and avoiding hostile campaigns by national and international social groups. According to interviewees, the cost of complying with certification schemes is greater than the price premiums for selling certified biofuels. Nevertheless, producers are starting to certify their mills in order to defend their market shares.

On the other hand, new markets for certified sugarcane are emerging in the form of high value added products like green plastic. For example, Braskem launched the "I'm Green" label for use by various companies marketing products containing Braskem's green polyethylene made from sugarcane ethanol. The core of the company strategy is based on the idea of "sustainable chemicals," including improved management of environmental, social and economic impacts. In this case producers are able to earn price premiums.

Responding to pressures from buyers, Brazilian sugarcane producers have made considerable efforts to defend their reputation as a sustainable industry: the producer association, UNICA, has published a sustainability report consistent with the G3 Guidelines of the Global Reporting Initiative (GRI), and half of its associated mills now have published their own GRI Sustainability Report, outlining environmental and social advances.

Demand for certified sugarcane is still small compared with the domestic Brazilian market and non-environmentally sensitive import markets. On average 30.8 % of total sucrose is exported as sugar and 3.9 % as ethanol. The largest markets for Brazilian sugar are Russia, Nigeria, Saudi Arabia, Egypt and Algeria, none of whom requires certified sugar or ethanol. In 2008, Brazilian ethanol exports were about 19% of domestic production, 30% of which was directed towards the U.S. and only 27% towards the EU.

The recent phasing out of the U.S. tariff on ethanol imports from Brazil will increase Brazil's

competiveness in the U.S. market. According to the US regime on biofuels, the Renewable Fuel Standard (RFS), Brazilian ethanol accounts as advanced biofuel. On the other hand, Brazilian competitiveness in the EU is much lower because of historical barriers which remain in place. As a consequence, the EU market does not represent an important driver for ethanol production. While traditional producers selling in the domestic markets show limited interest in achieving the EU certification standards, international companies wishing to expand on sensible and more lucrative foreign markets are becoming more interested in complying with these standards.

Domestic Legislation and Policy in Place and Its Enforcement

In Brazil, voluntary sugarcane certification schemes are emerging as a result of policy reforms which impose restrictive and controlled regulations, consisting of:

- agroecological-zones identification
- the law on sugarcane burning and harvesting
- the forest code
- the national policy on climate change

Because it is highly compatible with sustainability standard requirements, the existing legal regime has laid the bases for the success of certification by helping to reduce the compliance costs. The impact of these laws depends more on the level of enforcement of current laws than on the need for new legislation. Compliance has been ultimately more successful in the state of Sao Paulo and this success, together with San Paulo's more advanced laws, has a pull effect on the rest of the country, especially in the states where sugarcane production is expanding, such as Minas Gerais and Mato Grosso do Sul. While in Sao Paulo, enforcement can rely on the state authority, in the poorest states, such as those in the Amazon or the north-east characterized by a lower level of enforcement and weaker institutions, greater effort by the Federal Government is necessary.

When law requirements and sustainability principles and criteria are largely met, the major role for the third-party auditors is the verification of compliance with already-established norms. Existing public regulations is needed to maintain basic social and environmental conditions, while private certification initiatives can raise the bar, in cases where providing more socially and environmentally sustainable production is desirable.

Sugarcane Agroecological Zoning

The Brazilian government introduced agro-ecological zoning in 2009 in order to delimit areas where sugar cane, as well as other crops, can be produced. According to the zoning rule, the maximum permitted land area for sugarcane growing amounts to 64.7 million hectares, which represents about 7.5% of the

Brazilian territory (currently 0.9% of the area is now used for sugarcane). Under the zoning rule:

1. Sugarcane expansion is not allowed in the most sensitive biomes – e.g. Amazonia and Pantanal;
2. Sugarcane expansion is not allowed on any type of native vegetation (*Cerrados, Campos*, etc.).

The Agro-ecological Zoning is based on a thorough study of the Brazilian regions' weather and soil conducted by the Federal agency, Embrapa, which has taken into account environmental, economic and social factors to guide the sustainable expansion of sugarcane production and investments. Zoning considers soil and weather constraints, topography, water availability at the surface, risks to watersheds, and the existence of protected areas.

Figure 1 - Sugarcane Agro-ecological Zoning - Brazil

Source : UNICA

The AEZ affects the licensing and financing of new investments. The restrictions regarding the environment, economy, society, climate risks, and soil conditions, are set by ZAE Cana to guide the expansion of sugarcane farming. According to sugarcane agro-ecological zoning rules, 92.5% of the Brazilian territory is not suitable for sugarcane plantation. These rules are not applied to industrial units already installed, the cane produced for their supply, or their planned expansion.

Interviewees asserted that the perspective of the EU ethanol market has been a driving force in establishing the agro-zone according to environmental criteria.

The areas of cane expansion with greater future potential are those that combine good quality soil, pluviometric precipitation and prospects for a positive evolution in terms of logistics. Among these areas are parts of the states of Minas Gerais, Mato Grosso do Sul, Goias, the north-west of the state of Sao Paulo, and the north of the state of Espırito Santo. Most of the Amazon is not suitable for agricultural reasons, besides the fact that cane expansion would lead to further undesirable deforestation. Most of the expansion in sugarcane crops is taking place on degraded and pasture lands (Goldemberg et al., 2008). Fig. 2 shows where new mills are being installed.

Figure 2 - Location of new mills as expected

Source: Embrapa

State Law 11241 Of September 2002 On Sugarcane Harvesting

This law has banned the pre-harvest burning of sugar cane plantations in the State of Sao Paulo. Pre-harvest field burning is still a common practice in Brazil in order to allow manual harvesting. It represents a source of air pollution and the cause of significant health problems for sugarcane workers. The phasing out of burning has been made possible by the development of energy markets for sugarcane crops residues and by the introduction of advanced machinery for harvesting green cane and collecting residues more efficiently. The new technology has eliminated the need to burn the waste products before harvesting and allowed the use of residues in the cogeneration of heat and electricity (Moreira and Goldemberg, 1999, La Rovere et al., 2011). Currently, mechanical harvesting is already cheaper than manual harvesting, but the required investments and the local topography have constrained this transition. The law establishes the phasing out the pre-harvesting burning by 2021 in areas whose slope is below 12% - where mechanization is possible - and by 2031 in all areas. In June 2007, these deadlines were moved forward respectively to 2014 and 2017, thanks to a voluntary agreement - the Green Protocol - signed between the Government of Sao Paulo State – Ministry of Agriculture and Ministry of Environment - and UNICA, the association of sugarcane producers. The Protocol also establishes the prohibition of burning sugarcane in the new land converted to sugar cane cultivation; the implementation of technical programs for soil preservation and water resources; the protection of forest areas and natural vegetation around spring watersheds; and the adoption of good agricultural practices in industrial processes. The ban will mitigate the environmental impacts and optimize the recycling and reuse of residues generated by sugar and ethanol production. In March 2008, the protocol was also signed by the producers/suppliers of sugarcane represented by the Organization of Sugarcane Planters of South-Central Brazil (ORPLANA). Between the signing of the protocol and the most recent harvest (2011/12), the percentage of sugar cane harvested under the new law increased from 34.2 to 65.2, the percentages being 81.3% for mills and 24.2% for outgrowers.

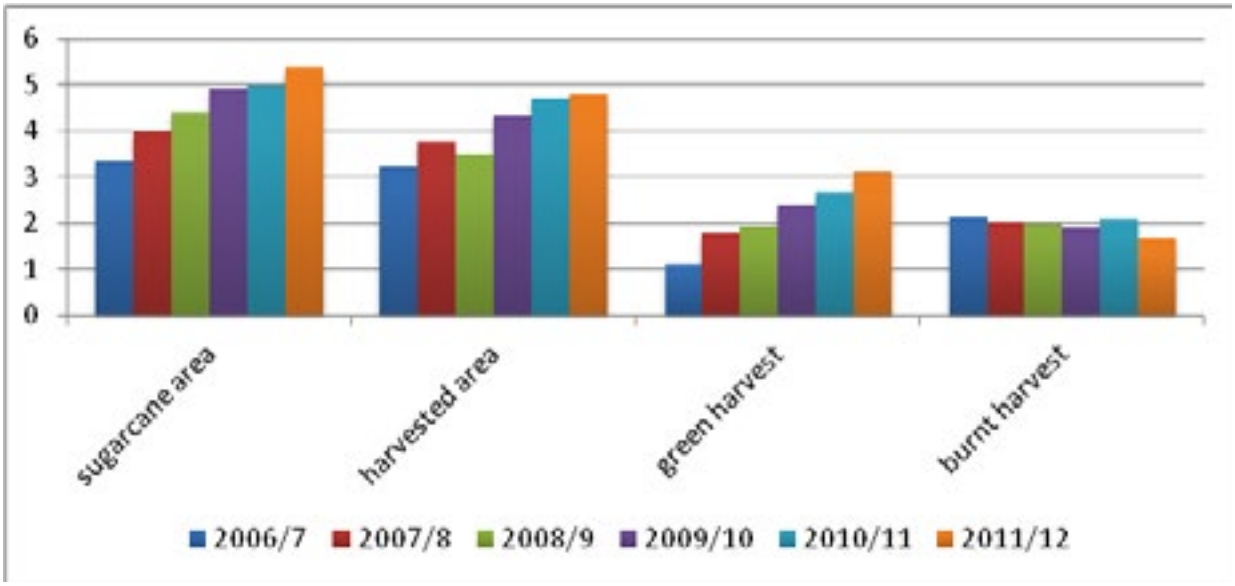
Although this Law was enacted only in the state of Sao Paulo, there is strong pressure to extend it to other regions. A Protocol operates in the state of Minas Gerais, and the Federal Government is proposing an end to residue burnings in existing production areas.

Currently in the state of Sao Paulo, 173 mills have signed the Protocol, accounting for more than 90% of the industry. More than 5,400 outgrowers have also adhered to the Protocol, representing 21.7% of the sugarcane area in the state. Since the first implementation of the Protocol, the harvested sugarcane area has grown by approximately 1.55 million hectares, but the area in which in-situ burning takes place has dropped by 460,000 hectares.

The implementation of the Protocol is an outstanding example of partnership between the public and the private sector for the production of sustainable sugarcane. By providing training and support services for commodity producers, the public sector contributes to increasing the efficacy of voluntary sustainability certification in achieving its goals. Since the inception of the Protocol, the reduction in sugarcane burning over a cumulative area of 4.5 million hectares has contributed to preventing the

emission of 16.7 million tons of pollutants (carbon monoxide, hydrocarbons and particulate matter) and more than 2.7 million tons of CO2 equivalents.

Fig.3: Sugarcane harvest (million hectares) in the state of Sao Paulo



Source: http://www.ambiente.sp.gov.br/etanolverde

Forest Code

The Brazilian Environmental Legislation is based on the National Forestry Code (Federal law 4771/65), which establishes a legal reserve of 80% for rural activities in the Amazon, 35% in the Amazonian Cerrado (savannas) and 20% in the other regions. Sugarcane plantations or those of other crops must guarantee a forest cover of native trees over an area at least equal to the legal reserve requirements. The state of Sao Paulo has imposed special requirements on the maintenance of riparian forests, so that such areas enhance the protection of water sources and promote the restoration of biodiversity. The Brazilian Parliament has recently approved a highly controversial "reform" law. Opponents claim that the law will open the way to additional deforestation, while the supporters, mainly linked to the agricultural lobby, argue that the changes will promote sustainable food production and eliminate uncertainty. Whilst the provisions on the legal reserve remain unchanged, the bill provides an amnesty from fines for illegally clearing trees before July 2008, although larger landholders would have to replant most of the cleared area or preserve the same amount of land elsewhere. This provision is considered necessary in the absence of official data on forest clearing in the past and in order to set a starting point for strict enforcement of the code. What appears to be less sustainable is the reduction of the requirements on buffer zones near water bodies (from 30 to 15m of legal preserve).

Brazilian National Policy On Climate Change

The law on Brazil's National Policy on Climate Change was enacted in 2010. The law specifies that the country will reduce greenhouse gas emissions by between 36.1% and 38.9% from business as usual levels - based on projections of future emissions if no action is taken-by 2020. Brazil plans to achieve this total emissions reduction target through actions in all sectors of the economy. The actions detailed in the decree to achieve these goals include:

- Reducing 80% of deforestation in the Amazon
- Reducing 40% of deforestation in the Cerrado biome
- Increasing the supply of renewable energies
- Implementation of a "Low Carbon Agricultural Plan" that includes the recovery of 15 million ha of degraded pastures, improving the system of integrated farming, forestry and cattle-raising by 4 million hectares, expanding direct seeding by 8 million hectares, and expanding biological nitrogen fixation by 5.5 million hectares

Structure of the Industry

The sugarcane supply chain in Brazil has undergone major changes since 2006, shifting from typical market-based relationships to a value chain with a higher degree of coordination as new players enter the market. Three main trends can be identified:

1. Large Brazilian producers are buying smaller and more fragile mills;
2. Trading companies and multinationals in the food industry are acquiring medium- and large-sized groups;
3. Multinational companies in the energy business are buying participations in mill groups.

In recent years, the sugarcane and ethanol industries have witnessed increased concentration and a greater prcentage of foreign investments. The market share of the ten largest industrial groups rose from 24% to 34% between 2002/3 and 2010/2011 while foreign capital increased from 10% to 23%. An example of the process of concentration, verticalization and globalization is provided by the history of the COSAN group, which started as a family enterprise in the 1930s, consolidated its position as a global market player during the 1980s, and started to be quoted on the Brazilian stock exchange (BOVESPA) in 2005. The company increased its returns to scale with the same administrative structure. In 2008 the group acquired 100% of the assets of Essobras, a firm active in gasoline distribution and in the production and commercialization of lubricants. This purchase allowed the COSAN group to consolidate its position in the distribution sector, obtain synergies in the rationalization of logistics, optimize stock management by reducing volatility in volumes and prices, and, finally, reduce volatility in profits as result of a better combination of production, distribution and commercialization margins (Verdi et al., 2012). The next step was a joint venture initiated in 2010 between COSAN and Shell International. COSAN transferred all its

mills to the joint venture and all its projects for the cogeneration of energy, logistics and other activities. Shell transferred its Brazilian segment of fuel distribution, its aviation business and two companies engaged in biomass fuels R&D in Brazil. RAIZEN, the new joint venture, owns 23 sugarcane mills in Brazil with a processing capacity of 62 million tons, which represents 9.4% of the country's capacity. Another initiative was the transformation in 2003 of the cooperative Coopersucar with 185 partners and 31 mills into one firm. The cooperative was responding to foreign investments, acquisitions and greenfield investments form global traders such as Cargill, Tereos, or by Brazilian transnationals such as Petrobras, Bunge, or Oderbrecht began to grow (Wilkinson and Herrera, 2010). By 2011, 20% of mills are concentrated in the hands of 12 business groups (Table 1).

New social and environmental regulations resulted in an increase in vertical integration, whereby leading buyers and exporters increase own-land production rather than purchase sugarcane from smallholders and contract farmers. Marketing alliances among mills, traders and buyers have emerged. Large multinational buyers have played a leading role in promoting modernization and increasing the scale of sugarcane processing. Multinational buyers impose standards for the social and environmental sustainability of production similar to those applied in the EU and in the US, which in turn are reflected in government regulation.

Table 1 – Main group in the sugar- alcohol industry in Brasil, 2011

Group	Number of mills
Cosan (Raízen)	26
LDC SEV	13
Usaçúcar	12
Farias	11
Eth Bionergia	09
Bunge	09
Tércio Wanderley	08
Tereos (Açúcar Guarani)	07
Carlos Lyra	06
Infinity Bionergia	06
Aralco	05
BP Biofuels	05

Source: ANUÁRIO DA CANA. ***Safra 2010/2011****. Volumes Centro/Sul e Norte/Nordeste. Ribeirão Preto: PROCANA, 2011.*

The evolution of the Brazilian sugarcane industry appears to be fully consistent with the theory of the global value chain, which highlights the links between the concepts of global organization of industry and the value added chain (Gereffi et al., 1999). This theory stresses the importance of coordination among firms (boundary networks) and of global buyers. It employs the expression 'buyer-driven commodity chain' where buyers use explicit coordination to create a highly competent supply-base upon which global scale production systems can be built without direct ownership. Global buyers like retailers, marketers and traders, exert a high degree of control over spatially dispersed value chains. In a further work, (Gereffi et al., 2005) a typology of value chain governance according to the spectrum of explicit

coordination and network relationships has been proposed. In this framework, different levels of the three main determinants of global value chain governance – the *complexity* of the information and knowledge transfer required to sustain a particular transaction, the *ability to codify* information such that it can be transmitted efficiently between the parties to the transaction; and the *capability* of suppliers in relation to the requirements of the transaction – give rise to various combinations, of which five are likely to occur in the real world as governance types (Table 2). This classification goes beyond the traditional distinction between buyer-driven or producer-driven supply chain governance.

Table 2 - Key determinants of global value chain governance

Governance type	Complexity of transactions	Ability to codify transactions	Capabilities in the supply-base	Degree of explicit coordination and power asymmetry
Market	Low	High	High	Low
Modular	High	High	High	↑
Relational	High	Low	High	|
Captive	High	High	Low	↓
Hierarchy	High	Low	Low	High

Source: Gereffi et al. (2005)

In the first case, transactions are easily codified, product specifications are relatively simple, and suppliers are able to make the products in question with little input from buyers, who respond to specifications and prices set by sellers. Because the complexity of the information exchanged is relatively low, transactions are governed with little explicit coordination through market linkages. The cost of switching to new partners is low on both sides. This form of governance is typical of the traditional agricultural sector where transactions take place in wholesale markets. More recently, large transnational corporations are expanding their roles in determining where food comes from and how it is produced, marketed, and made available for individual consumption. Governance has evolved towards relational interactions characterized by more stable contracts and reduced fragmentation along the supply chain.

At the opposite extreme, the *hierarchy* case describes the situation in which product specifications cannot be codified, products are complex, and highly competent suppliers cannot be found. In this situation, lead firms are forced to develop and manufacture products in-house, managing complex webs of inputs and outputs, and to control resources, especially intellectual property. This governance form is characterized by large vertical integrated firms. For example, the electronic industry was dominated for a long time by a few vertically integrated companies. In recent years it has switched to modular organization where many functions have been sourced out as manufacturing of specialized

subcomponents.

Moving from market to vertically integrated governance, relationships between suppliers and buyers become bilateral, and are characterized by higher complexity, mutual dependence and hierarchical coordination. Suppliers and buyers negotiate on the quality of the product, the production process, and the logistics, thus creating new value chain relationships and competences. Multinationals that buy sugar or ethanol to export to Western markets tend to establish more regular contracts with suppliers, whose systems become subject to regular monitoring and audit. When economic actors are able to embed relevant information about quality in standards, certification or labels, they can achieve a change in the form of coordination of the supply chain in the direction of a more 'hands-off', less hierarchical relationship (Ponte and Gibbon, 2005). By doing so, trust becomes institutionalized in the certification regime rather than via a direct relationship between buyer and seller. The development of certification and auditing systems shifts coordination of the global supply chain from direct control to 'control of the control'.

In the Brazilian sugarcane industry, the chain of custody is only required for producers and processors selling to premium markets such as the EU and the US. Multinationals that buy sugar or ethanol to export to Western markets tend to establish more regular contracts with suppliers, whose systems become subject to regular monitoring and audit. In the traditional subsector, because transactions are price-driven and the price is a function only of the sugar content, specific investments in labor and environmental protection, such as mechanization and the establishment of the legal reserve, are less likely to yield immediate returns.

At present, 15 mills have been certified by Bonsucro (Table A2). Most of them belong to export-oriented, vertically-integrated companies that adopt certification standards in order to respond to the requirements of multinational buyers operating in sensitive markets. For young companies that have recently bought mills, certification is also a way to homogenize practices and technology in different plants and increase their efficiency. The first mills to comply with certification protocols are usually characterized by an already-existing high level of compliance with social and environmental regulations. For these companies, the higher cost is in the form of record-keeping needed to prove compliance, and the main changes required are in organization and management.

Land Tenure and Ownership

Land ownership and tenure affects the diffusion of sustainable environmental and social practices in sugar cane production in more than one way.

First, land tenure regimes contribute to determining the rate of investment in new technologies and practices and consequent land-use changes. Second, indirect land-use changes, especially those pushing the rangeland frontier in the Amazon and the Cerrado, could be limited by regulating tenure regimes.

In Brazil, three types of land tenure can be identified with regard to sugarcane production: mills can

own the land; they can rent the land; or they can partly rely on outgrowers. In the last two cases, usually, contracts with the mills last five or six years, a period which corresponds to the sugarcane cycle. In the state of Sao Paulo these three forms were traditionally equally distributed, each of them accounting for one third of total sugarcane production. These patterns have recently changed as a consequence of the sector's reorganization and the entry of foreign capital. Foreign investors exhibit different attitudes, with some companies oriented towards outgrowers and others towards renting. According to some interviewees, mills increasingly rent land, which they operate directly. A second option is for the outgrower to be responsible only for the first part of the production cycle while the mill is in charge of the harvest. This development is linked to the costs of applying the green protocol and the forest code: mechanization is not affordable for small farmers because the minimum area that justifies the purchase of a machine is around 1000 ha or 100.000 tons; and also the cost of forestation is estimated at around four times the cost of planting sugarcane.[11] While large landowners who rent land are usually soya and corn producers, outgrowers are specialized in sugarcane. This explains why, if they cannot afford the requisite changes, owners decide to sell or to rent their land, or the mill to take charge of the harvest. Mills are constantly expanding their sugar production to maximize their efficiency. Considering that the sugarcane field must be within a radius of 40-70 km from the mill there is increasing competition for land in areas where several mills are present, so that land prices are constantly increasing (around threefold in the past five years). Some companies offer technical assistance to farmers in order to close the gaps on sustainability requirements, mainly on agrochemicals use. When opting for new planting technologies, mills can decide to take over this phase, together with the harvest and transport, leaving pest treatments and fertilization of sugarcane fields to the farmer. In the new states where sugar cane is expanding the situation is rather different and large producers prevail.

If outgrowers agree to comply with the green protocol and the forest code, they can obtain higher prices for their production and more stable contracts. The state of Sao Paulo is helping small producers by financing part of the investment in mechanization and creating producer consortiums. This process requires the elimination of farm boundaries, planting the same varieties, and homogenizing agricultural practices. While producers pay the cost of compliance with certification requirements, the mills pay the cost of the auditing. Some programs have been established to retrain producers for these new activities.

According to the interviewees, the mills are certifying the sugarcane produced on the land that they manage directly (both owned and rented) and these mills regard the certification of outgrowers as a second step, which is considered necessary because the objective is to certify 100% of their production. The major obstacle to certifying outgrowers is compliance with the forest code, especially with regard to providing proof of compliance in the past, considering that legal documents or remote sensing pictures are not available. Because mechanization can lead to a reduction in labor costs of up to 30% with respect to manual harvesting, some outgrowers are adopting a model of collective hiring of manpower and so-called 'condominium systems' for the use of machinery (Oliveira et al., 2011).

11 The forest code requires that sugarcane plantations guarantee a forest cover of native trees over an area at least equal to the legal reserve requirements (20% in the state of Sao Paolo).

The second way in which land tenure affects the sustainable development of production is by causing indirect land use changes, especially when pushing the rangeland frontier to high biodiversity areas like the Amazon and the Cerrado. Although recent years have seen a decreasing deforestation rate in Amazonia following the moratoria on soya, the Brazilian Cerrado, a large wooded savannah in Central Brazil, is experiencing a high rate of deforestation (Sawyer, 2008). Estimates range between 800,000 and 1,600,000 hectares, with a consequent loss of biodiversity. These trends could be limited by regulating tenure regimes.

The expansion of sugarcane in recent years has mostly (50%) occurred in the state of Sao Paulo and in the nearby central states of Goias, Mato Grosso and Mato Grosso do Sul. The expansion into these new areas has been due to the availability of land at low price and suitable conditions for sugarcane production, primarily a topography suited to mechanized harvesting. In the state of Sao Paulo the expansion of sugarcane has occurred at the expense of pasturelands and other permanent crops such as oranges and coffee and temporary crops such as soy and corn (Walter et al., 2011). Forest land has not been displaced, although some of the new forest areas are homogenous-planted forests for industrial purpose, for example eucalyptus for pulp production. In the meantime also cattle herds have increased in the state of Sao Paulo, so that it is difficult to establish a link between sugarcane expansion and ranching displacement to other forest areas, such as the Cerrado, where deforestation has occurred. Some studies (Lapola et al., 2010) predict indirect land use changes in the future given the projected expansion of biofuel demand[12]. Nevertheless they agree that natural resources depletion is accelerated by weakness of the institutions, including land tenure, and the low intensity of livestock production.

In Brazil the process whereby individuals show that they have a solid claim on land is squatting (Binswanger, 1991). The right known as *direito de posse* has been formally recognized since 1850, but it dates back to colonial times. This right states that a squatter, or *posseiro,* who lives on unclaimed public land *(terra devoluta)* and has used it 'effectively' for at least one year and one day, has a usufruct right over 100 hectares. If the *posseiro* fulfills the condition of living on and effectively using the land *(cultura efetiva e morada habitual)* for more than five years, he or she has the right to acquire a title to it. Land can also be acquired by squatting on private land for some time without being challenged by the owner. In lands under federal control, up to 3,000 hectares may be claimed by using the *direito de posse* and by complying with the attendant administrative and regulative procedures. In this situation, where property rights are insecure, forestlands can be considered as open access resources and deforestation as an ownership-establishment strategy (Araujo et al., 2009). Farmers choose among alternative land uses – forest exploitation, cattle ranching or agriculture – by comparing the relative risk-adjusted profitability of each. The risk of losing property rights on land affects landowners' choices: agents who face a risk of confiscation favor clear-cutting forests, agricultural land conversion, and cattle ranching, which yields immediate profits. Moreover, the mobility of livestock makes it easier to protect than fixed assets, such as standing forests, in the case of confiscation. After five years the land is usually sold to soy or palm oil

12 The study projected that, in Brazil, sugarcane ethanol and soy-bean biodiesel pushing the rangeland frontier into the Amazonian forest would be responsible for ≈40% and 60%, respectively, of the indirect deforestation by 2020.

producers.

Regulating tenure regimes is the best option to reduce deforestation, assuming that current deforestation is in large part due to untenured deforesters who acquire tenure in the process (Cattaneo, 2001). Accordingly, Brazil should support low-deforestation livelihoods for forest peoples and smallholder farmers, expand the law-abiding 'responsible' fraction of the cattle and soy sectors, improve law enforcement by introducing mechanisms to facilitate compliance with the 80% legal reserve obligation, and effectively manage protected areas. Indigenous groups and traditional forest communities have defended their perimeters from incursions by deforesters, but they have never received compensation for this enforcement service. Smallholder farms (up to 100 ha) established in forested or marginal lands could shift to low-deforestation production systems. Support within the cattle and soy sectors for declining deforestation could be strengthened by identifying, rewarding, and expanding the pool of 'responsible' producers striving to comply with the law and to practice good land stewardship (Nepstad et al., 2009). Sustaining the ecological diversity of Amazonia or Cerrado over the long run should entail the retention of forest on private lands, as required by law, the expansion of the current system of protected areas, and a more rational utilization of already cleared and degraded lands in order to diminish the need to clear additional land. In the Cerrado, where deforestation has proceeded at a higher rate than in the Amazon, the expansion of sugarcane at the expense of pastures usually requires the cultivation of other crops, such as soybeans, for two years in order to restore soil fertility and structure, and crop rotation is commonly used during sugarcane renovation. These practices, together with the widespread adoption of minimum tillage techniques, make it possible to increase the soil carbon content (Walter et al., 2011).

This analysis supports the idea that issues as indirect land use changes and deforestation must be addressed directly by other instruments as opposed to the certification processes. Increasing the burden of requirements on unobserved issues would create an unreliable and presumably distortive instrument.

CONCLUSION

The Brazilian sugarcane-based industry is going through a phase of profound transformation. New markets are emerging because the sucrose molecule and cane fiber are used in new materials applications besides sugar and fuels. Since the 1970s, when the Pro-Alcohol program was started, the production of sugarcane has increased eightfold, and the total sugar supply eleven fold. Since 2006 the industry has consolidated with the entry of new actors. Along this path, sustainability has increased (Goldemberg et al., 2008; Walter et al., 2011)). This study has explained how the evolution of the sugarcane industry in Brazil and its developments in terms of sustainability depend on the interaction among diverse driving forces: the industry structure, policy reforms, law enforcement, changes in export markets, and emerging markets for new products. The role of civil society expressed by the participation of NGOs in the partnership governing third party voluntary certifications is central to this process.

This paper's findings challenge the idea of the central importance of market benefits as "the" driving force behind private regimes for environmental and social governance. Sustainability certification is seen as a polycentric institution that facilitates cross-scale and cross-level interactions, where strategies of large scale purchasers and of environmental and social NGO's are essential as well as the role of public authorities in setting and enforcing the legal framework.

Although demand for certified sugarcane is growing, the size of environmentally-sensitive markets is still insufficient to promote certification on a large scale. Price premiums are rarely perceived by ethanol producers, although other benefits are evident like market access, reaching new buyers and clients, and higher efficiency levels. Low enforcement of environmental and labor regulations reduces the opportunity cost of obtaining certification. Nevertheless, it is evident that a pull-push effect is being produced by the interaction of market forces and public regulations. The EU RED has contributed to advancing this process by creating a favorable environment for policy reforms and company consolidation, but it has not delivered its full potential because of two main factors: the size of competing markets and the limitations due to the Directive's definition of sustainability. In both cases, removing trade barriers would open the EU market to imports and thus fostering the development of sustainable biofuel production worldwide and enhancing the EU commitments under the Kyoto Protocol at a lower cost (Young, 2006).

The omission of social sustainability concerns from the EU RED could may lower the bar rather than complement the commercial and civil society actors that are demanding voluntary sustainability certifications. With regard to indirect land use changes – the other concern much debated in the EU – our analysis supports the idea that deforestation and other land issues need to be addressed directly by other instruments. Certification must be enforceable by a third party i.e. attributes must be observable by a third party. Increasing the burden of requirements on unobserved issues would create an unreliable and presumably distortive instrument.

Balancing growth and sustainability still faces a number of challenges. The expansion of sugarcane

areas may increase the soil degradation associated with soil erosion and soil compaction. Preventing the deterioration of aquatic systems due to accelerated erosion and to the discharge of vinasse into surface waters rests on the enforcement of the forest code on riparian areas and the new legislation created to ban the direct discharge of vinasse (Martinelli et al., 2011).

Increasing economies of scale and land concentration have meant that to date the benefits of sugarcane ethanol production for small landowners have been limited, and large farmers and industrialists have benefited more from the industry's expansion (Peskett et al., 2007). The evidence from Brazil indicates that economies of scale have been vital in reducing operating and capital costs, making ethanol cost competitive in comparison with petroleum fuel. The selection of improved cane varieties (e.g. energy cane) has helped improve yields, as well as investment in irrigation, but the benefits of the new technologies have mostly been felt on large plantations. The positive relationship between socio-economic indicators and the presence of sugar mills in Sao Paulo has been demonstrated, by expanding employment opportunities, public services and infrastructure development (Martinelli et al., 2011).

More research is needed on livelihoods improvement and equalities in rural areas. Land concentration is increasing with the expansion of monocropping areas, mechanical harvesting, the reduction of sugar mill numbers, and the growth of foreign investment and land acquisition. The prime threat associated with biofuels is landlessness and the resultant deprivation and social upheaval (Worldwatch Institute, 2006; Dufey, 2006). Small farmers encounter technical and economical obstacles in the process of modernization. Large-scale and small-scale systems are not mutually exclusive and can interact successfully in a number of different ways. Some of the models for partnership between large-scale and small-scale enterprises include outgrower schemes, cooperatives, marketing associations, service contracts, joint ventures and share-holding by small-scale producers (Mayers and Vermeulen, 2002). Co-operatives operating in certain areas sell to Petrobras though a system of decentralized micro-distilleries (Wilkinson and Herrera, 2010). Research on production costs in different areas of the State of Sao Paulo has shown that small outgrowers farms can still be viable if innovative solutions are adopted such as collective acquisition and use of harvesting machinery, but examples of such structures are less common than the larger owned or rented sugar cane plantations (Oliveira and Nachluk, 2011; de Souza Lino, 2010).

Some of the benefits of certification are intangible, such as the strengthening of social capital and the improvement of community-cooperative governance structures. This case study has shown the role of certification in generating significant attitudinal changes and in creating a learning environment, raising awareness and disseminating knowledge. Sustainability certifications should not constitute static systems, but rather arenas of governance where learning, inclusion and adaptation occur over time. The capacities of plantation managers and communities improve due to certification requirements as they reflect on engagement outcomes and adapt practices based on prior learning (Dare et al., 2011). Moreover, as has already happened in the case of Fair Trade certification, efforts in one sector can spread to other commodities or markets.

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APPENDIX

Background information: The Brazilian context

Brazil is the second largest producer of fuel ethanol in the world, with 27.4 billion liters in 2011. In the period 2000–2011, ethanol production in Brazil increased at annual average rates of 14% (MAPA, 2012). Internal consumption is projected to reach 35 billion liters in 2015 and 50 billion in 2020 (EPE, 2008), while exports – which were 5.1 billion liters in 2008 (MAPA, 2009) – could increase to 13 billion by 2016 (UNICA). In the 2000–2011 period, sugarcane production recorded average annual growth rates of 9.9%, mainly due to the increased demand for ethanol. Currently, sugarcane occupies 9.1 Mha, (MAPA, 2012). The production of sugarcane is concentrated in the central-southern region of the country (92%), and specifically in the state of Sao Paulo, where 58–63% of the national production of ethanol has taken place in recent years. It is estimated that there are about 72,000 suppliers in Brazil (UNICA), with around 14 thousand in the state of São Paulo. Owing to the technological developments achieved in both agriculture and industry, average production yields have grown from 3,000 liters/ha/year (67 GJ/ha/yr) in the early 1980s to 6,500 liters/ha/year (145 GJ/ha/yr) in 2005 (UNICA). Production yields based on conventional processes can reach 8,000 litres/ha/year (178 GJ/ha/yr) in about 8 years, or even 9,000 liters/(ha/yr) (about 200 GJ/ha/yr) if ethanol production from the hydrolysis of sugarcane bagasse reaches a commercial stage. Yields are higher in the central-southern region, especially so in the state of São Paulo (e.g., at least 82 t/ha in São Paulo in 2006, compared with a national average of 74 t/ha). On average, yields grew more than 3% per year between 1975 and 1985 and 1% per year between 1986 and 2008. Since 1975, yields have grown by almost 60% due to the development of new varieties and to the improvement of agricultural practices (IEA).

The main innovation in regard to the social and environmental sustainability of sugarcane has been the mechanization of the harvest with the phasing out of burning. Further improvements – from both an environmental and an economic point of view – could be achieved by achieving higher efficiency in water use, by replacing transport on large trucks with pipelines from the storage facilities to the ports, and by enlarging the surplus electricity production from sugarcane residues.[13] The sugar and ethanol supply chain is an important source of employment in the Brazilian economy. It involves more than 1,1 million people, and it increased by 85% in the 2000-2009 period. Because of more efficient production and the intensive mechanization of agriculture activities, the central-southern region produces about 90% of the main products and accounts for 56.5% of jobs, while 45.5% of workers are located in the north-eastern region of the country. Compared with other agro-industries in Brazil, the sector shows closer compliance

13 Most of the ethanol exported is shipped to the port of Santos, located in the state of São Paulo, relatively close to many ethanol distilleries. The distance between mills/distilleries and the ports and shipping capacity are considered the main logistical constraints. The transportation of ethanol by trucks over large distances is not sustainable from the economic, energetic and environmental points of view. Ethanol producers and TRANSPETRO – the logistics subsidiary of PETROBRAS – are investing in pipelines. TRANSPETRO estimates that logistics costs represent 20% of the total cost of exporting ethanol, and that this cost could be reduced by at least 50% with an optimized infrastructure (IEA, 2009). Moreover, by 2015 TRANSPETRO plans to expand its capacity of ethanol exports to 13 billion litres, from 2 billion litres in early 2009, by diversifying transport modes (IEA).

with labor and environmental legislation, with a greater number of formal jobs in the sugarcane sector (81.4% compared with 40% in the agriculture sector[14]). It enjoys better working conditions and a larger share of adult workers, in that child labor has decreased from 15% to 0.3% in the past 30 years. These changes have been the joint result of a set of favorable conditions as the are the results of direct sugarcane producers' concerns better law enforcement, market's requirements, associated with government social programs, such as Bolsa Familia and Bolsa Escola, which make public support conditional on compliance with education requirements. Sugar and ethanol companies have invested in training and re-skilling. They have adopted social and environmental certification programs linked to the change associated with the prohibition of sugarcane burning, which requires fewer workers (one harvester substitutes about 80 workers) and at the same time requires changes in the worker's profile and consequent training and up skilling programs.

Besides foreign demand, domestic sales of ethanol have also been growing in Brazil. This has been brought about by a sharp increase in the sales of flex-fuel automobiles. Although the direct subsidies provided by the Pro Alcohol program have been phased out, taxation on gasoline in Brazil is about twice as high as that on ethanol, which is justified by ethanol's positive externalities.

14 This figure reaches 95% in the state of Sao Paulo.

Table A1: Summary of environmental laws

Law	Objective
No. 4,771, September 15th, 1965 Forest Code	Permanent preservation areas
No. 997, May 31st, 1976	Environment Pollution Control
Portaria do Ministério do Interior No. 323, November 29th, 1981	Prohibition of release of vinasse in the water
No. 6,938, August 31st, 1981	National Policy Mechanisms and instruments as Environmental zoning, Environmental Impact Assessment
CONAMA deliberation No.001/7986	General Guidelines for the Evaluation of Environmental Impact (for industrial complex and units and agroindustry)
No. 6,171, July 04th, 1988	Use, conservation and preservation of agricultural soil
No. 11,241, September 19th, 2002- State of São Paulo	Gradual elimination of burning the straw of sugarcane
No. 12183/05	Use of water charges
No. 50,889, June 16th, 2006- State of São Paulo	Legal Reserve of landed property: Obligation of reserving an area equivalent to 20% of each rural property
SMA deliberation 42, October 14th, 2006	Environmental prior license to distilleries of alcohol, sugar plants and units of production of spirits
Deliberation No. 382, December 26th, 2006	Maximum emission of air pollutants
Agricultural and Environmental Protocol of sugar/ethanol industry Government of the State of São Paulo and UNICA	Prominence to anticipate the legal period to the end of the harvest of sugarcane
State Law n.3357, 1/8/2007 – Mato Grosso do Sul	Removal of burnt by 2026
State Law n. 15.834, 11/23/2006 - Goias	Removal of burnt by 2028
Minas Gerais protocol	Removal of burnt by 2014

Table A2: Brazilian Companies that have obtained Bonsucro certification

Certified Production	Standard	Mill	Company	Company profile	Business segments
Sugar & Ethanol	Bonsucro EU Production Standard	Maracaí Mill	Raizen	Shell and Cosan joint venture	Sugar, ethanol, electricity and fuel distribution
Sugarcane	Bonsucro EU Production Standard	Usina Bom Retiro			
Sugarcane	Bonsucro EU Production Standard	Usina Costa Pinto			
Ethanol	Bonsucro EU Production Standard	Unidade Jatai			
Sugar & Ethanol	Bonsucro EU Production Standard	Equipav Mill	Renuka do Brasil S.A.	Former Brazilain company Equipav, it has been bought in 2010 by the indian company Renuka	Sugar, ethanol, electricity and yeast
	Bonsucro EU Production Standard	Usina Quatá	Copersucar	Leader in the commercialization of sugar and ethanol(18% market share); 48 mills from 26 groups	Sugar and ethanol
Sugar & Ethanol	Bonsucro EU Production Standard	Usina Acucareira São Manoel S.A			
Sugar & Ethanol	Bonsucro EU Production Standard	Usina Santa Adélia S.A.			
Sugar & Ethanol	Bonsucro EU Production Standard	Acucareira Zillo Lorenzeti S.A.			
Sugar & Ethanol	Bonsucro EU Production Standard	Usina Barra Grande de Lençois S.A.			
Sugar & Ethanol	Bonsucro EU Production Standard	Usina Moema de Açucar e Alcool Ltlda.	Bunge	Multinational	Agri-food and energy
Sugar & Ethanol	Bonsucro EU Production Standard	Usina Frutal de Açucar e Alcool S.A.			
Sugarcane	Bonsucro EU Production Standard	Unidade Consquita do Pontal	ETH Bioenergia	Belongs to Odebrecht, with 33% shares held by the Japanese company Sojitz Corporation	Ethanol
Sugar & Ethanol	Bonsucro EU Production Standard	USJ Açucar e Alcool S.A.	USJ	joint venture with Cargill	Sugar, ethanol, electricity
ETBE	Bonsucro	UNIB Bahia	Braskem S.A.	Multinational	Green plastic
ETBE	Bonsucro	UNIB Rio Grande do Sul			

Source: Bonsucro

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