RED’s Biofuel Certification Schemes: comparing stringency and costs

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Voor mijn ouders, die me altijd gesteund hebben

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Abstract

The European Union has set a mandatory 10 percent target for renewable energy sources in the transport sector. The Member States are responsible for reaching this target, in accordance with the Renewable Energy Directive (RED). Meeting this target will largely depend on sustainable biofuels. The certification schemes safeguarding the sustainability of biofuels differ in stringency and costs. Within this thesis, evidence is provided on the direct relationship between the two.

The certification schemes were assessed on stringency and costs resulting in a multi-criteria analysis (MCA) further investigating the differences between the schemes and identifying the preferable standard in terms of stringency and costs. Multi-stakeholder initiatives (MSIs) are more stringent but the company initiated certification scheme is less expensive. The preferable standard depends on the relative importance of stringency and costs.

Important issues related to biofuels are currently not included in the standards. These issues will have to be addressed in order to truly push to biofuel market towards more sustainable practices.
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### Abbreviations

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<td>2BSvs</td>
<td>Biomass Biofuels voluntary scheme</td>
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<td>ISCC</td>
<td>International Sustainability and Carbon Certification</td>
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<td>RED</td>
<td>Renewable Energy Directive</td>
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<td>RSB</td>
<td>Roundtable of Sustainable Biofuels</td>
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<td>RTRS</td>
<td>Round Table on Responsible Soy</td>
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<tr>
<td>BEFSCI</td>
<td>Bioenergy and Food Security Criteria and Indicators</td>
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<td>BSI</td>
<td>Better Sugarcane Initiative</td>
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<tr>
<td>CBA</td>
<td>Cost-benefit analysis</td>
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<td>CEA</td>
<td>Cost effectiveness analysis</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>EPFL</td>
<td>Energy Center at the École Polytechnique Fédérale de Lausanne</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<tr>
<td>G CO₂ eq</td>
<td>grams of CO₂ equivalent</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GMO</td>
<td>Genetically Modified Organism</td>
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<td>HCVA</td>
<td>High Conservation Values Areas</td>
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<td>IDB</td>
<td>Inter-American Development Bank</td>
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<td>ILO</td>
<td>International Labor Organization</td>
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<td>ILUC</td>
<td>Indirect land use change</td>
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<td>MJ</td>
<td>Mega Joule</td>
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<td>MS</td>
<td>Member States</td>
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<tr>
<td>MSI</td>
<td>Multi-Stakeholder Initiative</td>
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<td>MTI</td>
<td>Market Transition Initiative</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>RBSA</td>
<td>Abengoa RED Bioenergy Sustainability Assurance</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
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<td>USA</td>
<td>United States of America</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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Definitions

Ambition: refers to degree the standard goes beyond existing regulation (Kalfagianni and Pattberg, 2012).

Attestation: “issue of a statement, based on a decision following review that fulfillment of specified requirements has been demonstrated” (EC, 2010, p. 6).

Audit: “systematic, independent, documented process for obtaining records, statements of fact or other relevant information and assessing them objectively to determine the extent to which specified requirements are fulfilled” (EC, 2010, p. 6).

Biofuels: “liquid or gaseous fuel for transport produced from biomass” (EC, 2009a, p.27)

Certification: “third-party attestation related to products, processes, systems or persons” (EC, 2010, p. 6).

Certification schemes: Certification schemes for agricultural products and foodstuffs provide assurance (through a certification mechanism) that certain characteristics or attributes of the product or its production method or system, laid down in specifications, have been observed. They cover a wide range of different initiatives that function at different stages of the food supply chain” (EC, 2010, p. 2).

Completeness: A certification scheme is considered complete if it includes all relevant sustainability criteria (Kalfagianni and Fuchs, 2012).

Comprehensiveness: “Comprehensiveness refers to whether a standard has a broad or a narrow sustainability focus” (Kalfagianni, 2010, p. 4). In addition to this definition, comprehensiveness will also refer to whether a standard has a broad or a narrow socio-economic focus.

Feedstock: A biomass source used to produce bioenergy (Kadam and McMillan, 2002).

Food security: “A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2000, p. 26)
**Indicator:** Part of the operationalized variable. The indicator measures (part of) the characteristic (Baarda and de Goede, 2006). See also: operationalization.

**Market equilibrium:** Intersection of the demand and supply curve indicating the price and quantity traded (Harris, 2006).

**Market price:** The price on the market. Goods or services are traded at this price (Tietenberg and Lewis, 2010).

**MSI:** “In multi-stakeholder initiatives (MSI) different stakeholders decide upon the rules for business” (Starmanns, 2010, p. 3).

**Operationalization:** Making a characteristic measurable. The operationalized characteristic is called a variable. In the process of operationalization categories are created containing one or more indicators (Baarda and de Goede, 2006).

**Reversal point:** In an MCA, the reversal point is the point in which the ranking of the two selected alternatives is changed (Janssen et al., 2006).

**Smallholder:** “Farmers would qualify as smallholders when the expenses of direct certification of their product would be more than 2% of the value of the commodity produced” (IFOAM, 2003 p. 9).

**Specified requirement:** “need or expectation that is stated” (EC, 2010, p. 6).

**Standard:** The specifications of the certification scheme expressed in principles and criteria.

**Standardization:** The goal of standardization is to make criteria comparable (Poot, 2007). Two methods of standardization are used in the Multi-Criteria Analysis, transforming data into scores between 0 and 1.

**Stringency:** “Stringency refers to the degree to which the standards require actors to implement behavioral changes” (Kalfagianni and Pattberg, 2011, p. 11).
1 Introduction

In 2020, 10 percent of the fuel consumption of the transport sector in the European Union (EU) will be replaced by renewable energy sources (EC, 2009a). Most of this target will be met with sustainable biofuels (L. Máthé, 2012). Biofuels are “liquid or gaseous fuel for transport produced from biomass” (EC, 2009a p. 27). Biomass includes all organic material, but in case of biofuels it mostly refers to grown plants or agricultural residues. The 10 percent target is in accordance with the directive 2009/28/EC of the EU, better known as the Renewable Energy Directive (RED), which states that the European community, or Member States (MS), must comply with this mandatory target (EC, 2009a). In order to achieve this target the MS need to, for instance, blend sustainable biofuels into conventional fossil fuels. The RED aims to ensure the use of sustainable biofuels only (EC, 2009a). Noteworthy (and crucial for this research) is the word ‘sustainable’. The biofuels must meet the sustainability criteria included in the EU RED.

These sustainability criteria included in the RED are safeguarded by certification schemes: they provide the evidence required to prove the sustainability of biofuels. These certification schemes issue certificates labelling biofuels as sustainable. Currently, a plurality of such schemes can be identified at the global and regional (EU) levels. By April 2012, eight of these certification schemes have been approved by the European Commission (EC), on the basis of the EU RED, in order to signal to European countries that they fulfill the minimum sustainability criteria and confirm the credibility of the voluntary sustainability standards and certification schemes. The eight EC approved voluntary certification schemes are:

1) Abengoa RED Bioenergy Sustainability Assurance (RBSA);
2) Biomass Biofuels voluntary scheme (2BSVs);
3) Bonsucro EU;
4) Greenenergy Brazilian Bioethanol verification programme (Greenenergy)
5) International Sustainability and Carbon Certification (ISCC);
6) Roundtable of Sustainable Biofuels EU RED (RSB EU RED)
7) Round Table on Responsible Soy EU RED (RTRS EU RED); and
8) ENSUS
(EC, 2011a; EC, 2012)

The last certification scheme, ENSUS, received approval on the 19th of April (EC, 2012). This certification scheme is not included in this research, because the start of this research was prior to the date of approval. More certification schemes are awaiting approval and when they meet the sustainability criteria established in the RED are identified, they will join the eight schemes currently approved (J. van de Staaij, 2012)\(^1\).

The reason for the plurality of certification schemes can be partially accredited to the existence of different feedstocks, i.e. biomass sources used to produce bioenergy (Kadam and McMillan, 2002). The RTRS focuses on soy, Bonsucro on sugarcane and Greenenergy mostly on bioethanol made from

\(^1\) Throughout the thesis: sources including an initial represent open communication with said person
sugarcane from Brazil. Furthermore, the market of biofuel certification is highly competitive: the eight systems compete in the market to get a share of the money involved in this market. However, more differences are present and are elaborated on in this thesis.

If adopted on a large scale, these schemes have the potential to transform the global biofuel market towards more sustainable practices. If many companies uphold the minimum sustainability criteria in the RED, then the market will be more sustainable, since more companies apply more sustainable practices. The approval of the certification schemes by the EC gives the schemes the necessary legitimacy for such success. Furthermore, the mandated target of 10 percent renewable energy sources used in the transport sector in the EU will increase the chances of success. The legislative obligation for companies is set by the EU, therefore forcing the uptake of certification schemes. If sustainable produced biofuels become the preferred type of biofuel this can further boost the uptake of certification schemes.

The uptake can, however, be limited by the costs of certification. Research shows, that the costs of certification play a crucial role in that respect as they may exclude certain important actors from the market (González and Nigh, 2005; Kalfagianni and Pattberg, 2011). For example, smallholders (typically situated in developing countries) tend to face financial and organizational constraints that exclude them from certification (Barrett et al., 2001). Moreover, an exclusion of certain actors, such as smallholders, from participation on the basis of certification costs is problematic particularly when these actors already are environmentally sustainable but lack the financial means to verify that (González and Nigh, 2005).

**Research question and objectives**

This research explores certification schemes approved by the EC in accordance with the EU RED in a comparative manner in order to find an answer to the following question:

*Does variation in stringency explain variation in the certification costs of EC approved voluntary certification schemes for biofuels and which of these schemes is preferable in terms of stringency and cost?*

In order to answer this question, several sub-questions need to be answered:

- What level of stringency is adopted by the different schemes in terms of targets, comprehensiveness, completeness and compliance mechanisms?
- What are the direct costs for the certification scheme (per scheme)?
- What are the indirect costs for certification?
- How do differences in stringency relate to the differences in costs?

It is scientifically relevant to investigate the relationship between stringency and costs, because it gives insight in the determining aspect of the certification costs. This research has societal relevance as well: this research helps companies aspiring certification to make an informed decision. Based on the outcome of the investigation of the costs of the schemes, smallholders with less financial means will be able to make the switch to certified sustainable production with the lowest possible costs.
Smallholders and other companies can choose the desired stringency based on the financial means at their disposal. This insight in certification schemes can take uncertainty about costs away for companies and therewith generate more uptake of the certification schemes. Furthermore, recommendations to certification schemes are included in order to improve the standards of the certification schemes.

The thesis is structured as follows. In chapter two, this thesis presents some background information on biofuels, in general, and the certification schemes approved by the EC, in particular. Subsequently, chapter three elaborates on the analytical framework and methodology used to answer the research question and sub-questions stated above. In chapter four the analysis and comparison of the certification schemes and the results are presented. Lastly, chapter five contains a discussion section on the research and the results, and the conclusions based on the findings. The recommendations for different stakeholders are included in the last chapter as well.
2 Background

“All of a sudden, you know, we may be in the energy business by being able to grow grass on the ranch! And have it harvested and converted into energy. That’s what’s close to happening.” (Bush, 2006).

In fact, this is already the case. Biomass is grown or collected and used for coal substitution and petroleum substitution. Coal substitution occurs when grown plants or by-products of agricultural practices are collected and burned to produce energy. Petroleum substitution occurs when feedstocks (grown biomass or residues) are turned into bioethanol or biodiesel (MacKay, 2009). Since the year 2000, biofuel production has expanded immensely. Figure 2.1 shows the production of 2000 to 2010 from approximately 18 billion litres to about 100 billion litres produced globally. The production has quintupled in ten years and in 2011 biofuels provided approximately three percent of total road transport fuel globally (on energy basis) (IEA, 2011). This share of biofuels is expected to increase in the next decades (Rosegrant et al., 2008; Slade et al., 2010).

![Figure 2.1: Global biofuel production 2000-2010](image)

Biofuels are currently the only renewable energy source in the world that requires a certificate of sustainability (Leal and Walter, 2010). Non-renewable energy sources are not sustainable by definition: these sources cannot be regenerated and can thus be depleted. Therefore, non-renewable energy sources cannot be used indefinitely. Renewable energy sources such as wind or solar can be used indefinitely and are energy sources with small life cycles: the production phase, the transportation phase, use phase and the disposal phase. The most complex parts of the life cycle are the production and disposal (or recycle) phase. During the use phase energy is produced without side effects, such as greenhouse gas (GHG) emissions (MacKay, 2009). For biofuels this is different: the life cycle is more complex than for other renewable energy sources. The production phase especially is not sustainable per se. The methods of production can be unsustainable if water and chemical use is
high, if residues are burnt, if forest or grassland is converted into agricultural land for biofuel production, if habitats are fragmentized or destroyed (WWF, 2010b). In order to ensure that biofuels are sustainable certificates are needed as evidence of sustainability.

The expansion of the use of biofuels instigates a closer look at the issues surrounding biofuels. Biofuels represent a controversial and, therefore, fascinating issue in environmental governance. On the one hand, biofuels have a positive connotation because of their low GHG emissions and the step away from the fossil fuel lock-in they can provide (UNEP, 2009). The biomass used for biofuel production absorbs the CO\textsubscript{2} using photosynthesis. The CO\textsubscript{2} emitted through combustion in engines is equal to the CO\textsubscript{2} stored by the plants thus there is no additional CO\textsubscript{2} emitted into the environment: it is part of the carbon cycle (Mathews and Tan, 2009).

On the other hand, there is debate on some issues related to the production of biofuels. The biggest debates on the negative side of biofuels, however, revolve around food security and indirect land use change (ILUC). Food security is "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2000, p. 26). When this is not the case there is food insecurity. Food security can be endangered by biofuels because food crops are used for the production thereof (MNP, 2008). Therefore there is less food available for consumption leading to an increase of the price of food because of scarcity. In case of non-food crops, the problem is that the land that is used for the production of the feedstock is no longer available for food production (Kaye-Blake, 2010).

The phenomenon of food security concerns as a result of biofuel expansion can be illustrated with the following example. Elobeid and Hart (2007) investigated changes in food prices in the United States of America (USA) in relation with biofuel production. A 10-dollar price increase on a barrel of crude oil, the demand for bioethanol made from corn doubles, leading to a 40 percent increase in the price of corn domestically. This price increase can have consequences for countries importing corn from the USA. The increase in price has consequences for the expenditure of people because the demand for food is inelastic, meaning that is the price increases the demand for food does not decrease (Tietenberg and Lewis, 2010). Thus, people pay more for corn and have less money left for other expenses. The debate is commonly known as the food versus fuel debate (Elobeid and Hart, 2007). The analogy of corn can be generalized to other commodities as well, e.g. soy, sugarcane, sugar beet. Moreover, corn is also used for feed purposes, therewith also increasing the price of meat and other animal products (Elobeid and Hart, 2007), because if feed prices go up, the product where the feed is used for, becomes more expensive as well.

Regarding the GHG emissions critics note that the life cycle of biofuels include more steps adding emissions to the balance than the growing of biomass and the combustion of biofuels (Mathews and Tan, 2009). More specifically, research shows that if the demand for food remains stable but food crops are used for biofuels, other land is converted into agricultural land to address the decline in availability of food. These indirect land use effects are difficult to monitor and are often not taken into account in the life cycle analysis of biofuels and therewith hide part of the carbon sequestration
loss and the related additional GHG emissions (Searchinger et al., 2008). For example, in the case of biodiesel made from soy in Latin America the additional GHG emissions from indirect land use change ranges from 13 to 1380 grams of CO\textsubscript{2} equivalent (g CO\textsubscript{2} eq) per Mega Joule (MJ) biofuel, while the total GHG emissions allowed under the RED is 58 g CO\textsubscript{2} eq/MJ for direct and indirect land use change (PBL, 2010). The range of the indirect land use change effects is big, because of the difficulty of monitoring the precise GHG emissions due to indirect land use change, but the consequences can be substantial nevertheless.

Furthermore, much of the production of biofuels takes place outside of Europe: 55 percent of biodiesel is produced in Europe (IndexMundi, 2011). Bioethanol is mostly produced outside of Europe: the USA and Brazil were responsible for almost 90 percent of bioethanol production in 2009 (FAO/GBEP, 2008). With that amount of production outside of the European Union it is difficult to ensure the sustainable preconditions with regard to society, economy and environment, because the Europe based certification schemes are not close to the production sites, making monitoring more difficult, therewith making it more difficult to ensure compliance with the sustainable preconditions.

The negative aspects of biofuels mentioned above called for a more sustainable way of producing biofuels (PBL, 2012). In order to prove that a company’s biofuel is sustainable, evidence is required. When in possession of a certified label for a biofuel, companies show their clients that their biofuel satisfies the sustainability criteria of the certification scheme; assuming that when a certification scheme is compliant with the sustainability criteria in the RED, the biofuel is sustainably produced.

On 23 April 2009 the European parliament and the council issued the directive 2009/28/EC (the RED) (EC, 2009a). In this directive mandatory targets for the MS are given. In 2020, 20 percent of energy in the energy consumption in the European community (i.e. all the MS) should come from renewable energy sources. Moreover, by 2020 10 percent of energy consumed by the transport sector will largely consist of sustainable biofuels as stated in the RED (EC, 2009a). In order to be considered sustainable these biofuels must adhere to certain sustainability criteria mentioned in the directive to safeguard areas with high biodiversity, endangered ecosystems and threatened species (EC, 2009a).

### 2.1 Sustainability criteria of EU RED

The Directive 2009/28/EC on the promotion of the use of energy from renewable sources (RED) is part of the EU strategy for biofuels. This strategy was developed in response to the significant contribution of transport to GHG emissions. The contribution of the transport sector account for 21 percent of total emissions. The second reason of the development of the strategy was the need for energy security in Europe. Diversifying fuel sources can strengthen energy security. The biofuel strategy was finished in 2006 and is intended to stimulate demand for biofuels while ensuring environmental benefits. The EC envisioned development of production and distribution of biofuels by enhancing the trade opportunities. Furthermore, the EC considers support of research and innovation essential in the field of biofuels. Lastly, the EC intends to support developing countries with potential for biofuel production (EC, 2006).
The RED was developed to promote the use of renewable energy sources in accordance with the biofuel strategy. The proposal of the EC occurred in 2008, the RED was published on the 23rd of April in 2009 and came into effect on the 25th of June that same year. The EC put the obligation of enforcement of the mandatory targets on the MS. The MS had until the 5th of December 2010 to transpose the directive into national law (EUR-Lex, 2009).

The content of the RED is aimed at promoting renewable energy sources and states mandatory targets for the use of renewable energy in the Member States. One of these targets is that in 2020 10 percent of energy consumed in the transport sector will largely consist of sustainable biofuels. In the directive sustainability criteria are included that biofuels have to comply with in order to be sustainable, which is part of the mandatory target (EC, 2009a).

The sustainability criteria that the biofuels have to comply with in order to be considered sustainable and contribute to the mandatory target of the MS are included in Appendix B. The sustainability issues covered by the criteria in the RED include GHG emissions and protection of ecosystems. GHG emissions savings of biofuels compared to fossil fuels must currently be at least 35 percent. On January 1st 2017 the GHG emission savings have to be 50 percent and January 1st 2018 60 percent. The biodiversity and ecosystem issues are reflected by criteria that prohibit biofuel production from raw material obtained from land with high biodiversity value, meaning areas with endangered ecosystem and species. Furthermore, grasslands and primary forests are considered lands with high biodiversity value as well. Lands that have sequestered much carbon are also not available for the provision of raw material for biofuel production. These high carbon stock lands are mostly wetlands and continuously forested areas. The last type of land prohibited to use for biofuel production is peatland (EC, 2009a).

2.2 Voluntary certification schemes under the EU RED

After the announcement of the EU target for sustainable biofuels the EC received 25 applications of certification schemes aspiring approval (EC, 2011b). In 2011, seven certification schemes received this approval from the EC. These seven schemes for biofuels satisfied all the mandatory criteria established by the EU in the RED. The seven schemes can be divided into two categories: the multi-stakeholder initiatives (MSIs) and the industry or company initiated initiatives.

An MSI consults and negotiates with multiple stakeholders in order to develop the principles and criteria of the standard. The stakeholders remain involved in roundtables of the certification schemes after the standard is developed and/or share best management practices (WWF, 2010a). Company initiated certification schemes do not involve stakeholders from throughout the supply chain. Their intention is to compete with MSIs: to achieve certification with the lower costs (Auld et al., 2008).

Within the seven approved certification schemes for biofuels this division between MSIs and company initiated schemes is also observed. The MSIs are Bonsucro, the ISCC, the RSB and the RTRS.
The company initiatives category consists of the RBSA, 2BSvs and Greenergy. The seven approved schemes are briefly presented below.

2.2.1 Abengoa RED Bioenergy Sustainability Assurance (RBSA)

The RBSA is a company initiated certification scheme developed by one of Spain’s biggest multinationals (EC, 2011b). The RBSA was developed specifically to make sure that the bioethanol produced by Abengoa Bioenergy was in line with the criteria stated by the RED. All ethanol feedstocks are included in this scheme and the scope of the RBSA is global (German and Schoneveld, 2011), meaning all feedstocks from any region can be certified. The RBSA only certifies companies within the supply chain of Abengoa Bioenergy, i.e. the certification procedure is not accessible for other companies that may be interested. The certified producers do not have to pay fees to the standard. The implementation of the measures needed to comply with the standard and auditing costs on the other hand are paid by the producer (Johnson et al., 2012). Abengoa Bioenergy has 18 biofuel facilities in North America, Europe and Brazil and the distribution of product focuses on the USA, France, the Netherlands and Brazil (Abengoa Bioenergy, 2011).

2.2.2 Biomass Biofuels Sustainability Voluntary Scheme (2BSvs)

Seven French grain and biofuel companies and associations developed the 2BSvs certification scheme to ensure compliance with the RED. The consortium of companies and associations is led by Bureau Veritas, which is also the certification body (EC, 2011b; German and Schoneveld, 2011). Bureau Veritas Certification issued its first certificates in accordance with the 2BSvs standard in August 2011 and has currently issued over 100 certificates. The 2BSvs certificates are valid for five years with annual surveillance audits to check if compliance with the standard is maintained. After the five years a re-audit of the certified company takes place to elongate the certificate (Bureau Veritas, 2011). The 2BSvs certification scheme is a company initiated scheme.

2.2.3 Bonsucro EU

The Bonsucro standard was previously known as the Better Sugarcane Initiative (BSI) (German and Schoneveld, 2011). Bonsucro is an MSI, which means that stakeholders from different parts of the supply chain are involved, as well as Non-Governmental Organizations (NGOs). In the case of Bonsucro, the elected board of directors contains various stakeholders. Furthermore, Bonsucro works with experts groups and committees containing a number of stakeholders. The expert groups on agronomy (the science of the use of plants for fuel, food, fibre, etc.), social aspects and processing and milling inform the certification scheme about good management practices regarding these aspects. The committees focus on topics as certification, communication, governance and the EU RED (Bonsucro, 2011c). The focus of the Bonsucro certification scheme is on ethanol made from sugarcane, mostly produced in Brazil (EC, 2011b). A Bonsucro certificate is valid for three years after which re-audit is needed to extent this validity. Every year a surveillance audit is conducted to check the company’s compliance with the standard (NL Agency, 2012).
2.2.4 Greenergy

This certification scheme is a company initiated scheme created by Greenergy, the principal road fuel provider in the UK responsible for more than 20 percent of road fuel (petrol, diesel and biofuel) sold in Britain (Greenergy, 2012). The biofuel supplied by Greenergy consists mostly of sugarcane-based biofuel produced in Brazil. Together with ProForest, Greenergy set up the criteria for their standard in order to comply with the sustainability criteria of the RED (German and Schoneveld, 2011). As is the case with RBSA above, the Greenergy standard is not accessible to parties outside its own supply chain. The Greenergy scheme focuses mostly on sugarcane produced in Brazil; however, trade of this commodity to Europe is currently in a stand-still (F. van der Velden, 2012).

2.2.5 International Sustainability and Carbon Certification (ISCC)

The ISCC certification scheme is an MSI, involving different stakeholders from throughout the supply chain. The ISCC uses technical committees to advise the board. The board reports to the general assembly, that consists of all members of the ISCC representing the stakeholders of the supply chain (ISCC, 2012). The German Government supported the development of the ISCC standard. The ISCC includes all feedstocks on a global level (German and Schoneveld, 2011). Certificates of the ISCC are issued for 12 months after which a surveillance audit is conducted to check compliance with the criteria from the ISCC. If compliance with the criteria is identified the validity of the certificate is extended for another year (NL Agency, 2012).

2.2.6 Roundtable on Sustainable Biofuels (RSB)

The RSB is an MSI hosted by the Swiss Federal Institute of Technology in Lausanne (EPFL) with members representing all stakeholders throughout the supply chain, including NGOs, researchers, farmers, investors, producers and governments (RSB, 2012). The RSB certifies all feedstocks available for biofuel and in any region (German and Schoneveld, 2011). In January 2012, the RSB created a non-profit independent entity to implement the RSB standard. This independent entity is based in the USA and is called RSB services foundation. This foundation is in charge of all certification issues including the applications for certification (RSB services foundation, 2011). The RSB certificates are valid for 24 months after which a re-audit is conducted to extent the validity of the certificate. Every year, a surveillance audit is conducted to check the compliance with the RSB standard (NL Agency, 2012).

2.2.7 Round Table for Responsible Soy (RTRS)

The RTRS is an MSI based in Argentina (German and Schoneveld, 2011). The reason the RTRS is based in Argentina is that Argentina used to be the soy production capital of the world until recently. Figure 2.2 depicts this was the case until 2009.
The RTRS standard was developed through consensus with a plurality of stakeholders involved in the supply chain, including producers, civil society and trade & financial actors (RTRS, 2010b). The RTRS focuses on soy-based biofuel produced in any region in the world. Certificates of the RTRS are valid for five years after which a re-audit is conducted to extent the validity. Every year a surveillance audit is conducted to assess if the certified company still complies with the RTRS standard (NL Agency, 2012).
3 Analytical Framework and Methodology

Does variation in stringency explain variation in the certification costs of EC approved voluntary certification schemes for biofuels and which of these schemes is preferable in terms of stringency and cost?

In order to answer this question, the sub-questions in the introduction need to be answered. Literature review and information from experts form the basis to answer these questions. Additionally, certain methods are applied to process the information retrieved from literature and provided by experts.

First, the assumptions made in this research are stated. These assumptions enable a line of reasoning, although the reality might differ from the assumptions. Second, the underlying hypotheses on which the research question is based are elaborated on and the theory that the hypotheses are founded on is explained. Third, the methodological framework is explicated. In this section all the elements of the research question are defined and operationalized. It describes the way the research question is answered and how the certification schemes are compared to each other.

3.1 Assumptions

Within this thesis certain assumptions are made. These assumptions are necessary to assess the real situation in order to keep the research manageable. Without the assumptions the research is too complex. The first assumption is that biofuels are considered sustainable if they comply with the sustainability criteria stated in the RED. It is debatable is this is in fact the case. The sustainability criteria included in the RED are just a small part of the story. However, if this assumption is not included in the research it is difficult to define when biofuels are sustainable. Sustainability can imply different things for different stakeholders. For instance, an environmentalist can regard sustainability as an effort to do anything in his or her power to reduce the impact on the environment. A company, however, can consider to be sustainable if its practices are sustainable within the limits of its financial means. By including this assumption there is a clear boundary and the certification schemes can be assessed accordingly. Moreover, without this assumption certification schemes that are not approved by the EC would need to be included as well. The research focuses on certification schemes for sustainable biofuels and without a definition on what is considered sustainable all schemes would require assessment on sustainability. This assumption also implies that companies certified by the EC approved certification schemes are considered sustainable as well.

The second assumption is that high stringency and low costs are preferable, i.e. stringency is beneficial and costs are not. From a sustainability perspective a more stringent certification scheme envisions a greater change towards sustainable production practices. If this change is achieved with low costs this means a more sustainable world with low costs, bringing more sustainable practices in reach. Furthermore, both variables (stringency and costs) are considered equally important and
receive the same weight in the comparison, because when one of the variables is attributed a higher weight than the other, this research would consider one of the variables more important than the other. It is not the intention of this research to assess the importance of the two variables and both are thus weighted indiscriminately.

The third assumption is that the list of sustainability criteria of the Food and Agriculture Organization (FAO) of the United Nations (UN) is both comprehensive and scientifically sound. Part of the assessment of stringency consists of measuring the comprehensiveness of the certification schemes (see paragraph 3.3.1.2). Theretofore, a list of sustainability criteria of the FAO is used. Although the use of a list of criteria from one source limits the research to some extent, the assumption is that the FAO used multiple scientific sources and various experts for their sustainability criteria. This assumption is based on a literature review in which it became apparent that many of the environmental and socio-economic criteria that are in the FAO’s list, also feature in other sources (e.g.: Diligent Energy Systems, 2011; Ecofys, 2007; Ecofys, 2008; IDB, s.d.; McLaughlin, 2008; ProForest, 2011). This research did not include sustainability criteria from other sources, which could allow room for bias.

3.2 Analytical framework and hypotheses

The research question stated in the beginning of this chapter is aimed at exploring the relationship between stringency and costs and to identify the best certification scheme regarding these two variables. The relationship between stringency and costs is investigated in several scientific sources, mostly focusing on an economic approach.

Economic theory suggests that with more, or stricter, regulations, costs increase. This relationship is observed, for example, in international trade and safety regarding food. The impact of a new food safety regulation is depicted in figure 3.1. The new regulation leads to an increase in stringency.
The situation in market equilibrium shows the price and quantity of food traded (Harris, 2006), i.e. the intersection of the demand curve $D_1$ and the supply curve $S_1$. These line intersect at $Q_1$ and $P_1$, reflecting quantity and price respectively. The food traded at that point at this point, a desire for safer food arises, shifting the demand curve from $D_1$ to $D_2$ showing that people are willing to pay more for safer food. The government reacts on this desire for safer food by imposing an extra food regulation, which will increase food safety. The difference with the starting point is thus an extra regulation in comparison with the initial situation. The extra regulation represents additional stringency. The extra regulation is accompanied by higher costs for the companies producing the food, because the companies have to comply with more regulations. The extra costs for compliance cause the food prices to increase (USDA, 2003). An example of the additional costs is a more stringent regulation on antibiotics used. If the extra regulation requires a company to use more antibiotics on its livestock in order to avoid a certain disease, extra costs are needed. The additional medicines for the livestock are accompanied by additional expenses on medicines. This increase is depicted by the shift of the supply curve from $S_1$ to $S_2$: the price per product is higher meaning that more turnover is created per product, which is an incentive for producers to make more of the product. The new equilibrium of demand and supply is at $Q_2$. The price people pay for that quantity of food is $P_2$. The quantity supplied and demanded decreased from $Q_1$ to $Q_2$. The increase in price, however, is greater than the decrease in quantity. This represents the inelasticity of the price of food. Food is a necessity; therefore an increase in the price of food will not lead to an equal decrease in the demand for food (Begg et al., 2003).

Tietenberg (1990) and Malpezzi (1996) observe a similar relationship between stringency and costs. Tietenberg states that more stringent standards are usually accompanied by higher costs. Malpezzi
uses housing prices and rents to observe this relationship. He found that in cities with more stringent regulations the rents and housing prices are higher than in cities with less stringent regulations (Malpezzi, 1996).

The direct relationship between stringency and costs is observed in different research areas. The question is if this relationship also holds in the field of biofuel certification. The hypothesis is that costs are in fact explained by the degree of quality. The quality of a standard is represented by the stringency of a standard. In other words: higher costs are explained by a higher degree of stringency.

Thus,

\[ H_0: \text{the differences in costs associated with a standard are explained by differences in the stringency of that standard} \]

The alternative hypothesis states that this relationship does not hold:

\[ H_A: \text{the differences in costs associated with a standard are not explained by differences in the stringency of that standard} \]

The alternative hypothesis does also hold in some cases. A Rolex (or Nikes, haute couture or a Chanel purse) is of high quality, but it also demonstrates prestige. Part of the price is paid just for the brand itself, regardless of the regulations in place. This relationship mostly holds for luxury items (Begg et al., 2003).

3.3 Methodological Framework

This research consists of an analysis of the relationship between stringency and costs and of a comparison of the seven EU RED approved voluntary certification schemes. These certification schemes fulfill the requirements on minimum sustainability criteria of the EU RED. In order to answer the research question stated in the introduction it is necessary to define the independent variable stringency and the dependent variable costs. Stringency is the independent variable because the null hypothesis \((H_0)\) is that stringency explains costs. The hypothesis therewith also states that costs is the dependent variable. However, these variables are difficult to measure. In order to analyze stringency and costs, the variables are operationalized. In the process of operationalization categories are created containing one or more indicators (Baarda and de Goede, 2006). By assessing the certification schemes in accordance with the indicators, comparison between the certification schemes is possible.

3.3.1 Stringency

“Stringency refers to the degree to which the standards require actors to implement behavioral changes” (Kalfagianni and Pattberg, 2011, p. 11), i.e. the stringency of a scheme reflects the degree to which actors are required to implement strict rules of conduct by the standard. These rules entail
both environmental and social conduct. The more stringent a standard is, the greater the potential change in behavior among certified firms (Auld et al., 2008).

In this research the stringency of a standard is assessed by examining the targets, comprehensiveness, completeness and compliance mechanisms of the standards. Thus, the independent variable stringency consists of four categories. These categories contain sub-categories and/or indicators that will be used to measure stringency. The data for the assessment of stringency is gathered from the websites of the standards and, if needed, through consultation with experts. Information on stringency was not available on the website of the RBSA. Although communication was established with the Sustainability & Strategic Consultancy Senior Engineer (J. López López) of Abengoa Bioenergy Corporation, this has not led to the needed information on the stringency of the standard. Without the information it is not possible to assess the standard on stringency and the standard is therefore excluded from the research.

3.3.1.1 Targets

The first category under stringency is targets. The indicators in this category are: clear and verifiable, detail and ambition. These three indicators are explained below.

Clear and verifiable: refers to what degree measurement of compliance with the standard is possible. A standard that contains criteria including quantitative targets enlarges the clearness and verifiability (Jungmann, 2011). The mandated GHG savings criterion in the RED is an example of a clear and verifiable target. Currently, the GHG savings must be at least 35 percent. An aspirant for certification that produces biofuel with a lower percentage of GHG savings does not comply. If, on the other hand, the target was formulated as “the biofuel must perform better than fossil fuels regarding GHG emissions” the target is less clear and verifiable. In that case, GHG savings of one percent and savings of 60 percent both comply with the criterion. The more clear and verifiable a standard is, the more difficult it is to fulfill the target, therewith increasing the stringency of the standard. Thus, there is a direct relationship between “clear and verifiable” and stringency via the category targets. The verifiability of the criteria within each standard is measured by assessing whether quantifiable targets are included and if documentation is a prerequisite.

Detail: a criterion in a standard is considered detailed if there are three or more indicators specifying the criterion. The detail of a standard is assessed simultaneously with the comprehensiveness of the standard. The assessment of the comprehensiveness is based on the degree to which a certain list of sustainability criteria is included in the standard (see paragraph 3.3.1.2). The detail is assessed for the sustainability criteria from this list included in the standard. If a criterion is detailed, the target is harder to reach, increasing the stringency of the standard. Therefore, detail and stringency are directly related.

Ambition: refers to degree the standard goes beyond existing regulation (Kalfagianni and Pattberg, 2012). In this thesis the existing regulation is the RED. The ambition is assessed simultaneously with the comprehensiveness of the standard. A standard is ambitious when the standard includes more of the FAO sustainability criteria than the RED does. In other words, the ambition is the additional
comprehensiveness of a standard over the RED: the RED has a particular level of comprehensiveness and the standard is ambitious if it is more comprehensive than the RED. The degree of ambition depends on the surplus of comprehensiveness. An increase in ambition also entails an increase in the stringency of a standard, i.e. ambition and stringency are directly related.

3.3.1.2 Comprehensiveness

“Comprehensiveness refers to whether a standard has a broad or a narrow sustainability focus” (Kalfagianni, 2010, p. 4). Comprehensiveness refers to whether a standard has a broad or a narrow environmental and socio-economic focus. In order to assess the comprehensiveness of a standard, the criteria of a standard are compared to a comprehensive list of sustainability criteria, representing all imaginable sustainability issues. In the literature review for this research the most comprehensive list of sustainability criteria found was the list of the FAO (FAO, 2010). The sustainability criteria are divided into three categories: environmental, socio-economic and governance. This list of criteria is considered comprehensive based on literature review: the criteria included in the FAO list also feature in many other scientific sources (e.g.: Diligent Energy Systems, 2011; Ecofys, 2007; Ecofys, 2008; IDB, s.d.; McLaughlin, 2008; ProForest, 2011): this reduces the chance of bias.
The list of sustainability criteria is shown in table 3.1, followed by a brief description of each of the criteria.

<table>
<thead>
<tr>
<th>A. Environmental</th>
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<tbody>
<tr>
<td>A.1 Land use changes (both direct and indirect)</td>
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<tr>
<td>A.2 Biodiversity and ecosystem services</td>
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<tr>
<td>A.3 Productive capacity of land</td>
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<td>A.4 Crop management and agrochemical use</td>
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<tr>
<td>A.5 Water availability and quality</td>
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<td>A.6 GHG emissions</td>
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<td>A.7 Air quality</td>
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<td>A.8 Waste management</td>
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<td>A.9 Environmental sustainability</td>
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<tr>
<th>B. Socio-economic</th>
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<tr>
<td>B.1 Land tenure/access and displacement</td>
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<td>B.2 Rural and social development</td>
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<td>B.3 Access to water and other natural sources</td>
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<td>B.4 Employment, wages and labor conditions</td>
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<td>B.5 Human health and safety</td>
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<td>B.6 Energy security and access</td>
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<td>B.7 Good management practices and continuous improvement</td>
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<td>B.8 Social sustainability</td>
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<td>B.9 Food availability</td>
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<td>B.10 Food access</td>
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<td>B.11 Food utilization</td>
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<td>B.12 Food stability</td>
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<td>B.13 Food security</td>
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<tr>
<th>C. Governance</th>
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<tr>
<td>C.1 Compliance</td>
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<td>C.2 Engagement and transparency</td>
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Table 3.1: Comprehensive list of sustainability criteria (adapted from FAO, 2010)

The first category from table 3.1 is A. Environmental. This category contains the yardstick sustainability criteria associated with the environment.

- A. 1 Land use change (both direct and indirect): this criterion entails the GHG-emissions from direct land use change and the consideration of indirect land use change. Land use changes impact biodiversity, since land is (e.g.) converted from forest into a plantation (Ismail et al., 2011). From a sustainability perspective it is preferable is biofuel
production is situated on degradable land instead of converting other types of land into agricultural lands.

- **A.2 Biodiversity and ecosystem services**: focuses on the impact of a project on the biodiversity of an area. An associated term here is HCVA (High Conservation Values Areas), comparable to the criteria included in the RED on high biodiversity value. The conversion of the types of land (primary forest, peatlands, grasslands, etc.) described in this RED criterion is not allowed. Due to conversion of land, fragmentation of habitats occurs, reducing the chance of survival of species, because the carrying capacity of the habitat decreases (Cook et al., 2002). Furthermore, the human-wildlife contact increases as habitat areas are encroached by human intervention, leading to attraction of animals to humans or animal avoidance with respect to humans (Whittaker and Knight, 1998).

Apart from the impact of a project on biodiversity, invasive species are taken into account as well. If non-indigenous, invasive species are used on the new plantation intended for the production of biofuels, there are possible impacts on the indigenous organisms (IDB, s.d.). These impacts are direct, in the way that indigenous species are removed to make room for the plantation. Indirect impacts occur because indigenous wildlife does not have access to the former vegetation and the spreading of the new vegetation through pollination (Bradshaw et al., 2007).

In this respect Genetically Modified Organisms (GMOs) are considered possible invasive species too, because the genetically altered species are not the indigenous species. GMOs could have impacts on indigenous organisms (JRC, 2010). When the biodiversity is endangered, the local ecosystems are threatened as well. With a decline in biodiversity, the ecosystem services value decline too (Swift et al., 2004).

- **A.3 Productive capacity of land**: this criteria looks at the crops life cycle including issues as soil erosion, water run-off and energy input for harvesting. Furthermore, crop rotation is considered, focusing on soil quality and crop biodiversity (Ismail and Rossi, 2010).

- **A.4 Crop management and agrochemical use**: here fertilizer management is considered as well as the pesticide use, where using none is preferred from an environmental perspective (Ismail et al., 2011). Other ways of reducing pests can be considered here, such as owls to reduce rats.

- **A.5 Water availability and quality**: this criterion includes water management, relating to water scarcity and water run-off. Furthermore, water usage, quality and contamination are taken into account (Ismail et al., 2011).

- **A.6 GHG-emissions**: addresses the GHG-emissions from direct land use change, energy input in the production phase, transportation and distribution phase, use phase, the energy balance and the GHG savings (IDB, s.d.).

- **A.7 Air quality**: Aside from air pollution, this criterion also looks at nitrogen emissions from fertilizer (Ismail and Rossi, 2010).

- **A.8 Waste management**: addresses the management of waste disposal, waste reduction and recycling in reuse (Ismail et al., 2011).
- A.9 Environmental sustainability: this criteria looks at whether an Environmental Impact Assessment (EIA) is conducted (Ismail et al. 2011).

The second category (B) included in the list of sustainability criteria, focuses on socio-economic criteria.

- B.1 Land tenure/access and displacement: addresses land ownership, traditional (including undocumented) land rights, right to proper compensation, people's access to land and land security (Ismail and Rossi, 2010; Ismail et al., 2011; IDB, s.d.).

- B.2 Rural and social development: addresses knowledge and technology transfer, locale income generation, local grower arrangements, community development and impacts on indigenous peoples (Ismail et al., 2011).

- B.3 Access to water and other natural resources: addresses impacts of the project on the access by local people to natural resources (Ismail et al., 2011).

- B.4 Employment, wages and labor conditions: addresses the provision of learning, labor standards, basic human rights at the work place and forced labor. This criterion includes equal treatment despite gender, race and contract and interdicts child labor (Ismail et al., 2011).

- B.5 Human health and safety: focuses on health condition, humane housing and disruption of food security (Ismail et al., 2011).

- B.6 Energy security and access: looks at whether the food supply or local biomass applications are endangered (Ismail et al., 2011). Typical biomass applications are: energy supply, medicines and building materials (WWF, 2011).

- B. 7 Good management practices and continuous improvement: addresses the overall efficiency of the project with respect to yield and energy balance (Ismail et al., 2011).

- B.8 Social sustainability: checks whether a Social Impact Assessment is conducted (Ismail et al., 2011).

- B.9 Food availability: addresses changes in land with respect to food production. This criterion looks at the physical presence of food (FAO, 2006).

- B.10 Food access: addresses provision of food and access to natural resources for both locals and indigenous people. Food access is ensured if people have enough (financial) resources to obtain food (FAO, 2006).

- B.11 Food utilization: addresses the use of food, including preparation, storage options, knowledge and quality of the food (FAO, 2006).

- B.12 Food stability: addresses the risk of a person/household/population losing access to food due to sudden shocks, e.g. economic or environmental crises (FAO, 2006).
- B.13 Food security: addresses food access and safety and nutrition of food, for all people, always. When one or more of the other four food criteria (B.9 to B.12) is not satisfied, food insecurity occurs (FAO, 2006).

The third and last category incorporated in table 2.2 is governance (C), focusing on criteria on compliance and engagement and transparency.

- C.1 Compliance: this criteria addresses human rights and labor rights. This criterion examines if the standard included the notion that national and regional laws should be complied to. Furthermore, international laws, conventions or agreements are considered.

- C.2 Engagement and transparency: addresses local stakeholder's access to information on environmental, social and legal issues, prior and informed consent to developments and benefits for the local community.

In order to measure the comprehensiveness of a standard the presence of the sustainability criteria of the FAO is assessed. Each of the 24 sustainability criteria of the list is ascertained for inclusion in the standard. A standard can fully satisfy a criterion, partially satisfy the criterion or the criterion may not be included in the standard, i.e. no satisfaction of the criterion is observed. The list of sustainability criteria is thus used as a yardstick to compare the criteria of the standards with. The FAO assessed five of the EC approved certification schemes in a binary fashion. The standards could either comply with the criterion or not. The addition of the partial satisfaction of a criterion gives more insight in the comprehensiveness of the standards, since the criteria of the FAO each consist of a plurality of aspects.

When a standard is more comprehensive a company aspiring certification needs to comply with more criteria, which increases the stringency. Therefore, comprehensiveness and stringency are directly related. The assessment of comprehensiveness differs from the assessment of ambition in the sense that the assessment of ambition measures the additional criteria the standards include compared to the criteria mandated in the RED. The assessment of comprehensiveness measures to what extent the standards included criteria covering all imaginable sustainability issues, represented by the 24 sustainability criteria of the FAO.

3.3.1.3 Completeness

A certification scheme is considered complete if it includes all relevant sustainability criteria (Kalfagianni and Fuchs, 2012). From the sustainability criteria of the FAO 10 criteria were chosen as most relevant.

The 10 most relevant criteria are:
- A.1 Land use change (both direct and indirect)
- A.2 Biodiversity and ecosystem services
- A.5 Water availability and quality
- A.6 GHG-emissions
- B.1 Land tenure/access and displacement
- B.3 Access to water and other natural resources
- B.5 Human health and safety
- B.6 Energy security and access
- B.13 Food security
- C.1 Compliance

The selection of these 10 most relevant criteria is based on the most pressing impacts related to bioenergy practices identified by World Wide Fund for Nature (WWF). The Market Transition Initiative (MTI) of WWF is directed at changing the way key global commodities are produced, processed, consumed and financed (WWF, 2012a). Within WWF and the MTI the issues represented by the 10 criteria above are considered most important (WWF, 2010b; WWF, 2012b).

The assessment of the completeness consists of checking which of these 10 criteria are included in the standard. This information is already available from the assessment of the comprehensiveness, since these criteria originated from the comprehensive list of sustainability criteria of the FAO. The assessment of completeness differs from the assessment of comprehensiveness in the sense that the assessment of comprehensiveness measures to what extent all imaginable sustainability issues are included in the standard. The assessment of completeness measures to what extent the most relevant sustainability criteria are included, represented by the 10 criteria stated above.

The outcome of this assessment is a percentage. Each standard includes a number of these 10 criteria, e.g. if a standard included three of the 10 criteria, the completeness of the standard is 30 percent.

### 3.3.1.4 Compliance mechanisms

Compliance refers to the robustness of the standard in ensuring that the certified producers comply with the standard (L. Máthé, 2012). In order to assess the standards on compliance mechanisms, four compliance mechanisms are investigated: monitoring, sanctioning, third-party auditing and the public accessibility of reports. The degree of inclusion of these mechanisms contributes to the stringency of a standard, because the company will have to make sure it complies with the standard or else the certification scheme and the public will find out, which has consequences for the retainment of the certificate and the image of the company respectively.

Monitoring: refers to checking, either by the producer itself or an independent agent, whether the company is still complying with all the criteria. Monitoring executed by an accredited auditor is more transparent than self-monitoring. The assessment of the monitoring mechanisms focuses on the monitoring mechanisms stated in the criteria of a standard.

Sanctioning: refers to the consequences for a company that does not comply (anymore) with the criteria in a standard. With the threat of a punitive measure, certified producer will be more likely to comply in order to avoid sanctions (Belli, 1980), such as a revoked certificate. The assessment of the sanctioning mechanisms is based on information made available by the standards on their websites.
Third-party auditing: in case of third-party auditing, an objective certification body examines the company for compliance with the criteria in a standard. The use of objective, third-party auditing enlarges the transparency.

Public accessibility of reports: refers to whether standards publish their annual report online. Furthermore, the accessibility of (summaries of) the audit reports is assessed. If both reports are available, the transparency increases. The assessment on the public accessibility of reports is based on internet websites of the standards, because they are publicly accessible.

3.3.2 Costs

The second part of the relationship stated in the research question is costs. This is the dependent variable, because it is, according to the hypothesis $H_0$, explained by the independent variable stringency.

In figure 3.2 the distribution of the certification costs is depicted. This figure is based on the certification costs of the RSB but can be generalized to get an insight in the certification costs of the other certification schemes. The largest share of the pie chart (89 percent) is accounted for by the costs to be included for the business plan. These are measures needed for compliance in the longer run (Spöttl and Vissers, 2011). For some criteria there is more time available to implement them, e.g. criteria on continuous improvement of production. An example of the continuous improvement that is required is the mandatory GHG savings targets stated in the RED. Currently, the target is set at 35 percent. In the future however, the mandatory GHG savings target is more stringent. In 2017 the target is 50 percent and in 2018 60 percent. This increase in stringency of the target demands improvement and, therewith, future costs. These required improvements are the largest share of the costs, depicted in figure 3.2 by the biggest part of the pie chart. J. Gilhuis (2012) later confirmed this distribution of the certification costs.

The inevitable efforts for compliance (six percent in the pie chart) are expenses required ad hoc for initial certification, i.e. changes in production practices to comply with the sustainability criteria in the standard. The direct costs (four percent) consists of the RSB fee (membership fee and license fee) and auditing.
This research set out to assess all the costs depicted in the pie chart. However, data on the implementation and compliance costs proved difficult to collect. The market of biofuel certification is new and highly competitive. Therefore, certification schemes are reluctant to provide information on the costs. Moreover, implementation and compliance costs are dependent on several factors and differ per case depending on the characteristics of the aspirant company (size, turnover, location, complexity, current level of compliance) (J. van de Staaij, 2012; J. Heinrich, 2012; H. Rodriguez Arias, 2012; F. van der Velden, 2012).

The data that is available is data on the direct costs: the various fees and audit costs of the certification schemes. This information is gathered through literature review, websites of the standards and through consultation of experts. A list with the consulted experts is in Appendix A. Greenergy was unable to provide the author with any information on the direct costs of their standard and is therefore also excluded from the research, because an assessment on stringency without an assessment on costs would not contribute to this research.

Apart from the direct costs mentioned above, the market price for biofuels and the market premium received by certified biofuel producers are also available. However, the market price, i.e. the price at which goods or services are traded in the market (Tietenberg and Lewis, 2010), and the market premium are not used in this research, because they are not representative for the costs of a standard. The market price depends on demand and supply (Begg et al., 2003) and does not reflect the costs associated with auditing, licensing, expenses of the standard, etc. Because the market price depends on supply and demand, the price can fluctuate every month, depending on the popularity of the biofuels of the certification scheme. The market premium is dependent on supply and demand as well. This premium can be an incentive to convert producing practices to sustainable practices (González and Nigh, 2005). Ideally, the premium is higher when the costs are higher (J. van Dam, 2012). The market price and the premium cannot be used for this research because they are both influenced by external factors. They are not independent variables, nor are they dependent variables: they are externalities.
**Direct costs**

The unavailability of the largest share of the certification costs limits the assessment of the costs. The assessment of the costs focuses on the four percent on which information was available: the direct costs. The direct costs are visible costs that are made directly including the membership fee, the registration fee, the certificate/license fee, the initial audit and the surveillance audit. The surveillance audit is an annual audit that assesses if the company still complies with the standard.

The different kinds of fees are mostly published on the website of the standard. The information on the costs of the audits was gathered through literature review and consultation of experts.

The cost of an audit differs per case, as well as per standard. The location of a producer, the turnover, the number of sites of feedstock, the complexity of the chain of custody, the volume of production and the complexity of the firm itself all influence the cost of an audit (J. van de Staaij, 2012; DNV, 2012; F. van der Velden, 2012). Nevertheless, for each standard the length of an audit was estimated. The length of an audit gives insight into the costs of an audit, because the daily fee for an auditor does not differ much within each certification scheme. Two experts (DNV and J. van de Staaij) provided the author with a comparable estimate for the daily fee of an auditor, i.e. 1000 euro per day per auditor.

**Indirect costs**

In addition to cost of auditing, some standards require the producer to pay a quantity dependent fee (e.g. a fee per metric ton of product) (NL Agency, 2012). In this research this fee is considered an indirect cost. The quantity dependent fee differs per standard and in the RSB standard the fee also depends on the production level.

Both variables (stringency and costs) are defined and the underlying categories and indicators are explained. Table 3.2 visualizes the operationalization of the variables. The first column contains the independent variable stringency and the dependent variable costs. The second column shows the categories within the variables. This is the first level of operationalization. The third column contains the next step in the operationalization, i.e. the sub-categories or indicators. The last column shows the last step in operationalization. Here the indicators of the sub-categories of column three are stated.

---

2 The consulted expert requested to remain anonymous
<table>
<thead>
<tr>
<th>Variable</th>
<th>First Level</th>
<th>Second Level</th>
<th>Third Level of Operationalization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stringency of standards</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Targets</td>
<td>Clear and verifiable/ measurable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Detail</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambition</td>
<td>Beyond legal requirements of the Renewable Energy Directive</td>
<td></td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td>Environmental</td>
<td>Input, output, preservation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Socio-economic</td>
<td>Incomes, labor standards, social impacts</td>
<td></td>
</tr>
<tr>
<td>Completeness</td>
<td>All relevant environmental/social challenges are addressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most relevant environmental/social challenges are addressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Few relevant environmental/social challenges are addressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance mechanisms / governance</td>
<td>Monitoring mechanisms</td>
<td></td>
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<tr>
<td></td>
<td>Sanctioning mechanisms</td>
<td></td>
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<td></td>
<td>Third-party auditing</td>
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<tr>
<td></td>
<td>Public accessibility of reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Direct costs</td>
<td>Membership fee, initial audit, surveillance audit, registration fee, certificate fee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect costs</td>
<td>Quantity dependent fee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2: Operationalization of the variables (Table adapted from: Kalfagianni and Fuchs, 2012)

The next paragraph elaborates on how the assessments of the variables in accordance with the table above are processed and, ultimately, compared to each other.

**3.4 Comparative approach**

This research uses a comparative approach to examine the differences between the certification schemes. Furthermore, the relationship between the two variables stringency and costs is investigated. Several comparisons have already been conducted (e.g. NL Agency, 2012; Diligent Energy Systems, 2011; German and Schoneveld, 2011). However, these comparisons have limited assessment criteria and/or do not include costs. Moreover, these comparisons do not reach a conclusion on what the preferable certification scheme is in terms of stringency and costs. The addition of a valuation of the certification schemes gives insight the cost-benefit ratio of the certification schemes, assuming the variable costs is a cost and the variable stringency is a benefit.

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In order to accept or reject the hypothesis $H_0$, an assessment of the stringency and costs is required. A visual aid helps in this process. Furthermore, a valuation of the certification schemes that puts forth the preferable standard in terms of stringency and costs adds value to the research. Three methods frequently used for comparison are cost-effectiveness analysis (CEA), cost-benefit analysis (CBA) and multi-criteria analysis (MCA) (Driessen and Leroy, 2007). The difficulty in decision-making is the different characteristics of information: information can be both qualitative and quantitative (San Cristóbal Mateo, 2012). The former two methods (CEA and CBA) require quantitative data in order to assess which alternative is preferable. An MCA is a decision-making tool designed to identify the best alternative based on different factors. It is possible to include quantitative data, such as costs in terms of money, and qualitative data, such as a plus or a minus indicating an order of preference without quantifying the data (Poot, 2007). An MCA can handle both types of information and therewith aid decision-making. In this research an MCA is conducted to assess which alternative is preferable, because of the amount of qualitative data acquired. The software used for the MCA is DEFINITE 3.1 (Janssen et al., 2006), available at the Institute for Environmental Studies (IVM) at the Vrije Universiteit Amsterdam.

3.4.1 The effects table

In order to conduct the MCA, table 3.2 is transformed into an effects table, shown in table 3.3. The outcomes of the assessments of the five standards are put in the effects table to produce the output of the MCA.
The first row of the table shows the alternatives used in the MCA. Each certification scheme has two alternatives: one without membership and one with membership. The latter is called “[certification scheme] (member)”. Bonsucro is the only exception, because membership is mandatory. This division in two alternatives is significant for the ISCC, because the costs differ for members and non-members. In the ISCC members pay an annual membership fee, while non-members do not. However, members pay a lower quantity dependent fee: a fee per ton of product. The other standards do not differentiate the costs for members and non-members. The alternatives without membership are less expensive because the membership fee is excluded, although for the ISCC the alternative without membership is only less expensive until a certain production level because of the membership discount on the quantity dependent fee. The membership alternatives are included in
order to give a decision maker that uses this MCA as much information as possible. The decision maker may value the advantages of membership higher than the additional costs of the membership fee and may therefore prefer a membership alternative. The advantages of membership that may drive this preference for the membership alternatives are (e.g.) involvement in meetings and influencing further development of the standard. The alternatives with membership are therefore included: the decision maker can compare the membership options (if preferred) and ignore the less expensive, non-member alternatives.

The first column shows the variables, categories and the indicators. The variables stringency and costs are shown in **bold**. The variable stringency contains four categories: targets, comprehensiveness, completeness and governance. The categories, except for comprehensiveness, in their turn contain indicators. The category comprehensiveness is further divided in two categories: environmental and socio-economic. These subgroups contain the criteria to assess the comprehensiveness and thus part of the stringency.

The second column is named “C/B”. The C stands for Cost, the B for Benefit. This column determines if the criterion is a cost or a benefit, i.e. if a high score on the criterion is preferable (benefit) or not (cost). In case of a benefit criterion the higher the score, the more preferable the alternative is. For a cost criterion, the higher the score of an alternative is, the less preferable the alternative is. Thus, high scores on benefit criteria lead to a higher ranking of an alternative and high scores on cost criteria cause a lower ranking. The categories targets and comprehensiveness do not have an indication of cost or benefit, because these categories only contain criteria that are scored with a zero, a plus or two plusses. These options for the score indicate if the score is beneficial or not.

Lastly, the third column shows the unit in which the score is measured. The categories targets and comprehensiveness use an ordinal scale, a qualitative approach. An alternative can score 0, + or ++, where ++ is preferable over +, which is preferable over 0.

The category completeness is stated in the form of a percentage. The percentage shows the share of relevant environmental and socio-economic criteria included in a standard. 100 percent is preferable, because then all the relevant criteria are included in the standard. Therefore, this criterion is a benefit: the larger the share of included relevant criteria, the better.

The category governance contains two qualitative criteria of which the options are also 0, + or ++. In addition, the category contains two binary criteria. The criterion is either fulfilled or it is not. For both criteria it is beneficial to comply with these criteria, therefore it is considered a benefit.

The variable costs is divided in four different costs and are all cost criteria: the higher the cost, the lower the score. The membership costs are embedded in the direct costs. This criterion is measured in euro per year, because the membership fee is an annual fee. The initial audit is a non-recurring cost and is therefore measured in euros. The surveillance audit is an annual audit that checks compliance with the standard. The surveillance audit is measured in euro per year. The last criterion in the category costs is the indirect costs. This criterion consists only of the quantity dependent fee.
The cost of this fee changes for each production level in the RSB. In order to be able to compare all standards, the production is set on 100 million gallons of biofuel (or 333,250 metric tons).

In chapter four the standards are assessed on all categories, on all criteria. The scores of the alternatives on each criterion are put in the effects table. Once the effects table is completed, it is time for the next step of the MCA: standardization.

3.4.2 Standardization

The effects table contains the data of the alternatives for each criterion. However, without standardization and weight setting comparison is not clear, because the relative distance between the scores of the alternatives are difficult to comprehend without standardization. Standardization transforms the data for the criteria found for the alternatives into scores between 0 and 1. There are three different methods for standardization applied in this thesis.

The method of maximum standardization is used most often. The standardized score is the original score relative to the highest score. The highest score in a benefit criterion is transformed to 1. The standardized scores for the remaining original scores are calculated using this equation:

\[
\text{Score criterion} = \frac{\text{Standardized score}}{\text{Highest score}}
\]

In case of a cost criterion a higher score means that the alternative is less preferable based on that criterion. Therefore, the alternative with the highest score (i.e. the highest costs), scores 0 on the corresponding criterion. The remaining scores are calculated using the following equation:

\[
\text{Score criterion} = 1 - \frac{1}{\text{Highest score}}
\]

(Poot, 2007)

Scores for the completeness of a standard are standardized using the method of goal standardization. The original scores of the alternatives represent a percentage of the most relevant criteria included in the standard. If a standard includes all relevant criteria it has a score of 100 percent, which is, from a sustainability perspective, is preferable. More than 100 percent is not possible. In order to keep the percentages intact this method of goal standardization was used. By using this method the maximum score is defined by a value representing a certain goal (Poot, 2007). In this case the goal is 100 percent. The original scores are scaled down to a number between 0 and 1, but the differences between the relative distances between the scores of the alternatives remain the same.

The original scores for the binary criteria do not need to be standardized. The original scores are scores of 0 and 1, representing non-fulfillment or fulfillment of the criterion respectively.
3.4.3 Weighting

In an MCA weights are attached to the criteria. The weights represent the relative importance of the criteria (Poot, 2007). This research did not assess the relevance of the criteria and did therefore not attach a higher weight to a certain category. The variables stringency and cost are considered equally important and received the same weight, because this research does not investigate the relative importance of the two variables and both variables are thus valued with equal importance.

The overall weight of the MCA is 1; therefore stringency and cost both have a weight of 0.500, because the two variables are considered equally important. Each category is divided either into more sub-categories (e.g. comprehensiveness is divided in environmental and socio-economic) or directly into indicators. The sub-parts (either sub-categories or indicators) determine the score of the overarching category. For instance, if a category contains four sub-categories (or four criteria) each of the sub-parts weighs 0.250 within that category. The actual weight of the sub-part for the overall MCA is lower than 0.250, only within the parent category the weight equals 0.250.

The weight distribution usually influences the outcome of the analysis substantially. Ideally, the end-user (decision-maker) is involved in attributing the weights to the variables according to the preferences and application of the analysis. Since no decision-makers were involved in the analysis the research includes two perspectives: one perspective attributes more weight to stringency, the other one to costs. These perspectives are meant to represent different decision-makers and their preferences. The weight division used is 0.750 and 0.250 and vice versa. The two perspectives provide an alternate weight set, resulting in a different ranking. In paragraph 3.4.5 an additional approach is discussed, further exploring the consequences of altering the weight set and, therewith, providing potential decision-makers with more insight in alternative rankings based on different preferences.

3.4.4 Ranking

When the original scores are standardized and the weights for the variables and the underlying categories and/or indicators are set an outcome is produced using the weighted summation method. This method consists of multiplying the standardized scores with the attached weights. Subsequently, the outcomes are added per alternative. Based on the total score of the alternatives a ranking is produced (Poot, 2007).

The ranking is depicted as a bar chart. Bigger bars represent the preferable outcome. This is also true for the cost criteria: the standardization changed the original scores into standardized scores. A low original score on a cost criterion results in a high standardized score. Thus, in the ranking, bigger bars are always more preferable.

3.4.5 Sensitivity

This research did not assess the relative importance of the variables, nor of the criteria. To that end a sensitivity analysis is conducted. A sensitivity analysis assesses to what degree the ranking of the alternatives depends on the weight of a criterion (Poot, 2007). The program used for the MCA calculates the reversal points. The reversal point is the point in which the ranking of the two selected alternatives is changed (Janssen et al., 2006), i.e. the weight at which point another alternative ranks
higher. The sensitivity analyses on the weights of the two variables goes beyond the inclusion of the two perspectives described above in paragraph 3.4.3. A sensitivity analysis states the exact reversal points that are not included in the perspectives. The perspectives state an alternative ranking at a different weight set. The sensitivity analysis and the reversal points indicate where the tipping points of the ranking are. If a decision maker values costs more than stringency, but less so than demonstrated in the two perspectives, the ranking remains equal to the initial situation. However, by investigating the reversal points (the tipping points) it can become evident that an alternative ranks second at the equal division of weights (i.e. the initial situation) but ranks first if costs has a weight of (e.g.) 0.600 and stringency has a weight of 0.400.
4 Analysis and Results

In this chapter the five certification schemes are assessed on stringency and costs in accordance with the method described in chapter three. The assessments of the five certification standards are described per indicator. First, the variable stringency is assessed by checking the standards on the underlying operationalized indicators. Subsequently, the variable costs is assessed in the same manner. Third, the comparative approach is executed using an MCA. Lastly, the hypothesis is accepted or rejected based on the assessments and the comparison of the certification schemes.

4.1 Stringency

The stringency of the certification schemes is determined by assessing the targets, comprehensiveness, completeness and ambition of each standard.

4.1.1 Targets

The first category of stringency is targets. In chapter three this category was subdivided into clear and verifiable, detail and ambition. These indicators are assessed one by one and each indicator concludes with a table summarizing the results. These tables are combined to form the effects table needed for the MCA software DEFINITE 3.1.

Clear and verifiable

The clearness and verifiability of a standard is assessed by comparing the standards to each other. The principles and criteria of the certification schemes are used for this assessment. The references included in this assessment refer to the standard on which the assessment of the author is based. The standard with the most clear and verifiable criteria has the highest score. The standard with the least clear and verifiable criteria receives the lowest score. The remaining three standards score higher than the least clear and verifiable standard and lower than the most clear and verifiable standard. The scores range from 0 to ++ where the latter is the highest score. The scores of the standards are stated behind each paragraph.

The standard 2BSvs is the least clear and verifiable. For each criterion a number of verifiers is stated, which eases the process for the company, because the verifiers form a checklist for compliance. For example, to comply with the EU RED criterion of GHG emission savings, biofuel producers should develop a plan for increasing the GHG savings from 35 percent currently to 60 percent in 2018. The verifier to this criterion is a reduction plan or procedures developed to monitor progress (2BSvs, 2011a). With these verifiers the requirements for compliance with the criterion are clear. However, most of the criteria in the standard are not clear and verifiable. For example, the criteria in Principle 7 on Soil, water and air protection are not clear, but are verifiable. The criterion on soil states that the entity should inform biomass producers that raw material does not come from land where soil, water and air are not protected. Although this criterion is clear on the target, the
protection measures for soil, water and air are not defined. Moreover, the verifier consists of an information pack, however, the guidelines for this information pack are not given. Therefore, it may just be that the entity informs biomass producers of the criterion (i.e. raw material does not come from land where soil, water and air are not protected) without information on how to do this. The communication with these suppliers requires documentation so verification is possible (2BSvs, 2011a). There are no quantifiable targets included in the 2BSvs standard, which makes the verification of compliance harder. The verifiers included in the standard do make the criteria clear for companies aspiring certification, although the verifiers are not further explained as in the information pack example. (0)

The Bonsucro standard is the standard that scores best on this indicator. The inclusion of quantifiable targets, the use of clear criteria and requirements on documentation contribute to the clearness and verifiability of the standard. For example, criterion 3.2 in the Bonsucro standard on the monitoring of GHG emissions with a view to minimizing climate change impacts includes a clear and verifiable indicator: global warming burden per unit mass product. For ethanol produced the grams carbon dioxide per MJ may not exceed 24 (i.e. g CO₂-eq/MJ fuel < 24) (Bonsucro EU, 2011). The inclusion of the indicator in the form of a measurable unit and a limit to the global warming burden per unit mass of product shows that the criteria of the Bonsucro standard are clear and verifiable. (++)

The ISCC standard is clear and verifiable albeit less so than the Bonsucro standard. The ISCC includes some quantifiable targets and uses clear criteria. Documentation is required for compliance with the criteria. For example, the criterion on the use of fertilizer (4.2.6) contains eight indicators each with a number of verifiers. Fertilizers with a content of more than 1.5 percent nitrogen are not allowed to be used. This is a verifiable target, although it does not specify anywhere how much of approved fertilizer can be used. Documentation of the use of fertilizer is required including information on where the fertilizer was used, when, how much and which fertilizer it was (ISCC, 2011a). The detail of this documentation makes the criterion verifiable, however there are no limits stated on the use of fertilizer. (+)

The RSB standard states minimum requirements at each criterion, which creates a clear overview of the measures needed to comply with the criterion. Although few quantifiable targets are given, verification of the minimum requirements is possible through the minimum requirements. The criteria included in the RSB standard are not open for interpretation: the criteria are clear. For example, criterion 9.b states that an entity shall include a water management plan aiming at efficient water usage and enhancement of water quality. The criterion states which biofuel operators (biomass producer, gathering entity and biofuel producer) must comply with the criterion and what the minimum requirements are. The aspects to be included in the water management plan are stated in these minimum requirements and consistency with local rainfall conditions and any local or regional water management plans is required (RSB, 2010a). (+)

The criteria in the RTRS standard are clear and verifiable. The description in the standard is short, but guidance on the criteria is included in an annex. This guidance includes points of
verification of which some are quantitative targets. The criteria are not open for interpretation. For example, criterion 5.1 on the preservation or improvement of the quality and supply of surface and ground water is subdivided in four indicators. One of these indicators (indicator 5.1.2) states that monitoring to demonstrate that practices implemented to maintain or enhance water quality and supply are effective. More specifically, monitoring of parameters such as temperature, pH, turbidity, dissolved oxygen and electrical conductivity is required (RTRS, 2010a). This inclusion of parameters increases the verifiability and indicates to the applicant what is needed to comply with the criterion. However, it is not a quantitative target and verification is therefore possible but not ideal as is the case with the Bonsucro standard. (+)

Not many standards include quantitative targets. The only standard that includes quantitative targets extensively is Bonsucro. Therefore, Bonsucro has the highest score for this indicator (++). 2BSvs included verifiers for each criterion in the standard. However, these verifiers form a checklist for companies to comply rather than a verification tools for monitoring and auditing. The remaining three schemes are more clear and verifiable than the 2BSvs standard, but less so than the Bonsucro standard. The standards can increase the clearness and verifiability of the criteria by including more quantitative targets. The company initiated standard includes less clear and less verifiable criteria than the MSIs.

In table 4.1 the scores of the five alternatives are summarized.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on 'clear and verifiable'</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>0</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>++</td>
</tr>
<tr>
<td>ISCC</td>
<td>+</td>
</tr>
<tr>
<td>RSB</td>
<td>+</td>
</tr>
<tr>
<td>RTRS</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 4.1: summary of the results on the indicator 'clear and verifiable'.

Detail

The assessment on detail is conducted using the 24 FAO sustainability criteria. The FAO sustainability criteria included in the standards are assessed on detail. If a criterion is specified with three or more indicators, the criterion is considered detailed. The score for the standard depends on the number of FAO sustainability criteria that are detailed. If a standard has one to eight detailed criteria the standard is not very detailed and is scored with a (0). If a standard has nine to 16 detailed criteria the standard is considered as quite detailed and is scored with a (+). If a standard has 17 to 24 detailed criteria the standard is very detailed and is scored with (++).
The standard 2BSvs includes no detailed criteria: none of the included FAO sustainability criteria are specified with three or more indicators (2BSvs, 2011a). This standard is therefore considered as not detailed and scores a (0). Both the Bonsucro standard and the ISCC standard provide three or more indicators for nine of the 24 sustainability criteria (Bonsucro EU, 2011; ISCC, 2011a). These standards are considered to be quite detailed and score a (+). The RSB standard is detailed in 20 of the 24 sustainability criteria (RSB, 2010a) and is therefore considered to be very detailed and scores (++). The RTRS standard includes three or more indicators for 10 of the 24 criteria (RTRS, 2010a). The standard is thus considered as quite detailed and scores a (+). The MSIs perform better on detail than the company initiated standard 2BSvs. The results are summarized in table 4.2.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on 'detail'</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>0</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>+</td>
</tr>
<tr>
<td>ISCC</td>
<td>+</td>
</tr>
<tr>
<td>RSB</td>
<td>++</td>
</tr>
<tr>
<td>RTRS</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 4.2: summary of the results on the indicator 'detail'.

Ambition

The assessment of the ambition of each of the standards is based on the degree of additional comprehensiveness of the standards compared to the RED, i.e. to what extent the standards exceed the legal requirements represented by the mandatory sustainability criteria in the RED. If a standard includes more FAO sustainability criteria than the RED, the standard is considered to be more ambitious. The RED complies fully with three of the 24 FAO criteria: A.6 GHG emissions, B.4 employment and C.1 compliance. The RED complies partially with six of them: A.1 land use change, A.2 biodiversity and ecosystem services, A.3 productive capacity of land, A.4 agrochemical use, A.5 water availability and quality and B.7 good management and improvement. These nine criteria represent the mandatory targets stated in the RED to which certification schemes have to comply in order to be approved by the EC. The standards must comply fully with those three FAO criteria (A.6, B.4 and C.1) and at least partially to the six FAO criteria (A.1, A.2, A.3, A.4, A.5 and B.7) in order to comply with the RED. If a standard fully or partially satisfies the criteria that the RED does not comply with, the standard is more ambitious than the RED. If a standard satisfies a criterion fully, while the RED satisfies the same criterion partially, the ambition of the standard in question increases as well. The ambition is scored on a 0/+;++ scale, where 0 stands for no or little ambition, + stands for medium ambition and ++ stands for high ambition. The standard with the lowest ambition scores 0. The standard with the highest ambition scores ++. The remaining three standards score +, as long as the ambition is not equal to either the standard with the lowest ambition or the standard with the highest ambition. The ambition is depicted in table 4.4 which contains the assessment of the
comprehensiveness of the standards. The references included in this assessment refer to the standard on which the assessment of the author is based.

2BSvs: This standard does not comply with more FAO sustainability criteria than the RED: the same (and thus the same amount) of criteria are covered within the 2BSvs standard. The ambition of the standard on the criteria both the RED and the standard satisfy is not significantly higher. The 2BSvs standard added an extra indicator to the criterion on productive capacity of land (A.3). Furthermore, the criterion A.7 on air quality is satisfied to a greater extent in the 2BSvs standard than in the RED (2BSvs, 2011a). The ambition of the 2BSvs is the lowest of all the standards and therefore scores (0).

Bonsucro: This standard satisfies more FAO sustainability criteria than the RED does. The Bonsucro standard fulfills (either partially or fully) 19 of the FAO criteria, whereas the RED covers nine sustainability criteria of the FAO. In the criteria both the RED and the Bonsucro standard cover both, the Bonsucro standard is more ambitious in three of the nine criteria compared to the RED (Bonsucro EU, 2011). Because the Bonsucro standard is more ambitious than both the RED and the 2BSvs standard it scores (+). The standard is not awarded with (++) because it is not the most ambitious standards and three of the five standards score in the same range and therefore receive an equal score.

ISCC: This standard satisfies more FAO sustainability criteria than the RED. The ISCC fulfills (either partially or fully) 20 of the FAO criteria, whereas the RED covers nine sustainability criteria of the FAO. In the criteria both the RED and the ISCC standard cover both, the ISCC standard is more ambitious in one of the nine criteria compared to the RED (ISCC, 2011a). The ISCC is also not the standard with the highest ambition and its ambition is to the Bonsucro standard and is therefore scored with (+).

RSB: This standard satisfies more FAO sustainability criteria than the RED. The RSB standard fulfills (either partially or fully) 24 of the FAO criteria, whereas the RED covers nine sustainability criteria of the FAO. Hence, the RSB standard satisfies all the FAO criteria at least partially. In the criteria both the RED and the RSB standard cover both, the RSB standard is more ambitious in five of the nine criteria compared to the RED (RSB, 2010a). The RSB standard complies (partially) with all the sustainability criteria and is therewith the most ambitious standard. The RSB is therefore scored with (++).

RTRS: This standard satisfies more FAO sustainability criteria than the RED. The RTRS fulfills (either partially or fully) 21 of the FAO criteria, whereas the RED covers nine sustainability criteria of the FAO. In the criteria both the RED and the RTRS standard cover both, the RTRS standard is more ambitious in four of the nine criteria compared to the RED (RTRS, 2010a). Although the RTRS standard has the highest ambition after the RSB standard, it is scored with (+), because the ambition is higher than the 2BSvs standard but in the same range as the Bonsucro and the ISCC standard. These three standards have comparable ambition and therefore receive the same score.
In table 4.3 the results of the assessment for ambition is summarized. The assessment shows that the company initiated standard 2BSvs is less ambitious than the MSIs.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on ‘ambition’</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>0</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>+</td>
</tr>
<tr>
<td>ISCC</td>
<td>+</td>
</tr>
<tr>
<td>RSB</td>
<td>++</td>
</tr>
<tr>
<td>RTRS</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 4.3: summary of the results on the indicator ‘ambition’.

4.1.2 Comprehensiveness

The assessment of the comprehensiveness is conducted by comparing the standards to the comprehensive list of sustainability criteria of the FAO. The assessment of ambition measured the additional criteria the standards included, compared to the criteria mandated in the RED. The assessment of comprehensiveness measures to what extent the standards included criteria covering all imaginable sustainability issues, represented by the 24 sustainability criteria of the FAO.

The standards are checked for inclusion of each of the 24 sustainability criteria, representing all imaginable sustainability issues. The result of the assessment is table 4.4. The complete assessment on the comprehensiveness of the standards is included in Appendix C.

In the table the 24 sustainability criteria of the FAO are shown in the left column. The principles and criteria used by the standards are compared to the criteria the FAO uses. If the standard satisfies the criterion fully it scores a ‘Y’ in the table. The Y stands for ‘Yes’. Full compliance with the FAO criterion means that all aspects of the criterion are included in the standard. If not all aspects of a FAO criterion are incorporated in the standard but some are, the standard scores a ‘P’ on that particular criterion. The P stands for partial satisfaction of the criterion. If no elements of the FAO criterion are found in the standard the score is ‘N’ which stands for non-fulfillment of the criterion. This assessment is included in the effects table. In the effects table ‘Y’ is converted to ++, ‘P’ to + and ‘N’ to 0.

The first “standard” assessed in the table is the RED. This column depicts the sustainability criteria in the RED that standards have to comply with to receive approval of the EC. The actual regulations and requirements for the standards and the MS are more farreaching. This table is not meant to assess the stringency of the RED, but to assess the comprehensiveness of the standards. The sustainability criteria of the RED of article 17 (EC, 2009a) are included as a yardstick. This table is the basis for the assessment of the ambition of the standards described in paragraph 4.1.1. In this table it is instantly clear which standards are more comprehensive and more ambitious than the RED.
<table>
<thead>
<tr>
<th>Category</th>
<th>RED</th>
<th>2BSvs</th>
<th>Bonsucro ISCC</th>
<th>RSB</th>
<th>RTRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Land use change</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>A.2 Biodiversity and ecosystem services</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.3 Productive capacity of land</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.4 Agrochemical use</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.5 Water availability and quality</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.6 GHG emissions</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>A.7 Air quality</td>
<td>N</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.8 Waste management</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>A.9 Environmental sustainability</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.1 Land tenure</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.2 Rural and social development</td>
<td>N</td>
<td>N</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.3 Access to natural resources</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>B.4 Employment</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.5 Health and safety</td>
<td>N</td>
<td>N</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.6 Energy security</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>P</td>
</tr>
<tr>
<td>B.7 Good management and improvement</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>B.8 Social sustainability</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>B.9 Food availability</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>B.10 Food access</td>
<td>N</td>
<td>N</td>
<td>P</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>B.11 Food utilization</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>B.12 Food stability</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>B.13 Food security</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>C.1 Compliance</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>C.2 Engagement and transparency</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Table 4.4: assessment of comprehensiveness
Table 4.4 is based on the following sources: (EC, 2009a; EC, 2009b; ISCC, 2011a; ISCC, 2011b; ISCC, 2011c; RSB, 2009; RSB, 2010a; RSB, 2010b; RSB, 2011; RTRS, 2010a; RTRS, 2011a; RTRS, 2011b; 2BSvs, 2011a; 2BSvs, 2011b)

From this table the assessment of the ambition in paragraph 4.1.1 becomes visible. All standards satisfy more sustainability criteria than the RED, albeit in case of the company initiated standard 2BSvs on one occasion. The Bonsucro, ISCC and RTRS standard are in the same range of ambition and the RSB standard is most ambitious. The comprehensiveness of the standards is observed through the absence of red squares. If more cells in the table are green (or yellow) a standard is more comprehensive. The 2BSvs standard is least comprehensive in comparison with the other standards: it has the most red cells, meaning the corresponding FAO sustainability criteria are not included in the standard. The RSB is the most comprehensive, satisfying three sustainability criteria partially, 21 criteria fully and, moreover, no FAO criteria are absent from the RSB standard.

Three of the 24 FAO criteria are fully satisfied by all the standards: GHG emissions, employment and compliance. The RED is clear about the GHG emissions and the calculations thereof, and because the RED complies with this criterion, the standards also comply, for they must comply with the RED criteria. The employment criterion is safeguarded through the inclusion of the International Labor Organization (ILO) conventions by all the certification schemes. The compliance with national laws and relevant international treaties is also satisfied by all five schemes.

The first FAO criterion on the list is the land use change. None of the standards satisfies this criterion completely. The standards do include targets and criteria about the direct land use change, but the ILUC is mostly absent or not specified. This is interesting because one of the debates revolving around biofuels is related to the ILUC and the GHG emissions resulting from it. This could mean that the GHG savings the standards now advertise with are lower than in reality. Inclusion of the GHG emissions related to ILUC entails expanding the boundaries of the life cycle of biofuels taking into account land conversion not only for biofuel production but also land conversion resulting from loss in availability of food.

Furthermore, sustainability criteria related to food security are most absent. The only standard that covers all the food security criteria is the RSB. The ISCC mentions the food security criterion, but does not cover the different aspects of food security: availability, access, utilization and stability of food. This is interesting, because of the other debate present in relation to biofuels: the food versus fuel debate. By not including criteria on food security, food prices can increase and people living close to the production plant or countries depending on imported food from countries with biofuel production have to pay more for food, leaving less money available for other expenses.

4.1.3 Completeness

In paragraph 3.3.1.3 the 10 most relevant sustainability criteria of the FAO are stated. They are:

- A.1 Land use change (both direct and indirect)
- A.2 Biodiversity and ecosystem services
- A.5 Water availability and quality
- A.6 GHG-emissions
- B.1 Land tenure/access and displacement
- B.3 Access to water and other natural resources
- B.5 Human health and safety
- B.6 Energy security and access
- B.13 Food security
- C.1 Compliance

The selection of these 10 most relevant criteria is based on the most pressing impacts of bioenergy identified by WWF (WWF, 2010b; WWF, 2012b). The assessment of comprehensiveness measured to what extent all imaginable sustainability issues are included in the standard. The assessment of completeness measures to what extent the most relevant sustainability criteria are included, represented by the 10 criteria stated above.

Table 4.4, depicting the comprehensiveness of the standards, aids in the assessment of completeness as well the assessment of ambition. A standard is considered complete if all 10 sustainability criteria are fully satisfied in the standard. Since there are 10 criteria and the goal of completeness is equal to achieving compliance with 10 criteria, the goal is satisfying 100 percent of the criteria: 10 percent of completeness is earned for each fully satisfied criterion. If a standard complies with fewer criteria the percentage decreases, e.g. when five criteria are fully satisfied the completeness is 50 percent. However, partial satisfaction of criteria is also possible in this research. In order to tackle this problem, partial inclusion of a criterion is counted as a half satisfied criterion: five percent per partially satisfied criterion. The assessment of the completeness of the standards consists of counting the partially and fully satisfied FAO sustainability criteria and transforming that amount into a percentage.

The 2BSvs standard fully complies with two criteria and partially with three criteria. Therefore, the completeness of the 2BSvs standard is 35 percent (2 * 10 percent and 3 * 5 percent = 35 percent). The Bonsucro standard fully complies with five of the 10 most relevant criteria and partially with three of them. The completeness of the Bonsucro standard is thus 65 percent. The ISCC standard satisfies four of the 10 criteria fully and six are partially complied with, therewith scoring 70 percent on completeness. The RSB standard is the most comprehensive standard, meaning that the RSB has included the most FAO sustainability criteria. Hence, it is likely that the completeness of the RSB is highest as well. The RSB fully complies with eight of the 10 most relevant criteria and partially with the remaining two criteria. The completeness of the RSB is not 100 percent due to the two partially satisfied criteria: the score on completeness is 90 percent for the RSB. Lastly, the RTRS standard satisfies seven of the most relevant criteria fully and two partially. The completeness of the RTRS standard is 80 percent. The results are summarized in table 4.5. The MSIs are more complete than the company initiated standard 2BSvs (almost all standards are at least twice as complete), although none of the standards satisfy all criteria completely.
4.1.4 Compliance mechanisms

The last category within the parent variable stringency is compliance mechanisms. The compliance mechanisms of the five standards are assessed by looking at monitoring mechanisms, sanctioning mechanisms, third-party auditing and the public accessibility of reports.

Monitoring mechanisms

Within the standards criteria on monitoring are included. Furthermore, criteria on sustainability aspects also include sections that require documentation for verification. Self-monitoring is part of the monitoring mechanisms. Monitoring is also conducted by an independent agent (the auditor), which is more transparent than self-monitoring. All five standards require an annual surveillance audit by an accredited auditor. This surveillance audit contributes to the score on monitoring mechanisms. The complete assessment of the monitoring mechanisms is included in Appendix D.

The 2BSvs standard requires much documentation. This facilitates self-monitoring and ensures the annual surveillance audit is carried out with greater ease (2BSvs, 2011a). The amount of criteria that include monitoring aspects and the annual surveillance audit leads to a (+++ score for the monitoring mechanisms of the 2BSvs standard.

Monitoring and documentation is not mentioned extensively in the Bonsucro standard. A handful of criteria require documentation and monitoring, although they cover many aspects. Furthermore, an annual surveillance audit is mandatory in order to comply with the standard (Bonsucro EU, 2011). Nevertheless, because the required extent of monitoring and documentation is not made explicit in the Bonsucro standard, this standard performs less than the 2BSvs standard and therefore receives a (+).

The ISCC standard includes many monitoring criteria on safety regulations and on this topic the monitoring and documentation prerequisites are well elaborated on. An annual surveillance audit is required to ensure compliance with the standard (ISCC, 2011a). The degree of monitoring

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on 'completeness' in percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>35</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>65</td>
</tr>
<tr>
<td>ISCC</td>
<td>70</td>
</tr>
<tr>
<td>RSB</td>
<td>90</td>
</tr>
<tr>
<td>RTRS</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 4.5: summary of the results on 'completeness'.
mechanisms included in the ISCC standard is comparable with those of the Bonsucro standard. Hence, the ISCC standard receives the same score on this aspect as the Bonsucro standard. (+)

The monitoring mechanisms within the RSB standard are not described extensively. Although the RSB standard requires thorough continuous tracking of RSB certified product it is not explained how this should be done. The RSB standard does include monitoring mechanisms (e.g. an annual surveillance audit) and requirements for documentation, however, as with the Bonsucro standard, the extent of these aspects is not made explicit (RSB, 2010a). The mechanisms included in this standard are comparable to the Bonsucro standard. Therefore, the RSB receives the same score as Bonsucro: (+).

One of the monitoring mechanisms of the RTRS standard is an annual surveillance audit, alike the other four standards. Furthermore, the RTRS standard includes requirements for monitoring and documentation of many different subjects throughout the standards. These subjects and requirements are made explicit (RTRS, 2010a). The monitoring mechanisms of the RTRS standard are comparable with the 2BSvs standard and thus the RTRS receives the same score. (++)

In table 4.6 the summary of the results is stated. The company initiated standard 2BSvs scores high on monitoring mechanisms as does the RTRS, an MSI. None of the standards have poor monitoring mechanisms, as there is no standard that scores (0).

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on 'monitoring'</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>++</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>+</td>
</tr>
<tr>
<td>ISCC</td>
<td>+</td>
</tr>
<tr>
<td>RSB</td>
<td>+</td>
</tr>
<tr>
<td>RTRS</td>
<td>++</td>
</tr>
</tbody>
</table>

Table 4.6: summary of the results on the indicator 'monitoring mechanisms'.

Sanctioning mechanisms

Compliance with the standards is preferable, because without compliance the standard is an empty shell: no change is established if a company sees no reason to comply. If a company can carry the certificate without putting any effort in changing the way of production the company would not bother putting any effort in. With sanctioning mechanisms the compliance with the standard is safeguarded, ensuring that companies actually change their production to more sustainable practices in fear of being sanctioned.
The monitoring mechanisms describe how the compliance is measured. The sanctioning mechanisms describe what the consequences of non-compliance are. The sanctioning mechanisms can avoid non-compliance if certified companies fear the consequences of non-compliance, i.e. the sanctions. Below, a short description of the sanctioning mechanisms of the standards is given.

The 2BSvs standard distinguishes three categories of non-compliance: minor non-conformity, major non-conformity and critical non-conformity. A minor non-conformity occurs when non-conformity against an indicator within a criterion in the standard is identified. This non-conformity should be addressed by the certified company prior to the next surveillance audit. The minor non-conformity may be upgraded to a major non-conformity if the company does not address it in time. A major non-conformity in case of non-conformity against a criterion within the standard is identified. A new verification audit is not necessarily required, but the certification body (i.e. auditor) will ensure full compliance. A major non-conformity needs to be addressed within three months (2BSvs, 2011b). It is however not clear how the verification body will ensure this. A critical non-conformity occurs in case of non-conformity against a critical indicator or a principle level requirement. The certificate is issued after a new verification audit. If a critical non-conformity is identified during an annual surveillance audit the certificate is suspended (2BSvs, 2011b). The standard includes sanctioning mechanisms, however, compared to the other standards (see below) the sanctions are not strong. For example, in case of a critical non-conformity the certificate is suspended, not revoked. The certified companies get a large amount of time to address their non-conformities and when non-compliance is identified the company can try again and again to take corrective actions. The consequences of suspension of the certificate are not included in the document. The 2BSvs standard scores (0) on the sanctioning mechanisms.

The Bonsucro standard identifies two different categories of non-compliance: major non-conformity and minor non-conformity. A major non-conformity occurs when non-compliance with a core indicator of the standard is identified, compliance with less than 80 percent of the total amount of indicators, any chain of custody standard indicator or any EU RED indicator. The core indicators of the Bonsucro standard are: to comply with relevant applicable laws; to comply with ILO labour conventions governing child labour, forced labour, discrimination and freedom of association and the right to collective bargaining; to provide employees and workers (including migrant, seasonal and other contract labour) with at least the national minimum wage; to assess impacts of sugarcane enterprises on biodiversity and ecosystems services and; for greenfield expansion or new sugarcane projects, to ensure transparent, consultative and participatory processes that address cumulative and induced effects via an environmental and social impact assessment (ESIA).

The second category is minor non-conformity. This occurs in case of non-compliance with non-core indicators amounting to less than 20 percent of the total indicators or limited non-compliance with a chain of custody indicator. After an audit (either initial or the annual surveillance audit) the company receives a report with all non-conformities. The certificate is not issued in case of major non-conformity. In case of minor non-conformity the certificate is issued, however, the company needs to sign a corrective action plan, which is audited with the next surveillance audit (Bonsucro, 2011a). When minor non-conformity is identified with a surveillance audit a corrective action plan is used. In case of major non-conformity the certificate is suspended for a maximum time period of one month.
During this time, the company may not claim certification through advertising. The suspension is published on the Bonsucro website. If corrective action is not taken within the one month time period, the certificate is withdrawn (Bonsucro, 2011a). The sanctions of the Bonsucro standard are clear and strong. The one month time period to correct major non-conformity and the clear regulations regarding minor non-conformity are the reason the Bonsucro standard scores (++).

The ISCC states that all non-conformities must be solved before a certificate is issued. The missing documents or evidence must be available to the auditor within 40 days after the date of audit. In case of non-compliance with these requirements the certificate may be withdrawn. If the certification body (auditor) wrongfully accepted a company this may result in the withdrawal of the accreditation of the certification body. In the case there is any land use change, which violates ISCC principle 1, a certificate is not issued. If non-compliance with this principle is identified during a surveillance audit, the certificate is withdrawn immediately. Moreover, future certification is not possible (ISCC, 2011e). The sanctioning mechanisms of the ISCC are strict. The addition of sanctions against certification bodies and the immediate withdrawal of the certificate in case of non-compliance with the principle containing the land use change criteria are beneficial for the score of the ISCC on this indicator. However, it is not evident when non-compliance is at hand. The sanctions are strict, but it is not clear when these sanctioning mechanisms are triggered. Therefore, the ISCC scores (+) on the sanctioning mechanisms.

The RSB requests that the certified company declare any non-complaince through self-assessment. The declarations of the company are then verified by an auditor. This self-assessment is intended to keep the companies involved. The self-assessment is additional to the external (surveillance) audits of the certification body. The RSB distinguishes two types of non-compliances: major non-compliance and non-compliance. Major non-compliances have the potential to compromise the RSB certification system and are not corrected since the previous audit. If non-compliance is identified in self-claim of compliance this is also considered as a major non-compliance. Both categories of non-compliance are defined and listed and the corrective actions of the company are evaluated by the certification body (auditor) for compliance. Any non-compliances that remain prior to the evaluation are upgraded to major non-compliances. In case of a major non-compliance a certificate is not issued (in case of initial audit). The major non-compliance must be corrected within 90 days to avoid a full re-evaluation audit. If the major non-compliance is not corrected within this time period suspension or withdrawal of the certificate occurs (RSB, 2010c). Although there are strong sanctions stated in the RSB documents, it is not clear when major non-compliance or non-compliance occurs. Therefore, the guidelines for either suspension or withdrawal are unclear as well. The time period allowed for corrections is restricted and the possibility of withdrawal of the certificate contribute to the score of the RSB on the sanctioning mechanisms. The RSB scores (+) on this indicator due to the strict sanctions, but absence of information on when the sanctions are triggered.

The compliance with the RTRS standard is a gradual process. This means that the company that aspires certification initially must comply with approximately 62 percent of the standard in order to receive a certificate. This includes all immediate compliance indicators and 10 percent of total short and mid-term compliance indicators. An example of a short/mid-term indicator is indicator
4.5.2 stating: there is a plan, which is being implemented, to ensure that the native vegetation is being maintained. The plan represents the short-term part of the indicator: the plan must be present. The implementation of the plan takes longer to process: this is a mid-term action. After the first year the certified company must comply with all short-term compliance indicators representing (including the necessary compliance prior to certification) approximately 86 percent of the standard. Three years after certification the certified company must comply with 100 percent of the standard. The RTRS distinguishes minor and major non-conformities. The non-conformities lead to a request of corrective action to the company. In case of a major non-conformity the company is given 30 days after the request to undertake corrective action. If the company does not correct the non-conformity within that time period the certificate is suspended for a maximum period of 60 days. The certificate is withdrawn if the major non-conformity is not corrected during the suspension period (RTRS, 2011c). If a member does not comply with the code of conduct of the RTRS it can lose the membership (RTRS, 2011d). The sanctions of the RTRS are clear and strict. The inclusion of the compliance time frame contributes to the score as does the restrictive time period allowed for major non-conformities. The RTRS scores (++) on the sanctioning mechanisms indicator. In table 4.7 the summary of the scores on sanctioning mechanisms is given. The MSIs score better on sanctioning mechanisms than the company initiated standard 2BSvs. The monitoring mechanisms of the latter received a high score, however, if monitoring is not backed with sanctions there is a risk of non-compliance because there are no severe consequences of non-conformity.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on ‘sanctioning’</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>0</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>++</td>
</tr>
<tr>
<td>ISCC</td>
<td>+</td>
</tr>
<tr>
<td>RSB</td>
<td>+</td>
</tr>
<tr>
<td>RTRS</td>
<td>++</td>
</tr>
</tbody>
</table>

Table 4.7: summary of the results on the indicator ‘monitoring mechanisms’.

Third-party auditing

The assessment of third-party auditing is based on information on the websites of the five certification schemes. The accredited certification bodies (auditors) are listed on the websites of the schemes. The use of third-party auditing enlarges the transparency of the standard and increases the objectivity of the audit.

This is a binary indicator, allowing two options: a certification scheme either uses third-party auditing or it does not. The assessment of the certification schemes lead to the conclusion that all five
certification scheme require third-party auditing. The five standards therefore all have the same score. Because it is a binary indicator the score of the standards is (1).

Public accessibility of reports

The assessment of the public accessibility of reports was conducted on the internet. The websites of the certification schemes were consulted to assess whether or not the annual report and (summaries of) audit reports were available. These websites are listed separately in the reference list. This is also a binary indicator: the reports are either available or they are not.

The website of 2BSvs contains a reasonable amount of information. However, neither the annual report nor an audit report was available (0). The Bonsucro website requires membership for part of the website. It is possible that the reports are available there, although this does not count as public accessibility (0). The website of the ISCC contains a lot of information and documents. However, the annual report and audit reports are not among these documents (0). The website of the RSB contains much information, including an annual report and one summary of the audit report (1). The RSB has more applications for certification running, but issued one certificate to date. Lastly, the RTRS website contains detailed information about the RTRS including many documents. The annual report and the audit report summaries are available to the public (1). In table 4.8 an overview of the scores on the public accessibility of reports is stated. The MSIs RSB and RTRS allow the public to access their reports. Neither the other MSIs nor the company initiated standard 2BSvs publish these reports publicly.

<table>
<thead>
<tr>
<th>Standard</th>
<th>Score on ‘public accessibility of reports’</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>0</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>0</td>
</tr>
<tr>
<td>ISCC</td>
<td>0</td>
</tr>
<tr>
<td>RSB</td>
<td>1</td>
</tr>
<tr>
<td>RTRS</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4.8: summary of the results on the indicator ‘public accessibility of reports’.

4.2 Costs

Above the qualitative assessment of the stringency is conducted. The assessment of the costs results in quantitative data. In the assessment of costs two categories are considered: direct costs and indirect costs. These two categories make up for approximately four percent of the total costs associated with certification (Spöttle and Vissers, 2011).
4.2.1 Direct costs

The direct costs of certification include various fees that are paid to the certification scheme. The direct costs include the membership fee, the registration fee, the certificate/license fee, the initial audit and the surveillance audit. Most of these fees are published on the website of the standard, in some cases this information was retrieved from literature review. The costs of the audits are based on literature review and open communication with experts. The direct costs are different for each scheme.

4.2.1.1 Fees

The fees of the certification schemes differ not only per scheme but also vary with turnover and production. In general, bigger companies pay higher fees to certification schemes. In order to compare the five certification schemes, turnover and production is set on a certain amount, therewith only varying the fees of the scheme with all other things equal (ceteris paribus). The production is set to 100 million gallons (or 333.250 tons (Kingsman, 2010)) of biofuel and the turnover is set at 125 million euro. Furthermore, it is assumed that one certificate is needed. This is relevant because some certification schemes require a fee per certificate.

Both non-membership alternatives and the membership alternatives are considered in the comparison (see paragraph 4.3). In the Bonsucro certification scheme membership is mandatory, for the other schemes this is not the case. Nevertheless, both alternatives for each certification scheme are considered to also compare the differences in costs between membership and non-membership. Differences in stringency do not occur because the standard remains the same, regardless of membership.

Membership is not obligatory within the 2BSvs certification system. Companies that desire membership pay an annual fee of 4.000 euro assuming 333.250 tons of sustainable product (2BSvs, 2011c). The 2BSvs certification scheme does not require any registration or license fee.

Bonsucro is the only certification scheme with a mandatory membership. The annual fee of membership is 4.000 British pounds (NL Agency, 2012). 4.000 pounds is equal to 4,947,43 euro based on the exchange rate of June 21st 2012 (Valuta.nl, 2012a). Bonsucro does not require any registration or license fee. Certification bodies that want to conduct audits for the Bonsucro standard pay an annual fee amounting to 2.000 British pounds per year plus 100 British pounds per auditor per year (Bonsucro, 2011b). The certification body must pay this fee to be able to certify companies. Other certification schemes will most likely also ask a fee of the certification body. However, this information was not available for all the certification schemes. Henceforth, these fees are not included in the comparison, but are stated in the corresponding section if information on this type of fee is available.

The membership fee of the ISCC is dependent on the turnover of a company. The membership fee varies between 50 and 3.000 euro (NL Agency, 2012). In this research the turnover is set on 125 million euro. At this production level the membership fee is 2.000 euro. The ISCC requires additional
fees of the companies: a registration fee and a certificate fee. These non-recurring fees are paid via the certification body (auditor) and are dependent on turnover and production. Both the registration fee and the certificate fee range from 50 to 500 euro. For the set turnover and the set production the registration fee and the certificate fee amount to 600 euro: 300 euro each (Kingsman, 2010).

The membership fee of the RSB certification schemes varies between 250 and 10,000 dollar (NL Agency, 2012). The conditions for this variation were not found. It is likely that companies with a higher turnover may have to pay more, as is the case with other standards. It was, however, not clear what turnover results in a membership fee of 250 dollars and what turnover results in 10,000 dollars. Therefore, the average of the membership fee is used in this assessment, i.e. 9,750 divided by two, which makes 4,875 dollar, which is equal to 3,838.58 euro, based on the exchange rate of the 21st of June 2012 (Valuta.nl, 2012b). The membership fee of the RSB is the highest of the five certification schemes. The RSB certification scheme requires a license fee (i.e. certificate fee) of 4,000 dollar per license (NL Agency, 2012). In this research one license or certificate is assumed. The fee of 4,000 dollar is equal to 3,149.36 euro based on the exchange rate of June 21st, 2012 (Valuta.nl, 2012b).

The membership fee of the RTRS is either 250 or 2,500 euro. For smallholders and NGOs the fee is 250 euro. In this assessment a regular company is considered, i.e. not a smallholder. Hence, the membership fee is 2,500 euro (NL Agency, 2012), which is the lowest of the five standards. The RTRS does not require any registration or certificate fee. The RTRS includes information on the website on the fees the certification bodies (auditors) are required to pay to the RTRS. If the RTRS is the first standard that the certification body applies to, the fee amounts to 3,600 dollars. If the RTRS is the second standard applied to by the certification body the fee amounts to 1,500 dollar (RTRS, 2011e).

4.2.1.2 Initial audit

The second part of the direct costs is the initial audit. This audit is conducted to check if the applicant complies with the standard. If the company complies, it receives a certificate and is allowed to advertise with and sell certified products. The initial audit is assessed with estimations for each certification scheme on the length of the initial audit in number of days (based on literature review and consultation of experts) multiplied by an estimate of a daily fee for one auditor. The daily fee of an auditor is set on 1,000 euro. This estimate is based on open communication with two experts (J. van de Staaij, 2012 and DNV, 2012). The number of days needed for the audit is assumed to include preparation of the audit, the audit itself and a report stating the outcome of the audit.

In table 4.9 the estimations of the length of the audit are stated for each certification scheme. The sources of these estimations are given in the last column. The audit cost in the fourth column is an average of the length of the audit. For example, the length of the audit of the ISCC is three to four days. Therefore, the average cost of the audit is 3,000 plus 4,000 euro divided by two. This leads to the average audit cost of 3.500 euro.
Table 4.9: Length of the initial audit and the corresponding costs. Sources are stated in the last column.

<table>
<thead>
<tr>
<th></th>
<th>Estimate of length of audit</th>
<th>Estimate of daily fee</th>
<th>Average audit cost</th>
<th>Source estimate of days</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>2-3 days</td>
<td>1.000 euro</td>
<td>2.500 euro</td>
<td>(NL Agency, 2012)</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>4-5 days</td>
<td>1.000 euro</td>
<td>4.500 euro</td>
<td>(NL Agency, 2012)</td>
</tr>
<tr>
<td>ISCC</td>
<td>3-4 days</td>
<td>1.000 euro</td>
<td>3.500 euro</td>
<td>(DNV, 2012)</td>
</tr>
<tr>
<td>RSB</td>
<td>5-6 days</td>
<td>1.000 euro</td>
<td>5.500 euro</td>
<td>(DNV, 2012)</td>
</tr>
<tr>
<td>RTRS</td>
<td>3-5 days</td>
<td>1.000 euro</td>
<td>4.000 euro</td>
<td>(H. Rodriguez Arias, 2012)</td>
</tr>
</tbody>
</table>

Table 4.9: Length of the initial audit and the corresponding costs. Sources are stated in the last column.

The table shows that the audit for the 2BSvs standard takes up the least number of days and that the audit for the RSB standard takes the most time. Consequently, the same order is observed in the average audit costs.

It is important to note again that the costs presented in the table are an estimate. This research works under the assumptions that one auditor is required for the audit. For larger firms more auditors may be needed to conduct the audit. The average audit cost is based on one auditor and will thus double if two auditors are needed.

4.2.1.3 Surveillance audit

The surveillance audit is the annual audit companies undergo to assess if the company still complies with the criteria in the standard and if corrective actions that needed attention have been processed. The surveillance audit is assessed using the same method as in the assessment of the initial audit: estimate of the length of the surveillance audit in number of days multiplied by an estimate of a daily fee for one auditor. Table 4.10 shows the estimates for the length of the audit and the corresponding average audit costs.

The audit cost in the fourth column is an average of the length of the surveillance audit. For example, the length of the audit of the ISCC is one to 1.5 days. Therefore, the average cost of the audit is 1.000 plus 1.500 euro divided by two. This leads to the average surveillance audit cost of 1.250 euro.

Table 4.10 Length of the surveillance audit and the corresponding costs. Sources are stated in the last column.

<table>
<thead>
<tr>
<th></th>
<th>Estimate of length of audit</th>
<th>Estimate of daily fee</th>
<th>Average audit cost</th>
<th>Source estimate of days</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BSvs</td>
<td>1 day</td>
<td>1.000 euro</td>
<td>1.000 euro</td>
<td>(NL Agency, 2012)</td>
</tr>
<tr>
<td>Bonsucro</td>
<td>1-1.5 days</td>
<td>1.000 euro</td>
<td>1.250 euro</td>
<td>(NL Agency, 2012)</td>
</tr>
<tr>
<td>ISCC</td>
<td>1-1.5 days</td>
<td>1.000 euro</td>
<td>1.250 euro</td>
<td>(DNV, 2012)</td>
</tr>
<tr>
<td>RSB</td>
<td>1.5-2 days</td>
<td>1.000 euro</td>
<td>1.750 euro</td>
<td>(DNV, 2012)</td>
</tr>
<tr>
<td>RTRS</td>
<td>1.5 days</td>
<td>1.000 euro</td>
<td>1.500 euro</td>
<td>(H. Rodriguez Arias, 2012)</td>
</tr>
</tbody>
</table>

Table 4.10 Length of the surveillance audit and the corresponding costs. Sources are stated in the last column.

* This source refers to open communication with an expert.

* This source refers to open communication with an expert.
The table shows the same pattern as table 4.9 above. The surveillance audit for the 2BSvs standard takes up the least number of days (one) and the audit for the RSB standard takes the most time (1.5 to 2 days). Hence, the same order reoccurs in the average audit costs.

### 4.2.2 Indirect costs

The assessment of the indirect costs, i.e. costs not paid upfront in order to comply with the standard, is based on the quantity dependent fee required by most certification schemes. The quantity dependent fee is a price per ton of product paid by the company to the certification scheme. The 2BSvs scheme does not require a quantity dependent fee (NL Agency, 2012). For all other certification schemes the amount of product is set at 100 million gallons of biofuel or (i.e.) 333.250 tons (Kingsman, 2010).

The Bonsucro scheme uses a quantity dependent fee of 0.075 dollar per ton of product (NL Agency, 2012). Converted into euro this fee is equal to 0.06 euro per ton based on the exchange rate of the 21st of June, 2012 (Valuta.nl, 2012b). The six cents per ton of product amount to 19.995 euro for 333.250 tons of product.

The ISCC certification scheme distinguishes two alternate quantity dependent fees. The distinction is made between members and non-members. Non-members pay a higher fee than members do. In the comparison in paragraph 4.3 both alternatives are taken into account. Therefore, both quantity dependent fees for the set production of 333.250 tons of product is calculated below. For non-members the quantity dependent is 0.03 euro per ton of product (NL Agency, 2012). The three cents per ton of product amount to 9997.50 euro for 333.250 tons of product. Members pay a lower quantity dependent fee. The fee per ton of product is 0.02 euro (NL Agency, 2012). The two cents per ton of product amount to 6665 euro for 333.250 tons of product.

The RSB certification scheme does not use one fixed quantity dependent fee. For biofuel producers the quantity dependent fee for the first 50 million gallons of product is 0.000214 dollar per gallon. For the next 50 million gallon, the quantity dependent fee is lower: 0.000155 dollar per gallon. When more biofuel is produced (more than 100 million gallons) the fee is 0.000125 dollar per gallon (M. Williams, 2012). In the case of a production of 100 million gallons the first 50 million gallons require the highest fee. The additional 50 million gallons require the second highest fee. In total the fee required for the amount of 100 million gallons of product is 18.450 dollar, which is equal to 14.526.42 euro based on the exchange rate on June 21st, 2012 (Valuta.nl, 2012b).

The quantity dependent fee of the RTRS certification scheme is the highest compared to the other four schemes. The quantity dependent fee of the RTRS is 0.30 euro per ton of product (NL Agency, 2012). This means that for the set production of 333.250 tons of product, the fee paid to the RTRS amounts to 99.975 euro.

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3 The quantity dependent fees of the RSB are confidential information and can only be used for the purposes of this thesis. For future publications permission is required.
For the assessment of the quantity dependent fee the production was set on a fixed amount. This was needed because in the RSB certification scheme the fee varies with the output. The production of 100 million gallons has consequences on the total costs per scheme. The RTRS certification scheme has a high quantity dependent fee (0.30 euro per ton) but low fixed costs (membership fee of 2.500). Furthermore, the length of the audit is shorter than those of the Bonsucro and the RSB schemes. This may cause the RTRS standard to seem expensive at this production level, while at lower production levels the RTRS standard is cheaper than (e.g.) the RSB standard. In order to assess the validity of this argument the total costs for a range of production levels is calculated and depicted in figure 4.1.

![Figure 4.1: Total costs per certification scheme for different production levels. The Y-axis is total cost in euros, the X-axis is the amount of production x 1000 tons (extrapolated from the mentioned quantity dependent fees).](image)

The figure show that at high production levels the RTRS standard is the most expensive. At a production level of 15,000 tons the RTRS with and without membership is less expensive than the RSB with membership. This figure is interesting for companies seeking certification. With low production levels the RTRS is more appealing than with high production levels. Based on the results from executed audits last year, the certification costs for a producer is 1 dollar per ton of production, including the standard fee and excluding implementation costs to comply with the criteria of the
standard (H. Rodriguez Arias, 2012). The implementation costs are not included in this research so the above figure should depict this trend. The figure does not support this statement for the higher production levels, but at a production of 15,000 ton the 1 dollar per ton of production seems viable. Based on the graph and the statement of Mr. H. Rodriguez Arias two possible conclusions can be drawn. The first possible conclusion is that the information in the graph is not complete. At high production levels the costs do not reflect a 1 dollar per ton of production. For example at a production of 500,000 tons the costs are 160,000 euro, which does not reflect the 1 dollar per ton of production. Therefore, it is possible that not all costs are included in the graph. The second possible conclusion is that the RTRS is only used by companies with production levels up to approximately 15,000 tons. At that production level the costs are comparable to 1 dollar per ton of production.

Furthermore, it is interesting to see from this figure that the membership of the ISCC standard is beneficial from a production of 200,000 tons onwards. With lower production levels, the alternative ISCC without membership is less expensive. The standards demonstrate straight cost curves except for the RSB alternatives. The RSB cost curve starts out straight, but after a production of 50 million gallons (i.e. 166625 tons (Kingsman, 2010)) the slope of the curve declines because of the lower quantity dependent fee.

With this sidenote, that the chosen production of 100 million gallons (or 333,250 tons) influences the total costs, the next paragraph contains the comparison of the five certification schemes assessed on stringency and costs.

### 4.3 Comparison

The assessments of the variables and the underlying categories and indicators resulted in scores per certification scheme. The stringency is assessed in a qualitative manner, while the costs are presented in quantitative scores. In paragraph 3.4 the comparative approach used to compare the five certification schemes is elaborated on. The assessments in the previous paragraphs (4.1 and 4.2) are transformed into an effects table.

#### 4.3.1 Effects table

The effects table allows for further analysis of the relationship between stringency and costs and the comparison of the five standard to determine which one is preferable in terms of stringency and costs. The effects table is given in table 4.11. Note that for all certification schemes except Bonsucro, two alternatives are included: one with membership and one without.

Some minor alterations are made compared to the assessments. The criteria C.1 Compliance is not in the effects table. All the standards and their certified companies are required to obey the law. Therefore, this criterion was excluded from the comparison. Furthermore, the registration fee and the certificate fee of the ISCC certification scheme and the license fee of the RSB scheme are included in the initial audit costs. This approach was chosen because these costs are all non-recurring, while the other costs are either quantity dependent or annual payments.
The variable stringency (first column, in **bold**) and the underlying categories consist mostly of 0 to ++ range scores. The only exceptions are the category completeness (presented in a percentage) and the binary indicators of governance: third party auditing and public accessibility of reports.

<table>
<thead>
<tr>
<th>Stringency</th>
<th>C/B Unit</th>
<th>2BSvrs (member)</th>
<th>2BSvrs Bonsuro (member)</th>
<th>ISCC (member)</th>
<th>ISCC (member)</th>
<th>RSB (member)</th>
<th>RSB (member)</th>
<th>RTRS (member)</th>
<th>RTRS (member)</th>
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</thead>
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<td>Clear and verifiable</td>
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<td>0</td>
<td>0</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Detail</td>
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<td>++</td>
<td>++</td>
<td>++</td>
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<td>++</td>
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<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
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<td></td>
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<tr>
<td>Direct costs</td>
<td>C euro/year</td>
<td>0</td>
<td>4000</td>
<td>4947.43</td>
<td>0</td>
<td>2000</td>
<td>0</td>
<td>3338.58</td>
<td>0</td>
</tr>
<tr>
<td>Initial audit</td>
<td>C €</td>
<td>2500</td>
<td>2500</td>
<td>4200</td>
<td>4100</td>
<td>4100</td>
<td>8649.36</td>
<td>8649.36</td>
<td>4000</td>
</tr>
<tr>
<td>Surveillance audit</td>
<td>C euro/year</td>
<td>1000</td>
<td>1000</td>
<td>1250</td>
<td>1250</td>
<td>1250</td>
<td>1750</td>
<td>1750</td>
<td>1500</td>
</tr>
<tr>
<td>Internet costs</td>
<td>C euro per 1000L</td>
<td>0</td>
<td>0</td>
<td>19995</td>
<td>19995</td>
<td>19995</td>
<td>19995</td>
<td>19995</td>
<td>19995</td>
</tr>
</tbody>
</table>

Table 4.11: Completed effects table containing all scores of the standards acquired through assessment

The variable stringency has a direct relationship with all indicators. The higher the score, the higher the stringency. The variable costs also has a direct relationship with the underlying indicators. However, costs is valued as a cost, meaning higher scores are less preferable.
4.3.2 Standardization

The next step in the comparison is standardizing the data: transforming the original scores into values ranging from 0 to 1, therewith making comparison of the values possible. The methods used for standardization in this comparison are described in paragraph 3.4.2. In table 4.12 the method of standardization is given per criterion. All except three are standardized with maximum

<table>
<thead>
<tr>
<th>Stringency</th>
<th>Unit</th>
<th>Standardization method</th>
<th>Minimum Range</th>
<th>Maximum Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td></td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Clear and verifiable</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Detail</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Ambition</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.1 Land use change</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.2 Biodiversity and ecosystem services</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.3 Productive capacity of land</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.4 Crop management and agro-chemical use</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.5 Water availability and quality</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.6 GHG emissions</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.7 Air quality</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.8 Waste management</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>A.9 Environmental sustainability</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Socio-economic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.1 Land tenure/access</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.2 Rural and social development</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.3 Access to water and other natural resources</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.4 Employment</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.5 Human health and safety</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.6 Energy security and access</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.7 Good practices and improvement</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.8 Social sustainability</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.9 Food availability</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.10 Food access</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.11 Food utilization</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.12 Food stability</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>B.13 Food security</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>C.2 Engagement and transparency</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Completeness</td>
<td>percent</td>
<td>goal</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Sanctioning</td>
<td>0++</td>
<td>maximum</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td>Third party auditing</td>
<td>binary</td>
<td>binary</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Public accessibility of reports</td>
<td>binary</td>
<td>binary</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct costs</td>
<td>euro/year</td>
<td>maximum</td>
<td>0.00</td>
<td>4304.43</td>
</tr>
<tr>
<td>Initial audit</td>
<td>€</td>
<td>maximum</td>
<td>0.00</td>
<td>804.93</td>
</tr>
<tr>
<td>Surveillance audit</td>
<td>euro/year</td>
<td>maximum</td>
<td>0.00</td>
<td>1750.00</td>
</tr>
<tr>
<td>Indirect costs</td>
<td>euro per 1000 gallons</td>
<td>maximum</td>
<td>0.00</td>
<td>9997.50</td>
</tr>
</tbody>
</table>

Table 4.12: standardization methods of the scores and range of scores
standardization: the standardized score is the original score of the standard relative to the highest score in the data set on that particular criterion. Goal standardization is used for the criterion completeness. The goal is 100 percent inclusion of the most relevant sustainability criteria. The standardized score is the original score compared to the goal. Lastly, binary standardization is used twice. The original scores are not transformed because the original scores (either 0 or 1) are already standardized values.

The table also includes the range of the scores. The second last column states the minimum range, i.e. the lowest possible score (e.g. 0 euro per year for an audit). The last column shows the maximum range, i.e. the highest possible score (e.g. 100 percent completeness). The minimum and maximum are not among the scores of the alternatives per se.

The result of the standardization methods is shown in table 4.13. All original scores from the effects table are transformed into numbers ranging from 0 to 1.
Table 4.13 Standardized scores

Table 4.13 allows for some preliminary conclusions about the total score of the alternatives. For instance, in the categories measuring stringency both 2BSVs alternatives score 0 frequently. The RSB and RTRS alternatives often score a 1. Conversely, in the section containing the costs, the 2BSVs alternatives have higher scores than the RSB and the RTRS alternatives.

4.3.3 Weighting

In an MCA weights can be attributed to the criteria indicating relative importance.
This research does not assess the relevance of stringency or costs for the five certification schemes. Therefore, the variables stringency and costs are both given equal weights. The weight assessment is shown in Table 4.14. The total weight of the MCA is 1. Henceforth, both stringency and costs are attributed a weight of 0.500 (as stated in the second column in the table. The variable stringency contains the four categories, targets, comprehensiveness, completeness and governance. Each of

<table>
<thead>
<tr>
<th>Stringency</th>
<th>Weight level 1</th>
<th>Weight level 2</th>
<th>Weight level 3</th>
<th>Weight level 4</th>
<th>Actual weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear and verifiable</td>
<td>0.333</td>
<td>0.042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detail</td>
<td>0.333</td>
<td>0.042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambition</td>
<td>0.333</td>
<td>0.042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.1 Land use change</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.2 Biodiversity and ecosystem services</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3 Productive capacity of land</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4 Crop management and agro-chemical use</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.5 Water availability and quality</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.6 GHG emissions</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7 Air quality</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8 Waste management</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.9 Environmental sustainability</td>
<td>0.111</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.1 Land tenure access</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.2 Rural and social development</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.3 Access to water and other natural resources</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.4 Employment</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.5 Human health and safety</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.6 Energy security and access</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.7 Good practices and improvement</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.8 Social sustainability</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.9 Food availability</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.10 Food access</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.11 Food utilization</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.12 Food stability</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.13 Food security</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.2 Engagement and transparency</td>
<td>0.071</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completeness</td>
<td>0.25</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td>0.25</td>
<td></td>
<td>0.125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>0.25</td>
<td>0.031</td>
<td></td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>Sanctioning</td>
<td>0.25</td>
<td>0.031</td>
<td></td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>Third party auditing</td>
<td>0.25</td>
<td>0.031</td>
<td></td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>Public accessibility of reports</td>
<td>0.25</td>
<td>0.031</td>
<td></td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct costs</td>
<td>0.25</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial audit</td>
<td>0.25</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surveillance audit</td>
<td>0.25</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect costs</td>
<td>0.25</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.14 Weight distribution
these categories receives a weight of 0.250 amounting to 1. This weight of 1 relates only to the variable stringency; it is not the overall weight of the categories on the entire MCA. The weights of the underlying categories and/or indicators are given in the subsequent columns. The last column shows the actual weight of the indicator on the entire MCA. For instance, completeness determines 0.250 of stringency, but weighs 0.125 in the MCA. Similarly, the indicator A.7 air quality weighs 0.111 in the category environmental of the parent category comprehensiveness. The weight of this criterion on the total MCA is 0.07. The weights in the last column add up to 1, representing the overall weight of the MCA.

4.3.4 Ranking

Using weighted summation, multiplying the standardized scores with the attached weights, a ranking of the alternatives is produced. The total scores of the alternatives are shown in table 4.15.

<table>
<thead>
<tr>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSB</td>
</tr>
<tr>
<td>ISCC</td>
</tr>
<tr>
<td>ISCC (member)</td>
</tr>
<tr>
<td>RTRS</td>
</tr>
<tr>
<td>RSB (member)</td>
</tr>
<tr>
<td>2BSys</td>
</tr>
<tr>
<td>RTRS (member)</td>
</tr>
<tr>
<td>Biosuco (member)</td>
</tr>
<tr>
<td>2BSys (member)</td>
</tr>
</tbody>
</table>

Table 4.15 Ranking of the alternatives

The RSB has the highest score and therefore ranks first. If stringency and costs are weighed equally, the RSB is preferable in terms of stringency and costs, assuming high stringency and low costs are desired. The ranking above is depicted in figure 4.2.
The ranking gives an idea about the performance of the standards. However, it is not clear how the standards perform on stringency and costs. In figure 4.3 the scores of the standards are divided into the scores on stringency and costs.

Figure 4.2: Ranking of the alternatives

Figure 4.3: Ranking of the alternatives divided in stringency and costs
Both RSB alternatives score especially well on stringency. The score on costs is higher for the RSB alternative without membership. A higher score on costs means that the alternative is less expensive: the higher bars are always favourable over the lower bars. The membership fee of the RSB alternative with membership causes that alternative to rank lower. The 2BSvs alternative without membership performs best on costs (i.e. the highest bar).

Figure 4.3 contains additional information, aside from the ranking: it shows the relationship between stringency and costs. The most apparent examples are the RSB alternatives and the 2BSvs alternatives. Both RSB alternatives have high scores on stringency and low scores on costs, indicating high stringency and high costs. Conversely, the 2BSvs alternatives have low scores on stringency and high scores on costs, indicating low stringency and low costs. This relationship is observable to a lesser extent in the other certification schemes, because the differences are smaller. This figure provides evidence for the acceptation of the hypothesis $H_0$.

### 4.3.5 Sensitivity

This research does not assess the relative importance of the variables or indicators. Although no statement is made on the correct weight distribution it is interesting to see if the results change if the weights are modified. Hence, two perspectives are introduced to assess whether or not the ranking changes if more weight is attached to either stringency or costs. The stringency perspective attributes more weight to stringency and less weight to costs. The costs perspective does the opposite. Table 4.16 presents the weight distribution of the perspectives.

<table>
<thead>
<tr>
<th>Perspectives:</th>
<th>Stringency</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0.5</td>
<td>0.25</td>
</tr>
<tr>
<td>Perspective:</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Stringency</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.16: Weight distribution of the perspectives

The standardized scores are equal, only the weight set is altered. By multiplying the standardized scores with the new weights a new ranking is produced. Table 4.17 shows the original ranking (in the column ‘total’) and, additionally, the rankings with a stringency perspective and a costs perspective.
Table 4.17: Ranking of the alternatives including the perspectives

The table shows that the RSB ranks the highest in the stringency perspective. The RTRS ranks higher than in the original weight set, because the relatively high costs of the RTRS weigh less. In the costs perspective the RSB does not rank first anymore. The ISCC and the 2BSvs standard tie at first place. The three rankings (original and both perspectives) are depicted in figure 4.4.

Figure 4.4: Ranking of the alternatives divided in stringency and costs including the two perspectives

Additionally, figure 4.5 depicts the changes in ranking for the three situations. With the original weight distribution, the ranking is the one shown in the figure above. In the stringency perspective the ISCC drops three places in the ranking compared to the original situation. In the costs perspective
2BSVs and the ISCC rank higher and the RSB lower. The distribution of the weights thus influences the ranking significantly.

Figure 4.5: Ranking of the alternatives divided in stringency and costs including the two perspectives

The perspectives give some insight in the elasticity of the ranking. In order to assess the true sensitivity of the ranking, the DEFINITE software used for this MCA allows for sensitivity analyses. Figure 4.6 depicts the sensitivity analysis for the weight of stringency.
Figure 4.6: Sensitivity analysis for the weight of stringency

In the figure above the blue vertical line shows the original weight (0.5). The other lines represent the alternatives. At the original weight the RSB is the top line, which means it ranks first. However, when the weight of stringency is lowered to 0.4681 (calculated using the DEFINITE software), allowing more weight for costs, the ISCC reverses rank with the RSB. Lowering the weight to 0.2461 would lead to a reversal in ranks between the ISCC and 2BSvs. In the costs perspective shown in figures 4.4 and 4.5 2BSvs seemed to tie at first place with the ISCC. Actually, the ISCC was first in ranking because the weight in the costs perspective was higher than 0.2461, namely 0.250.

The ranking of the alternatives is also sensitive to the weight of costs. Figure 4.7 shows the sensitivity analysis of the weight of costs.
At the original weight, represented by the blue vertical line, the RSB ranks first. As in the sensitivity analysis for stringency, by allowing more weight to costs the ISCC reverses ranks with the RSB. This occurs at a weight of 0.5319. Similarly, at a weight of 0.7539 the ISCC surrenders the first position to 2BS vs. All the intersections represent reversal points, i.e. the point in which the ranking of the two selected alternatives is changed (Janssen et al., 2006). Without intersections the ranking is not sensitive to changes in weight. With many intersections, like in figure 4.6 and 4.7, the chosen weight set influences the analysis significantly.

### 4.4 Result

Based on the assessments of the five certification schemes on the variable stringency and costs and the subsequent comparison the hypothesis is accepted or rejected. The hypotheses as stated in paragraph 3.2 are:

$H_0$: the differences in costs associated with a standard are explained by differences in the stringency of that standard

The alternative hypothesis states that this relationship does not hold:

$H_A$: the differences in costs associated with a standard are not explained by differences in the stringency of that standard
The comparison of the standard allowed for some insight in the relationship between the variables stringency and costs. Although the sample is small (five standards) there is evidence that the null hypothesis $H_0$ holds. Based on this research the hypothesis is accepted: the differences in costs associated with a standard are explained by differences in the stringency of that standard. By accepting the null hypothesis $H_0$, the alternative hypothesis $H_a$ is rejected.
5 Conclusions, discussion and recommendations

The European community is transitioning to a transport sector in which 10 percent of the energy consumed consists of renewable energy sources. The EU made a choice to promote sustainable biofuels to substitute part of the energy consumption of the transport sector. The sustainability of the biofuels is safeguarded by certification schemes through certificates of sustainability. The seven certification schemes comply with a set of sustainability criteria established in the EU RED. The certification schemes differ in origin, stringency and costs. Based on the assessments in this research and the comparison of the schemes the MSIs are more stringent and more expensive than company initiated scheme. If stringency and costs are considered equally important, the RSB standard is the preferable option in terms of stringency and costs. However, the weight set used for the comparison influences the ranking of the standards considerably. Although the sample in the research is small, there is evidence that the costs associated with the certification schemes are determined by the stringency of the schemes, therewith accepting the null hypothesis, albeit inconclusively.

It is likely that the reason the MSIs are more stringent is that more stakeholders are included in the development of the standard. Therefore, more demands and preferences have to be considered and (possibly) included. The biofuel producers, local growers, traders and NGOs all have different opinions on what is relevant to include in the standard, resulting in a long list of criteria and therewith making the standard more stringent. Local growers or communities may desire a more stringent standard to protect their community, maximizing their benefits and minimizing the negative aspects of biofuel production. Additionally, the MSIs are more ambitious than the company initiated scheme: they envision a greater change to be made through certification. This argument may especially hold for NGOs involved in the MSIs.

The MSIs are not only more ambitious than the company initiated scheme; the criteria included in the MSI standards are also more clear and better verifiable than the criteria in the company initiated scheme. However, quantifiable targets are mostly absent from the standards, with the exception of Bonsucro. The implications of the absence of such quantifiable targets are that the criteria are more difficult to verify and that applying companies are unsure about the steps needed to comply. Moreover, without quantifiable targets the criteria are open for interpretation, possibly causing other results than the certification schemes intended to achieve.

The company initiated scheme 2BSvs is less comprehensive than the MSIs. Within the MSI group, the RSB standard is the most comprehensive standard, i.e. it includes most of the FAO sustainability criteria, representing all imaginable sustainability issues. The sustainability issues that were most absent from the standards are criteria on indirect land use change and food security. The absence of criteria on the effects of land use change is worrisome because the reality is not represented in the values of GHG emissions currently used by certified schemes. Biofuels have neutral CO₂-emissions if the focus is solely on the feedstock growth and the combustion of the fuels. However, if the entire life cycle of biofuels is considered, including the GHG emissions resulting from land use change, the emissions may turn out higher. Food security is only covered extensively in the RSB standard. The
absence of criteria on this subject is remarkable in view of the food versus fuel debate. Due to biofuel production, food prices can increase because there is less food available. Especially local communities and countries dependent on food imports suffer from an increase in food prices.

The absence of the criteria on food security and indirect land use change are noteworthy. These two issues are currently heavily debated on, because if these issues are not taken into account, biofuels are less sustainable. According to WWF, food security and indirect land use change effects are two of the 10 most pressing impacts associated with bioenergy. The absence of these criteria in (most of) the standards is the reason that none of the standards are considered complete. If the 10 most important criteria are not included, the debate on whether biofuels can be sustainable is not yet over. The inclusion of these 10 criteria will help make biofuels more sustainable.

The criteria in a standard need compliance mechanisms to ensure compliance. The company initiated scheme 2BSvs includes good monitoring mechanisms. However, these are not backed by strong sanctioning mechanisms. This may lead to monitored non-compliance without consequences and the company may continue its non-sustainable practices. The MSIs balance their monitoring and sanctioning mechanisms. The monitoring of the certified companies is supported by sanctioning mechanisms ensuring continuous compliance with the standards.

The criteria in a standard are only one side of the coin. The other side of the coin is the costs that accompany the criteria. The more stringent a standard is the higher the costs are. The MSIs are more stringent and therefore also more expensive than the company initiated scheme. Between the MSIs there are also differences observed. The RTRS standard is only appealing to companies with low production levels, because of the low fixed costs and the high quantity dependent fee. For the ISCC membership is only beneficial at high production levels. However, the costs might be higher than can be concluded from this research. The costs included represent approximately four percent of the total certification costs. The total costs could thus be 25 times higher than made apparent in this research, although it is unclear if, and for which certification schemes, this would apply.

The question is if biofuels are really the way forward for the transport sector in the EU. The proposed step away from fossil fuels in the EU is a good start to combat global warming, however, the sustainability criteria mandated by the EC in the RED are not sufficient to ensure the sustainability of biofuels.

The MSIs included in this research recognized the low ambition of the RED and developed a more stringent standard in order to achieve more sustainable practices. However, the additional stringency compared to the RED is accompanied by additional costs. The uptake of these certification schemes could therefore be hindered, because companies aspiring certification might not have the financial means to acquire a certificate of a more stringent and, therefore, more expensive scheme. The company may also find that the benefits of certification do not outweigh the costs of certification. Moreover, companies may not share the idealism and sustainability aspirations of the MSIs and choose for an equally valuable certificate (at least to the company) of the company initiated scheme 2BSvs. Such a certificate provides evidence of sustainability in accordance with the RED, alike the MSI certificates, against lower costs. The EU target for the transport sector may well be reached using a
certification scheme with low costs and low stringency, but from a sustainability perspective, this would not be preferable.

**Recommendations**

This research provided evidence on the direct relationship between stringency and costs. Furthermore, the seven EC approved certification schemes were assessed and their characteristics were valuated. Based on the outcome some recommendations can be made for certification schemes, companies, policy makers and researchers.

The certification schemes can draw conclusions from the research. The inclusion of more quantitative targets and more detailed criteria helps to ensure sustainability. If criteria are verifiable and not open for interpretation, the intended results of the standard are more likely to be established. Moreover, many of the most pressing impacts associated with biofuels are not covered in the standard. In order to realize a substantial change in the practices of biofuel producers these criteria should be included. The focus should be firstly on the effects of indirect land use change and criteria on food security. Furthermore, with a realistic rendition of the GHG emissions (including those resulting from indirect land use change) attention is drawn to this issue. The attention then can spur on regulations to prevent indirect land use change altogether. Regarding the food security, inclusion of criteria on this issue will reduce the chance of food insecurity in local communities and countries depending on food imports. Furthermore, the compliance mechanisms should be strengthened: without strong sanctioning mechanisms, compliance cannot be ensured. Lastly, if possible, the costs should decrease. This is especially the case for MSIs if they want to be able to compete with company initiated schemes. A decoupling of stringency and costs would be ideal from a sustainability perspective, as more sustainable practices could be achieved with lower costs.

Companies aspiring certification by one of the certification schemes covered in this research can use the assessments and the MCA to make a more informed decision. A certification scheme that complies with the RED is not sustainable per se. There is several differences between the certification schemes. The more stringent standards bring about a greater change in terms of sustainability, but are also more expensive. Based on a company’s financial means and/or envisioned change the company can use the comparison to choose a certification scheme matching its preferences.

Policy makers in the EU should include the 10 most pressing impacts associated with biofuels in the RED. If the RED includes all relevant sustainability criteria, the certification schemes that want to compete in the biofuel certification market in the EU have to comply with the criteria in the RED. That way, stringency is less of an issue and the costs of certification of the schemes will be more comparable to each other. Moreover, sustainable biofuels will be ensured and a more sustainable practices guaranteed.

Additional research is needed in order to include the implementation costs of the standards. This would give a more realistic insight in the expenses required for certification. This lion's share of the costs is difficult to assess, because the implementation costs differ per case. However, with enough time and resources, it may be possible to retrieve information on these costs. Furthermore, this
research did not include information on the uptake of the certification schemes. More research is needed on the relationship between stringency and uptake and between costs and uptake. The consequences of a more stringent and expensive standard will then become clear. If the costs are believed to be too high, non-compliance with the standard may occur as the company does not value the benefits of certification higher than the costs. In order to prove this relationship, additional research on costs and compliance is required. When the market of biofuel certification is somewhat matured and the competitiveness has subsided, the information on the costs may be more easily accessible as well as information on the certification schemes that were not included in this research. If these schemes are included, stronger evidence on the performance differences between company initiated schemes and MSIs will be available, resulting in a stronger argument for acceptance of the null hypothesis $H_0$. In this research, some evidence on the relationship and the difference between MSIs and company initiated certification schemes is available, however, it is debatable if the sample is large enough to generalize the results to theory.
References


Bonsucro


EC


ISCC


RSB


RTRS

Round Table on Responsible Soy Association (RTRS) (2010a). RTRS Standard for Responsible Soy Production Version 1.0. Reference code: RTRS_STD_001_V1-0_ENG for responsible soy production.


Round Table on Responsible Soy Association (RTRS) (2011a). RTRS EU RED Scheme: System Description. Reference code: RTRS EU RED System 2.0_ENG

Round Table on Responsible Soy Association (RTRS) (2011b). RTRS EU RED Compliance Requirements for Producers. Reference code: RTRS EU RED Compliance Requirements for Producers 3.0_ENG


Round Table on Responsible Soy Association (RTRS) (2011d). RTRS EU RED Communications and Claims Policy. Version 1.0.

Round Table on Responsible Soy Association (RTRS) (2011e). Application for formal recognition of certification bodies under RTRS standards. Reference code: RTRS_AGR y CoC_ENG.


2BSvs


Software


Websites certification schemes

Abengoa RBSA: http://www.abengoabioenergy.com
Bonsucro: http://www.bonsucro.com
Greenergy: http://www.greenergy.com
ISCC: http://www.iscc-system.org
RSB: http://rsb.epfl.ch
RTRS: http://www.responsiblesoy.org
2BSvs: http://en.2bsvs.org

Other websites

Appendix A: Consulted experts

Some information was retrieved through open communication with experts. When information of experts was used the reference in the text included the initial of the expert.

<table>
<thead>
<tr>
<th>Consulted expert</th>
<th>Job Title</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam, Jinke van</td>
<td>Consultancy on sustainable resources, value chains and energy; co-author NL Agency, 2012</td>
<td>Jinke van Dam Consultancy</td>
</tr>
<tr>
<td>DNV⁴</td>
<td>N/a</td>
<td>DNV Climate Change Services (a certification body, among other things)</td>
</tr>
<tr>
<td>Gilhuis, Jan</td>
<td>Senior Programme Manager</td>
<td>IDH – The Sustainable Trade Initiative</td>
</tr>
<tr>
<td>Heinrich, Jan</td>
<td>Managing Partner</td>
<td>JH Green Consulting</td>
</tr>
<tr>
<td>López López, Jesús</td>
<td>Sustainability &amp; Strategic consultancy; senior engineer</td>
<td>Abengoa Bioenergy Corporation</td>
</tr>
<tr>
<td>Máthé, László</td>
<td>Bioenergy coordinator</td>
<td>WWF International/WWF Scotland</td>
</tr>
<tr>
<td>Rodríguez Arias, Hernán</td>
<td>Certification coordinator</td>
<td>Schutter Argentina SA. (a certification body, among other things)</td>
</tr>
<tr>
<td>Staaij, Jasper van de</td>
<td>Consultant sustainable energy</td>
<td>Ecofys Consultancy</td>
</tr>
<tr>
<td>Velden, Frank van der</td>
<td>Program Manager</td>
<td>Control Union Certifications</td>
</tr>
<tr>
<td>Williams, Melanie</td>
<td>Director EMEA (Europe, Africa and Middle East)</td>
<td>RSB services</td>
</tr>
</tbody>
</table>

⁴ The consulted expert expressed the desire to remain anonymous.
Appendix B: Sustainability criteria in the RED

The sustainability criteria stated below are taken from the Renewable Energy Directive, article 17 (EC, 2009a).

1. Irrespective of whether the raw materials were cultivated inside or outside the territory of the Community, energy from biofuels and bioliquids shall be taken into account for the purposes referred to in points (a), (b) and (c) only if they fulfil the sustainability criteria set out in paragraphs 2 to 6:

(a) Measuring compliance with the requirements of this Directive concerning national targets;

(b) Measuring compliance with renewable energy obligations;

(c) Eligibility for financial support for the consumption of biofuels and bioliquids.

However, biofuels and bioliquids produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues, need only fulfil the sustainability criteria set out in paragraph 2 in order to be taken into account for the purposes referred to in points (a), (b) and (c).

2. The greenhouse gas emission saving from the use of biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall be at least 35 percent.

With effect from 1 January 2017, the greenhouse gas emission saving from the use of biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall be at least 50 percent. From 1 January 2018 that greenhouse gas emission saving shall be at least 60 percent for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.

The greenhouse gas emission saving from the use of biofuels and bioliquids shall be calculated in accordance with Article 19(1).

In the case of biofuels and bioliquids produced by installations that were in operation on 23 January 2008, the first subparagraph shall apply from 1 April 2013.

3. Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land with high biodiversity value, namely land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status:

(a) Primary forest and other wooded land, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed;

(b) Areas designated:
(i) by law or by the relevant competent authority for nature protection purposes; or

(ii) for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition in accordance with the second subparagraph of Article 18(4);

unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes;

(c) Highly biodiverse grassland that is:

(i) natural, namely grassland that would remain grassland in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes; or

(ii) non-natural, namely grassland that would cease to be grassland in the absence of human intervention and which is species-rich and not degraded, unless evidence is provided that the harvesting of the raw material is necessary to preserve its grassland status.

The Commission shall establish the criteria and geographic ranges to determine which grassland shall be covered by point (c) of the first subparagraph. Those measures, designed to amend non-essential elements of this Directive, by supplementing it shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 25(4).

4. Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land with high carbon stock, namely land that had one of the following statuses in January 2008 and no longer has that status:

(a) Wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year;

(b) Continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 percent, or trees able to reach those thresholds in situ;

(c) Land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 percent and 30 percent, or trees able to reach those thresholds in situ, unless evidence is provided that the carbon stock of the area before and after conversion is such that, when the methodology laid down in part C of Annex V is applied, the conditions laid down in paragraph 2 of this Article would be fulfilled.

The provisions of this paragraph shall not apply if, at the time the raw material was obtained, the land had the same status as it had in January 2008.
5. Biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil.

6. Agricultural raw materials cultivated in the Community and used for the production of biofuels and bioliquids taken into account for the purposes referred to in points (a), (b) and (c) of paragraph 1 shall be obtained in accordance with the requirements and standards under the provisions referred to under the heading 'Environment' in part A and in point 9 of Annex II to Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers and in accordance with the minimum requirements for good agricultural and environmental condition defined pursuant to Article 6(1) of that Regulation.

7. The Commission shall, every two years, report to the European Parliament and the Council, in respect of both third countries and Member States that are a significant source of biofuels or of raw material for biofuels consumed within the Community, on national measures taken to respect the sustainability criteria set out in paragraphs 2 to 5 and for soil, water and air protection. The first report shall be submitted in 2012.

The Commission shall, every two years, report to the European Parliament and the Council on the impact on social sustainability in the Community and in third countries of increased demand for biofuel, on the impact of Community biofuel policy on the availability of foodstuffs at affordable prices, in particular for people living in developing countries, and wider development issues. Reports shall address the respect of land-use rights. They shall state, both for third countries and Member States that are a significant source of raw material for biofuel consumed within the Community, whether the country has ratified and implemented each of the following Conventions of the International Labour Organisation:

Convention concerning Forced or Compulsory Labour (No 29), —

Convention concerning Freedom of Association and Protection of the Right to Organise (No 87), —

Convention concerning the Application of the Principles of the Right to Organise and to Bargain Collectively (No 98), —

Convention concerning Equal Remuneration of Men and Women Workers for Work of Equal Value (No 100), —

Convention concerning the Abolition of Forced Labour (No 105), —

Convention concerning Discrimination in Respect of Employment and Occupation (No 111), —

Convention concerning Minimum Age for Admission to Employment (No 138), —
Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour (No 182).

Those reports shall state, both for third countries and Member States that are a significant source of raw material for biofuel consumed within the Community, whether the country has ratified and implemented:

The Cartagena Protocol on Biosafety, —


The first report shall be submitted in 2012. The Commission shall, if appropriate, propose corrective action, in particular if evidence shows that biofuel production has a significant impact on food prices.

8. For the purposes referred to in points (a), (b) and (c) of paragraph 1, Member States shall not refuse to take into account, on other sustainability grounds, biofuels and bioliquids obtained in compliance with this Article.

9. The Commission shall report on requirements for a sustainability scheme for energy uses of biomass, other than biofuels and bioliquids, by 31 December 2009. That report shall be accompanied, where appropriate, by proposals for a sustainability scheme for other energy uses of biomass, to the European Parliament and the Council. That report and any proposals contained therein shall be based on the best available scientific evidence, taking into account new developments in innovative processes. If the analysis done for that purpose demonstrates that it would be appropriate to introduce amendments, in relation to forest biomass, in the calculation methodology in Annex V or in the sustainability criteria relating to carbon stocks applied to biofuels and bioliquids, the Commission shall, where appropriate, make proposals to the European Parliament and Council at the same time in this regard.

These criteria are all adopted from the Directive 2009/28/EC (EC, 2009a). Article 6 redirects to different legal documents and the articles in question are not included in the appendix. The information in these articles is included in the assessment of the certification schemes.
Appendix C: Assessment of comprehensiveness

The assessment of comprehensiveness is based on the 24 sustainability criteria of the FAO. In this appendix the standards are assessed one by one. Each FAO criterion is stated followed by the criteria and indicators of the standard that include the FAO criterion. The assessments are conducted using the principles and criteria stated in the standards of each certification scheme. For each certification scheme the document containing the standard is referred to once at the start of each assessment. This reference applies to all information of that standard, unless stated otherwise.

2BSvs (2BSvs, 2011a)

A.1 Land use change (both direct and indirect). The criteria and indicators reflecting this sustainability criterion are:

Indicator 0.6.2: For all suppliers of biomass claiming sustainability that have declared land use change in the previous year(s), the 1st gathering entity shall have recorded the corresponding eI value (land use change).
Verifier: List of suppliers of biomass claiming sustainability where land use change has resulted in carbon emission and carbon stock change.

Indicator 2.2.1: For suppliers of biomass claiming sustainability that are located outside the European Union or in a European Union NUTS 2 region qualified for cultivation default values on the European Commission transparency platform, the relevant default value for the corresponding raw material, biomass and correct process type, if relevant, may be used. To use a default value the 1st gathering entity shall ensure that the biomass has not been produced on land with land use change since January 2008, such as the conversion of permanent grassland.

These two indicators represent everything the standard includes on land use change. However, the GHG emissions from direct land use change are incorporated. The standard requires that the methodology used to calculate GHG emissions is approved or recognized by the EC. In the methodology mentioned in the RED (i.e. EC approved) the GHG emissions from land use change are incorporated. ILUC is not mentioned in the standard. Therefore: partial fulfillment. The FAO criterion is not detailed because less than three indicators are used.

A.2 Biodiversity and ecosystem services

Criterion 3.1: The 1st gathering entity shall demonstrate that a system has been implemented to inform biomass producers claiming sustainability that raw material for the production of sustainable biofuels does not come from land that had/has High Biodiversity Status in or after January 2008, unless, for the areas covered by the article 17-3-b of the RED only, he can provide evidence that the production of raw material did not interfere with nature protection purposes.

Indicator 3.2.4 (Critical Indicator): The 1st gathering entity shall ensure that biomass does not come from areas designated by law, or by other competent national authority, for nature protection purposes, or
• from areas designated for the protection of rare, threatened or endangered ecosystems or species recognized by international agreements or included in lists drawn up by intergovernmental organizations or the IUCN, subject to their recognition by the European Commission

Criterion 3.3: The 1st gathering entity should record whether the country of origin of the biomass has ratified and implemented the relevant international biodiversity agreements, conventions and protocol.
Indicator 3.3.1: The 1st gathering entity should record whether the country of origin of the biomass has ratified and implemented the Cartagena Protocol on Biosafety.
High Conservation Areas are taken into account, however invasive species and ecosystem services are not included. Therefore: partial fulfillment. The FAO criterion is not detailed because less than three indicators are used.

A.3 Productive capacity of land
Criterion 7.1: The 1st gathering entity should inform biomass producers that raw material for the production of sustainable biofuels shall not come from land where soil, water and air have not been protected. Indicator 7.1.2: The 1st gathering entity should ensure that biomass comes from land where soil has been protected.
• Verifier: Agriculture practices to protect soils against erosion between 2 crops, or
• Verifier: Procedure regarding agriculture practices to protect soil against erosion between 2 crops.

Principle 7: Soil, Water and Air Protection
Sustainable biofuels should not be made from raw material produced on land where soil, water and air have not been protected (EU Directive Article 18, section 3). This criterion of the European Directive is not a requirement for the 1st gathering entity. This is the reason why this Principle is worded as a recommendation and is indicative only.
Indicator 7.1.1: The 1st gathering entity should inform all its suppliers that appropriate measures must be implemented to protect soil, water and air.
• Verifier: Information pack, or
• Verifier: Interview with suppliers.

The standard makes a distinction between "shall" and "should". Here the word "should" is used although it is unclear what the difference between shall and should entails. The word "shall" implies a mandate while should implies an advice. Only erosion is taken up in the standard. No water runoff is mentioned nor crop life cycle. Partial fulfillment and not detailed.

A.4 Crop management and agrochemical use
Principle 6: Agro-environmental Practices
Sustainable biofuels shall not be made from raw material produced within the Community that have not been cultivated in accordance with the requirements and standards under the provisions referred to under the heading 'Environment' in part A and in point 9 of Annex II to Council Regulation (EC) No 73/2009 of January 2009 and with the minimum requirements for good agricultural and environmental condition established in Article 6(1) of that Regulation.

Criterion 6.1: The 1st gathering entity should ensure that all suppliers of biomass claiming sustainability based within the Community are committed to fulfill the requirements of the relevant agro-environmental practices.
Indicator 6.1.1: The 1st gathering entity should ensure that all its suppliers based in the Community declare that they comply with the European Agro-Environmental Practices.

Criterion 6.2: The 1st gathering entity should inform, train and/or advise suppliers on best environmental and agricultural practices in conformity with the European Legislation. Fertilizer and pesticide use is not mentioned in the standard. Compliance with European Agro-environmental practices should be declared.
Fulfillment: partial. Detailed: no

A.5 Water availability and quality
Criterion 7.1: The 1st gathering entity should inform biomass producers that raw material for the production of sustainable biofuels shall not come from land where soil, water and air have not been protected.

Indicator 7.1.1: The 1st gathering entity should inform all its suppliers that appropriate measures must be implemented to protect soil, water and air.

Indicator 7.1.3: The 1st gathering entity should ensure that biomass does not come from land where excessive water has been consumed in areas where and during period when water is scarce.

Contamination of water is considered but not a critical criterion ("should"). Scarcity is taken into account. Fulfillment: partial. Detailed: no.

A.6 GHG-emissions
1st gathering entity should develop a reduction plan to go from 35 % savings to 50 and then to 60% as set out in the RED. Default values of the RED ("shall"). 2.3.1: Only use of EU approved GHG calculations.
2.4: life cycle is considered and accurate info recorded. Detailed: no. Fulfillment: yes.

A.7 Air quality
Criterion 7.1: The 1st gathering entity should inform biomass producers that raw material for the production of sustainable biofuels shall not come from land where soil, water and air have not been protected.

Indicator 7.1.4: The 1st gathering entity should ensure that biomass comes from land where air has been protected. No burning of residues.

Fulfillment: partial, nitrogen is not considered. Detailed: no.

A.8 Waste management
Indicator 2.4.2: The 1st gathering entity shall consider wastes and residues, to have zero life cycle greenhouse gas emissions up to the process of collection. (GHG criterion)

A.9 Environmental sustainability
No criteria or indicators found. Fulfillment: no. Detailed: no.
B.1 Land tenure/access and displacement
Indicator 0.1.1: The 1st gathering entity shall define the data, documents and/or records needed for its suppliers of biomass covered by the certification unit to demonstrate that the biomass is in conformity with the European Directive and that the biomass can be considered as sustainable. Such evidence shall be based on relevant official records, official land registry, data or documents that can be independently verified.
Land rights are not mentioned. Official land registry source hints in the direction. Furthermore, compensation, access to land and land security are not mentioned. Fulfillment: no. Detailed: no.

B.2 Rural and social development
Criterion 0.4: The 1st gathering entity shall ensure that all suppliers of biomass covered under the certification unit (i.e. group members) and personal have received adequate information and/or training as needed to implement the system and ensure the sustainable characteristics of the biomass. The 1st gathering entity can choose its own preferred method to inform and train people but records of information and/or training shall be kept.
This can be interpreted as knowledge transfer to the community. However, it is likely to be meant for the firm and partners thereof. Fulfillment: no detailed: no.

B.3 Access to water and other natural resources
Indicator 7.1.3: The 1st gathering entity should ensure that biomass does not come from land where excessive water has been consumed in areas where and during period when water is scarce.
Only scarcity is taken into account. Water rights and use for indigenous people are not covered. No mentioning of other resources. Fulfillment: no. Detailed: no.

B.4 Employment, wages and labor conditions
Principle 8: Social Sustainability
For countries that are a significant source of raw material for sustainable biofuels, the 1st gathering entity should report whether the country of origin has ratified and implemented the ILO conventions No 29 [forced labor], 87 [freedom of association and protection of the right to organize], 98 [right to organize and collective bargaining], 100 [equal remuneration], 105 [abolition of forced labor], 111 [discrimination], 138 [minimum age] and 182 [worst forms of child labor]. This criterion of the European Directive is not a requirement for the 1st gathering entity. This is the reason why this Principle is worded as a recommendation and is indicative only.
ILO conventions are considered in the standard. Fulfillment: yes. Detailed: no.

B.5 Human health and safety

B.6 Energy security and access
No criteria found on this subject. Fulfillment: no. Detailed: no.

B.7 Good management practices and continuous improvement
Criterion 6.1: The 1st gathering entity should ensure that all suppliers of biomass claiming sustainability based within the Community are committed to fulfill the requirements of the relevant agro-environmental practices.
Criterion 6.2: The 1st gathering entity should inform, train and/or advise suppliers on best environmental and agricultural practices in conformity with the European Legislation.


**B.8 Social sustainability**
No criteria found. Fulfillment: no. Detailed: no.

**B.9 Food availability**
No criteria found. Fulfillment: no. Detailed: no.

**B.10 Food access**
No criteria found. Fulfillment: no. Detailed: no.

**B.11 Food utilization**
No criteria found. Fulfillment: no. Detailed: no.

**B.12 Food stability**
No criteria found. Fulfillment: no. Detailed: no.

**B.13 Food security**
No criteria found. Fulfillment: no. Detailed: no.

**C.1 Compliance**
Convention on International Trade in Endangered Species of Wild Fauna and Flora and ILO conventions No 29, 87, 98, 100, 105, 111, 138 and 182

Criterion 3.3: The 1st gathering entity should record whether the country of origin of the biomass has ratified and implemented the relevant international biodiversity agreements, conventions and protocol.

**C.2 Participation and transparency**
Criterion 0.4: The 1st gathering entity shall ensure that all suppliers of biomass covered under the certification unit (i.e. group members) and personal have received adequate information and/or training as needed to implement the system and ensure the sustainable characteristics of the biomass. The 1st gathering entity can choose its own preferred method to inform and train people but records of information and/or training shall be kept.
This criterion provides information only to suppliers. Local consent is not mentioned. The word “stakeholders” is not mentioned in the standard. Fulfillment: no. Detailed: no.

**Bonsucro** (Bonsucro EU, 2011)

**A.1 Land use change (both direct and indirect).** The criteria and indicators reflecting this sustainability criterion are:
The GHG emissions of LUC are mentioned in criteria 6.1. The division in direct and indirect is mentioned in appendix 3: GHG calculations (point 3). So far, only partially fulfilled. Calculation and default values are mentioned extensively. Number of indicators is 1; however, that indicator is described thoroughly.
Fulfillment: partial. Detailed: no

A.2 Biodiversity and ecosystem services
This criterion is covered in much detail. 7 indicators are defined to assess the impact of a project on biodiversity and ecosystem services (criterion 4.1). Producers must satisfy this criterion completely. HCVA are mentioned: *HCV 1 Areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia) *HCV 2 Areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance *HCV 3 Areas that are in or contain rare, threatened or endangered ecosystems *HCV 4 Areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control)
Furthermore oxygen demand, use of co-products, fertilizer management and limits on Nitrogen and phosphorus fertilizer and herbicides and pesticides are covered. Moreover an environmental management plan (EMP) is required, taking into account endangered species, habitats and ecosystems as well as reference to ecosystem services and alien invader plant and animal control (NIS).
Fulfillment: yes. Detailed: yes

A.3 Productive capacity of land
Soil erosion is covered in criterion 5.2. HCVA category 4 also covers areas that are important for erosion control. The EMP mentions a soil erosion plan. The crop life cycle is mentioned in the GHG calculations. However, other effects of the crop life cycle such as water run-off and crop rotation are not covered. The soil erosion is only mentioned in relation to protection of HCVA. Therefore, Bonsucro does not satisfy this criterion fully, but partially. Detailed: no.

A.4 Crop management and agrochemical use
This also falls under the biodiversity and ecosystem services criterion: fertilizer is applied according to soil or leaf analysis. Nitrogen and phosphorus fertilizers have an upper limit. Herbicides and pesticides have an upper limit as well and only Persistent Organic Pollutants (POPs) that are registered for use and at registered rates may be used, also complying with the Stockholm convention on POPs. Fertilizer and chemicals are included in the system boundary for the GHG calculations, including energy for the production of those products.
Ergo, Bonsucro satisfies. Detailed: no

A.5 Water availability and quality
In biodiversity and ecosystem services criterion 4.1 water is mentioned in the fertilizer indicator. The limit on fertilizer is set to minimize ground water and downstream contamination. The herbicides and pesticides indicator is set to minimize air, soil and water contamination. Criterion 4.2 focuses on mitigation measures including consultation with downstream stakeholders affected by the contamination. Principle 5 focuses on continuous improvement points. In 5.2 the improvement of
water resources is stated: net water consumed per unit mass of product is mentioned. Water is mentioned in the EMP but this can be filled in as pleased by the producer. Apart from the mentioning of improving the status of water resources and securing drinking water and protecting HCVA with a watershed function, water is not extensively mentioned in the Bonsucro standard. Limiting the fertilizer and pesticides minimizes the contamination. Water run-off is not mentioned, quality and scarcity only partly. Detailed: no. Fulfillment: Partially

A.6 GHG-emissions
The GHG emissions of LUC are mentioned in criteria 6.1. The division in direct and indirect is mentioned in appendix 3: GHG calculations (point 3). The GHG emissions calculations and default values are extensively described in appendix 3. Although Bonsucro complies with the criteria in the EU RED, the GHG savings of 35, 50 and 60 percent mandated by the EU are not mentioned in the standard nor are other percentages that supersede these percentages. The criterion of the FAO is fulfilled with much detail.

A.7 Air quality
The limit of pesticides and herbicides is calculated as a measure of potential effect on the environment. This is a means to reduce air pollution. Air is mentioned in the EMP, but this is flexible. Nitrogen emissions are included in the GHG emission calculations. The polluting capacity of nitrogen emissions to air is not included. Therefore, partially fulfilled. Detailed: no.

A.8 Waste management
Waste streams are mentioned under the continuous improvements. Recycling is promoted. <1.0 t of non-hazardous residues allowed per ton of cane. Fulfilled: partially. Detailed: no.

A.9 Environmental sustainability
The producer must satisfy this criterion. Stated in 5.7 that for new projects an Environmental and Social Impact Assessment (ESIA) is required. Contributes to transparency. Detailed: yes. Although it is only divided in two indicators, the HCV indicator refers to more indicators. Criterion is satisfied.

B.1 Land tenure/access and displacement
Addressed in criterion 1.1. Producers most satisfy this criterion. In appendix 2 a list of relevant laws that should be followed is stated.

Criterion 1.2 states that the producer should be able to demonstrate clear title to the land. In appendix 2.2 international conventions are stated. The ones related to this FAO criterion: the ILO Convention 169 (1989) on Indigenous and Tribal people states: “Respect and safeguard rights to lands and natural resources traditionally occupied and used; respect for customs of inheritance; no forced removals; compensation for loss and injury; Right to distinctive relationship with land; right to own, use, develop and control their lands, territories and other resources”. The UN Declaration on the Rights of Indigenous Peoples (2007) states: “Right to free, prior and informed consent to any project affecting their lands as expressed through their own representative institutions.” Protection of HCVA includes access of peoples to natural resources. Detailed: yes. This criterion has several (>3) indicators for this FAO criterion. Addressed are: land ownership, land rights, compensation and access to land. Land security is not mentioned as a concept, but the conventions that need to be complied with do secure that indigenous peoples do
not lose their land on a whim. If these peoples waive their land, compensation must be offered. Moreover, consent of the peoples must be given (i.e. no land-grabbing). Fulfilled: yes.

B.2 Rural and social development
UN Declaration of the Rights of Indigenous Peoples (2007) states: Indigenous peoples have the right to self-determination and to freely pursue their economic, social and cultural development. Impacts on local communities are limited to impacts on ecosystem services (e.g. contaminated drinking water). These issues may be incorporated in the Environmental and Social Impact Assessment (EISA) that is mentioned in criterion 5.7. However, neither in the standard, the website, nor the EU RED the ESIA is elaborated on. This enables producers to interpret this mandatory criterion quite flexibly. Detailed: no. Fulfillment: partially.

B.3 Access to water and other natural resources
This may also be part of the ESIA. The status of water resources is under constant monitoring due to the uptake in the continuous improvements stated in principle 5. Within the ecosystem services criterion, water availability may not be compromised. Water is also part of the EMP. The ILO Convention 169 (1989) on Indigenous and Tribal Peoples (mandatory criterion) states: Respect and safeguard rights to lands and natural resources traditionally occupied and used; respect for customs of inheritance; no forced removals; compensation for loss and injury; Right to distinctive relationship with land; right to own, use, develop and control their lands, territories and other resources. The UN Convention on Biological Diversity (1992) states: Protect and encourage customary use of biological resources in accordance with traditional practices. Therefore the access to natural resources is protected under the Bonsucro standard. Since producers must obey the related laws and international conventions this criterion is safeguarded. Fulfilled: yes. Detailed: yes, several criteria/indicators.

B.4 Employment, wages and labor conditions
Criterion 5.1 states that all employees are trained and their general skills will be developed. Criterion 2.4 (MUST satisfy) ensures employees get the national minimum wage. In absence of such a wage ILO C131 serves as a basis for this definition. Criterion 2.1 ensures the compliance with ILO labor conventions on basic human rights at the work place and forced labor. Fulfillment: yes. Detailed: yes.

B.5 Human health and safety
In the UN Declaration on Rights of Indigenous Peoples (2007) it is stated: Improvement of livelihood in sanitation, health and housing; participate in health delivery; maintain traditional health systems; effective monitoring of health. This convention covers most health and housing issues. Food security or food availability is not mentioned in the standard. Issues that fall under food security may be connected to the access to natural resources, which is protected under international conventions as well. Detailed: no. Fulfillment: partially.

B.6 Energy security and access
Energy security and energy access are not mentioned in the Bonsucro standard. Neither is food. Medicines and building materials are not mentioned. The implications of the project on these issues and energy security and access may also be covered in the ESIA. Detailed: no. Fulfillment: no.
B.7 Good management practices and continuous improvement
Continuous improvements are stated in principle 5 of the Bonsucro standard. Herein the ambition is to use less water, increase the quality of sugarcane (increasing the yield), promote energy efficiency, conduct research and increase added value. Fulfilled: yes. Detailed: yes.

B.8 Social sustainability
In the mandatory criterion 5.7 it is stated that new projects need to conduct a recognized ESIA, of which a SIA is part. Fulfilled yes, detailed: no

B.9 Food availability
No criteria found. Fulfillment: no. Detailed: no.

B.10 Food access
Although food is not mentioned explicitly as a natural resource, access to natural resources is ensured in the international conventions. Natural resources were covered before. The emphasis on food is not reflected in the standard. Therefore this criterion is only partially fulfilled, without detail.

B.11 Food utilization
No criteria found. Fulfillment: no. Detailed: no.

B.12 Food stability
No criteria found. Fulfillment: no. Detailed: no.

B.13 Food security
No criteria found. Fulfillment: no. Detailed: no.

C.1 Compliance
Compliance to national laws and international conventions is included in the standard (including ILO). Quite a lot of conventions are included. Fulfillment: yes. Detail: yes.

C.2 Participation and transparency
Consultation with affected stakeholders. Within the mandatory criterion 5.7 the ESIA must include Transparency and participatory consultation with all relevant stakeholders required. Criterion 5.8 states: To ensure active engagement and transparent, consultative and participatory processes with all relevant stakeholders. This includes an Existence of a recognized grievance and dispute resolution mechanism for all stakeholders. And, Percentage of meetings of stakeholder engagement where agreement has been reached by consensus driven process must eventually (through improvements) >90%.

ISCC (ISCC, 2011a)

A.1 Land use change (both direct and indirect).
In the GHG calculation methodology it is stated that: net emissions from land use change always need to be added. There is no division made between direct and indirect land use change. Food security may not be impaired due to replacement of stable crops for biomass production (4.4.22). This is not, however, due to ILUC. Fulfillment: partially. Detailed: no
A.2 Biodiversity and ecosystem services
Principle 1 of the ISCC states that biomass shall not be produced on land with high biodiversity value or high carbon stock. HCV areas shall be protected. 4 statuses of land are described that represent HCV areas: forest land, nature protection purpose land, grasslands of high biodiversity and areas for protection of endangered, threatened or rare ecosystems or species. 
NB: Highly biodiverse grassland, as stated in the RED, has not yet been fully defined by the EC. Until definitions, criteria and geographic areas featuring grassland with high biodiversity are determined by the Commission, any conversion of grassland in or after January 2008 is prohibited within the ISCC system.
Invasive species could interfere with the status “natural grassland”: A significant occurrence of invasive species, for instance, could indicate that natural grassland does not feature a natural species composition. This is not allowed in the standard. Although invasive species are not directly mentioned, it is more or less included.
Ecosystem services are not mentioned in the standard. It might be included in the EIA.

A.3 Productive capacity of land
The life cycle of crops is not mentioned but measurements to battle soil erosion are included in the standard. (4.2.3) Many indicators/measurements for erosion. Water run-off is not covered explicitly but measurements for water are present. Crop rotation is not considered. Soil quality on the other hand is. Fulfillment: partially. Detailed: on the points that are included, yes.

A.4 Crop management and agrochemical use
In 4.2.5.3 good agricultural practices need to be documented with respect to responsible use of agrochemicals. Fertilizer (4.2.6): The producer must demonstrate that he observes at least a distance of 3 m to riverbanks. He takes care that there is no run-off of applied fertilizer into surface water bodies and the ground water; Fertilizer with a content of more than 1.5% of nitrogen in the dry matter are not applied onto flooded, water logged or frozen soils; Complete records of all fertilizer applications are available (where, what, how much, date); responsible storage of inorganic fertilizer. Pesticides/ Plant protection products (PPP) (4.2.8): appropriate storage to avoid contamination of water. Competent staff; All the plant protection products applied are officially registered or permitted by the appropriate governmental organization in the country of application. Where no official registration scheme exists, reference to the FAO International Code of Conduct on the Distribution and Use of Pesticides is possible; It must be documented and secured that the producers are aware of restrictions of use of pesticides and is following them; Recording where, what, when, how much, why and who.
The only reference to the amount of pesticides used is the restrictions imposed by the appropriate governmental organization. No limits mentioned on fertilizer either. Mostly about avoiding contamination of water. Fulfillment: partially. Detailed: yes, on the points that are included.

A.5 Water availability and quality
Water contamination is well covered in both the pesticides and the fertilizer section. 4.2.5.3 Application of good agricultural practices to reduce water usage and to maintain and improve water quality. Documentation of water management plan aimed at sustainable water use and prevention of water pollution. Annual documentation of applied good agricultural practices with respect to:
• Efficient water usage;
• Responsible use of agro-chemicals;
• Waste discharge;
To protect the environment, water is abstracted from a sustainable source; there is a farm waste
management plan in which water contamination is considered.
Contamination is taken up thoroughly. Documentation of the practices relating to water looks
promising. Scarcity is implicitly in the use of a sustainable water source. Improvement of water
quality is aspired through avoiding contamination and re-establishing (or protecting) the riparian
zone.

A.6 GHG emissions
In case of a land-use change from grassland without high biodiversity, the greenhouse gas emissions
caused by that change must be incorporated into the greenhouse gas emissions calculation.; there is
no GHG emissions default value for land use change. If default values are used for cultivation, net
emissions from land use change always need to be added. (GHG calculations file); If it is proven that
no land use change took place after the reference year, i.e. if the land was classified as agricultural
land or falls within one of the exceptions as described in ISCC Document 202, eI equals zero. Only if
this is the case, overall default values or default values for cultivation may be applied. (ISCC, 2011c);
For the calculation of “actual values” all relevant inputs throughout the production process must be
considered. It would not seem necessary to include in the calculation inputs throughout the supply
chain, which will have little or no effect on the result, such as chemicals used in low amounts in
processing. 8 Inputs with little or no effects are those that have an impact on overall emissions of the
respective production unit that is lower than 0.5% of the total emissions of the production unit.
Energy input in the production, transportation and distribution phase are included. GHG savings are
also included.
The ISCC standard fulfills this criterion. Detailed: yes

A.7 Air quality
Principle 2 states that biomass shall be produced in an environmental responsible way. This includes
protection of air; Compliance with national and local laws and regulations relevant to soil
degradation, soil preservation, soil management, contamination and depletion of water sources,
water quality, air emissions and burning practices is required. The burning of stubble or other crop
residues is allowed only with the permission of competent authority. Burning as part of land
clearance is not allowed; There is a farm waste management plan. Waste recycling avoids or reduces
wastage and avoids the use of landfill or burning. A comprehensive, current, documented plan that
covers wastage reduction, pollution and waste recycling is available. Air, soil, water, noise and light
contamination must be considered.
Air pollution is considered and somewhat avoided by restricting burning of land and residues.
However, this is not made explicit. Moreover, air pollution must be considered. These give producers
leeway to interpret the criteria in their own way. Nitrogen emissions from fertilizer are not
mentioned.
This criterion is partially fulfilled. Detailed: no.

A.8 Waste management
The farm has designated areas to store litter and waste. Different types of waste are identified and
stored separately. There is a farm waste management plan. Waste recycling avoids or reduces
wastage and avoids the use of landfill or burning.
There is a waste management plan. Recycling is promoted. Waste should be disposed of responsibly.
A.9 Environmental sustainability
4.2.1 Environmental impact assessment: 4.2.1.1 Environmental aspects are considered if planning buildings, drainage etc. Environmental impact of new buildings, drainage systems and other constructions or systems is assessed and kept as little as possible. If any of these activities are done at the farm documents must be available to show that environmental aspects have been considered. Fulfillment: yes. Detailed: no.

B.1 Land tenure/access and displacement
Land tenure is included. Land rights have been secured. (4.5.1). Sufficient compensation for communities is addressed in 4.4.1. Access to land and land security is not taken up in the standard. The fulfillment is therefore partial. Detailed: no.

B.2 Rural and social development
The employer offers other forms of social benefits to employees, their families and/or community; improvements of social surroundings are offered (4.4.19). There is nothing mentioned about the development of locals, the community or indigenous people. Impacts for surrounding communities are taken into account. (4.4.8) All children living on the farm have access to quality primary school education. Fulfillment: partially. Detailed: no.

B.3 Access to water and other natural resources
All impacts for surrounding areas, communities, users and landowners taken into account and sufficiently compensated for (4.4.8). The impacts are taken into account. 4.2.5.2 The producer respects existing water rights, both formal and customary, and can justify the irrigation. Local legislation is followed. Other natural resources are not mentioned explicitly but are taken into account. Detailed: no. Fulfillment: partially.

B.4 Employment, wages and labor conditions
ILO standards are followed. Legal minimum wage. Safety is very important for ISCC. Learning is not mentioned. Fulfillment: yes. Detailed: yes.

B.5 Human health and safety
Food security may not be impaired by the production of biomass. Safety is extensively adopted in this scheme. Housing is not covered. Although health/medical care provisions are. Fulfillment: partially. Detailed: yes

B.6 Energy security and access
All impacts for surrounding areas, communities, users and landowners taken into account and sufficiently compensated for (4.4.8). That is all that is mentioned. Fulfillment: partially. Detailed: no.

B.7 Good management practices and continuous improvement
Application of good agricultural practices to reduce water usage and to maintain and improve water quality (4.2.5.3) PRINCIPLE 6: Good management practices shall be implemented. Good agricultural practices must be applied with respect to:
* Prevention and control of erosion;
* Maintaining and improving soil nutrient balance;
* Maintaining and improving soil organic matter;
* Maintaining and improving soil pH;
* Maintaining and improving soil structure;
* Maintaining and improving soil biodiversity;
* Prevention of Stalinization.

There is a drive for improvement. The improvement for yield and energy balance however is not expressed. Partially fulfilled. Detailed: on the points incorporated, yes.

**B.8 Social sustainability**

All impacts for surrounding areas, communities, users and land owners taken into account and sufficiently compensated for (4.4.8) A participatory social impact assessment has been conducted, and the report is publicly available in appropriate language to surrounding communities. On the basis of that report a continued dialogue with surrounding communities is in place. Documents of regular meetings with communities (with two-way communication) and local government with listed risks and/or impacts and evidence of minuted negotiations or resolution processes are compiled.


**B.9 Food availability**

No criteria found. Fulfillment: no. Detailed: no.

**B.10 Food access**

No criteria found. Fulfillment: no. Detailed: no.

**B.11 Food utilization**

No criteria found. Fulfillment: no. Detailed: no.

**B.12 Food stability**

No criteria found. Fulfillment: no. Detailed: no.

**B.13 Food security**

“Biomass production does not impair food security:
Biomass production shall not replace stable crops and does not impair the local food security. Local food prices do not rise as a direct effect of biomass production.”


**C.1 Compliance**

Compliance with national and local laws and regulations relevant to biomass production in the area and surroundings where biomass production takes place is required. The company should be familiar with the relevant legislation and should remain informed on changes in legislation. Relevant international treaties must also be followed (e.g. ILO).


**C.2 Participation and transparency**

Stakeholder consultation is included. Local consent and benefits are included. Information is available in local language.

Fulfillment: yes. Detailed: no (only mentioned not explained)
A.1 Land use change (both direct and indirect).
Land use change is incorporated in the GHG emissions. (criterion 3b). The importance of impacts from ILUC is recognized by the standard and the file refers to a work plan on indirect impacts. However, this document cannot be found on the website. Fulfillment: partially. Detailed: yes (separate chapter in GHG calculations).

A.2 Biodiversity and ecosystem services
Criterion 7.b Ecosystem functions and services that are directly affected by biofuel operations shall be maintained or enhanced. Criterion 7.c Biofuel operations shall protect, restore or create buffer zones. Criterion 7.d Ecological corridors shall be protected, restored or created to minimize fragmentation of habitats. Criterion 7.e Biofuel operations shall prevent invasive species from invading areas outside the operation site. In the guidance on the principles and criteria file the HCV are extensively covered. Remarkably the conversion date of 1st of January 2008 is not mentioned. Ambition might occur here. All points are covered in great detail. Fulfillment: yes. Detailed: yes.

A.3 Productive capacity of land
Participating Operators shall implement measures to improve soil health, such as Conservation Agriculture practices as defined by the FAO including:
- Organic direct planting,
- Permanent soil cover,
- Crop rotation, or
- Fallow areas with natural or planted vegetation in order to recover natural fertility and interrupt pest life cycles.

Soil erosion shall be minimized through the design of the feedstock production site and use of sustainable practices in order to enhance soil physical health on a watershed scale. (8.1)
- The water management plan shall be consistent with local rainfall conditions, not contradict any local or regional water management plans, and include the neighboring areas, which receive direct runoff from the operational site. Any negative impact on these neighboring areas shall be mitigated.

Adequate precautions shall be taken to contain effluents and avoid runoffs and contamination of surface and ground water resources, in particular from chemicals and biological agents.
- Waste water or runoff that contains potential organic and mineral contaminants shall be treated or recycled to prevent any negative impact on humans, wildlife, and natural compartments (water, soil). Fulfillment: yes. Detailed: yes.

A.4 Crop management and agrochemical use
- The use of ground or aerial pesticides shall comply with the FAO's Guidelines on Good Practices for Ground and Aerial Applications of Pesticides. Any chemical used in biofuel operations shall be in accordance with the manufacturer’s safety instructions.
Criterion 9.d Biofuel operations shall contribute to the enhancement or maintaining of the quality of the surface and groundwater resources. Possible contaminations of water resources include:
- microbial and organic contamination; contamination by pesticides or fertilizers (e.g. nitrates, phosphate);
A.5 Water availability and quality
Principle 9. Biofuel operations shall maintain or enhance the quality and quantity of surface and ground water resources, and respect prior formal or customary water rights. Criterion 9.a Biofuel operations shall respect the existing water rights of local and indigenous communities. Criterion 9.b Biofuel operations shall include a water management plan, which aims to use water efficiently and to maintain or enhance the quality of the water resources that are used for biofuel operations. Criterion 9.c Biofuel operations shall not contribute to the depletion of surface or groundwater resources beyond replenishment capacities. Criterion 9.d Biofuel operations shall contribute to the enhancement or maintaining of the quality of the surface and groundwater resources (RSB, 2010b). All points in this criterion are covered. Fulfillment: yes. Detailed: yes.

A.6 GHG-emissions
Land use change, production, transportation and distribution are included (RSB, 2011). Energy is extensively written down. GHG savings are not mentioned explicitly, but are in the RED, which the RSB standard follows. (RSB, 2011)
Fulfillment yes. Detailed: yes.

A.7 Air quality
Nitrogen emissions are covered in GHG calculation. Furthermore: Principle 10. Air pollution from biofuel operations shall be minimized along the supply chain. Criterion 10.a Air pollution emission sources from biofuel operations shall be identified, and air pollutant emissions minimized through an air management plan. Criterion 10.b Biofuel operations shall avoid and, where possible, eliminate open-air burning of residues, wastes or by-products, or open air burning to clear the land.

A.8 Waste management
Criterion 11.d Good practices shall be implemented for the storage, handling, use, and disposal of biofuels and chemicals. Criterion 11.e Residues, wastes and byproducts from feedstock processing and biofuel production units shall be managed such that soil, water and air physical, chemical, and biological conditions are not damaged.
The water management plan shall include steps for reusing or recycling wastewater, appropriate to the scale and intensity of operation. (9.b) Recycling and waste reduction not mentioned for all waste. Fulfillment: partially. Detailed: yes, on points covered.

A.9 Environmental sustainability
Criterion 2a. Biofuel operations shall undertake an impact assessment process to assess impacts and risks and ensure sustainability through the development of effective and efficient implementation, mitigation, monitoring and evaluation plans.
This is both an EIA and a SIA.
Where an impact assessment is required by national, regional, or local laws, the process shall be integrated with the RSB impact assessment process to avoid duplication of efforts, but the higher and more comprehensive standard shall be applied. (2a)
Fulfillment: yes. Detailed: yes, through “RSB, 2010b”.

Environment and Resource Management
B.1 Land tenure/access and displacement
Principle 12. Biofuel operations shall respect land rights and land use rights. Criterion 12.a Existing land rights and land use rights, both formal and informal, shall be assessed, documented, and established. The right to use land for biofuel operations shall be established only when these rights are determined. Criterion 12.b Free, Prior, and Informed Consent shall form the basis for all negotiated agreements for any compensation, acquisition, or voluntary relinquishment of rights by land users or owners for biofuel operations.
All aspects are covered. Fulfillment: yes. Detailed: yes.

B.2 Rural and social development
Career development shall be encouraged for all workers (4.d) Principle 5. In regions of poverty, biofuel operations shall contribute to the social and economic development of local, rural and indigenous people and communities. Criterion 5.a In regions of poverty, the socioeconomic status of local stakeholders impacted by biofuel operations shall be improved. Criterion 5.b In regions of poverty, special measures that benefit and encourage the participation of women, youth, indigenous communities and the vulnerable in biofuel operations shall be designed and implemented.
Where biofuel operations will have significant social impacts, as measured during the screening exercise, a social impact assessment process shall be carried out using local experts to ensure that local customs, languages, practices and indigenous knowledge are respected and utilized (2a)
The ESIA facilitators shall invite all locally affected stakeholders, local leaders, representatives of community and indigenous peoples groups and all relevant stakeholders to participate in the consultative process. (2b)
All aspects are covered. Fulfillment: yes. Detailed: yes.

B.3 Access to water and other natural resources
12.a Existing land rights and land use rights, both formal and informal, shall be assessed, documented, and established. The right to use land for biofuel operations shall be established only when these rights are determined. Criterion 9.a Biofuel operations shall respect the existing water rights of local and indigenous communities. Criterion 7.b Ecosystem functions and services that are directly affected by biofuel operations shall be maintained or enhanced.

B.4 Employment, wages and labor conditions
Principle 4. Biofuel operations shall not violate human rights or labor rights, and shall promote decent work and the well being of workers. Criterion 4e. Workers’ wages and working conditions shall respect all applicable laws and international conventions, as well as all relevant collective agreements. Where a government-regulated minimum wage is in place in a given country and applies to the specific industry sector, this shall be observed. Where a minimum wage is absent, the wage paid for a particular activity shall be negotiated and agreed on an annual basis with the worker. Men and women shall receive equal remuneration for work of equal value. Career development shall be encouraged for all workers (4.d) ILO convention is used. Fulfillment: yes. Detailed: yes.

B.5 Human health and safety
Criterion 4.f Conditions of occupational safety and health for workers shall follow internationally recognized standards. Any housing provided by the Participating Operator for permanent or temporary workers shall be built and maintained to ensure good sanitary, health, and safety

B.6 Energy security and access
At least one measure to significantly optimize the benefits to local stakeholders shall be implemented within a three-year period of the start of the operations, for instance:

a. Creation of year round and/or long term jobs
b. The establishment of governance structures that support empowerment of small-scale farmers and rural communities such as co-operatives and micro credit schemes
c. Use of the locally produced bio-energy to provide modern energy services to local poor communities
d. Shareholding options, local ownership, joint ventures and partnerships with the local communities
e. Social benefits for the local community such as the building or servicing of clinics, homes, hospitals and schools (5.a)

Impacts on food supply and use of land and natural resources are incorporated in the impact assessment. However, this criterion is not included explicitly. Fulfillment: partially. Detailed: no.

B.7 Good management practices and continuous improvement
comply with the FAO’s Guidelines on Good Practices for Ground and Aerial Applications of Pesticides (11.d.1) Criterion 11.d Good practices shall be implemented for the storage, handling, use, and disposal of biofuels and chemicals. Principle 11. The use of technologies in biofuel operations shall seek to maximize production efficiency and social and environmental performance, and minimize the risk of damages to the environment and people. 11.e.2 Progress requirements

• Measures shall be taken to implement clean and efficient processes for conversion of residues, wastes or by-products into energy appropriate to the scale and intensity of operation. Such processes shall always occur in an appropriate facility to minimize air pollution from substances recognized as potentially harmful for the environment or human health. Solid residues from fermentation or burning shall be disposed of such that soil and water conditions are not damaged or according to national regulations.

• For others than small-scale operators, by-products or wastes shall also be reused by the processing/production unit or transferred to other sectors whenever their use may improve the overall system’s energy balance, greenhouse gas emissions, and/or economic viability without impairing the other principles and criteria in this standard.

Good management practices are included. Improvements as well. Fulfillment: yes. Detailed: no.

B.8 Social sustainability

B.9 Food availability
In regions where food security is an ongoing risk and concern, operations shall enhance food security of the locally affected community by, for instance, setting aside land for food growing, increasing yields, providing opportunities for workers to carry out household-level food production, sponsoring agricultural support programs and activities, and/or making value-added food byproducts available to the local market. (6b) Fulfillment: yes. Detailed: no.

B.10 Food access
Food access is part of food security. Information relevant to assessing the indirect and longer
term food security impacts of biofuel production and processing operations will be collected under the RSB Rapid Environmental and Social Assessment (RESA) or Environmental and Social Impact Assessment, and the RSB Socio-economic Impact Assessment.

Criterion 6a. Biofuel operations shall assess risks to food security in the region and locality and shall mitigate any negative impacts that result from biofuel operations. Where the screening exercise of the RSB impact assessment process reveals a direct-impact on food security in food insecure regions, Participating Operators shall conduct a food security assessment in accordance with the RSB Food Security Assessment Guidelines.

In these guidelines B.9-B.13 are covered in great detail. The guidelines describe how this information should be gathered. This criterion (and the following criteria) is/are covered.


**B.11 Food utilization**
Overlap with other criteria. Fulfillment: yes. Detailed: yes.

**B.12 Food stability**

**B.13 Food security**

**C.1 Compliance**
Standard complies with national laws and relevant international laws and agreements. Criterion 4e. Workers' wages and working conditions shall respect all applicable laws and international conventions, as well as all relevant collective agreements.
The use of genetically modified organisms shall follow relevant national or international guidelines, laws and agreements, crop-specific stewardship systems, and local and community coexistence agreements or understandings. (11b) Rotterdam and Stockholm convention on POPs, ILO conventions. Fulfillment: yes. Detailed: yes.

**C.2 Participation and transparency**
Criterion 2b. Free, Prior & Informed Consent (FPIC) shall form the basis for the process to be followed during all stakeholder consultation, which shall be gender sensitive and result in consensus-driven negotiated agreements.

While FPIC provides the process conditions for stakeholder engagement and negotiated agreements, consensus shall be the decision-making tool applied in all cases and carried out in accordance with the RSB consensus building toolkit in the Impact Assessment Guidelines.
The ESIA facilitators shall invite all locally affected stakeholders, local leaders, representatives of community and indigenous peoples groups and all relevant stakeholders to participate in the consultative process.

Documentation necessary to inform stakeholder positions shall be made freely available to stakeholders in a timely, open, transparent and accessible manner through distribution channels appropriate to the local conditions in accordance with the RSB Impact Assessment Guidelines.

A.1 Land use change (both direct and indirect).
1.2.5 GHG emissions from land use change, highly degraded or contaminated land and accumulation via improved agricultural management are calculated. There is no distinction made between direct and indirect land use change. Fulfillment: partially. Detailed: yes.

A.2 Biodiversity and ecosystem services
2.1 There is no conversion of high biodiversity areas; 2.2 There is no conversion of high carbon areas; land currently under soy cultivation may not have the following status: threatened or endangered ecosystems or species recognized by the European Commission; (RTRS, 2011b) Data capture requirements for future Payment for Environmental Services (PES) schemes; HCV4: Areas that provide basic ecosystem services in critical situations; 5.8 Systematic measures are planned and implemented to monitor, control and minimize the spread of invasive introduced species and new pests(Standard). Fulfillment: yes. Detailed: yes.

A.3 Productive capacity of land
The crop life cycle is not mentioned. Good Agriculture practice is implemented to minimize soil erosion; 5.3 Soil quality is maintained or improved and erosion is avoided by good management practices. Energy input is covered (RTRS, 2011b). Crop rotation is covered as well. Although water run-off is not mentioned, water issues are covered extensively. Fulfillment: yes. Detailed: yes.

A.4 Crop management and agrochemical use
Agrochemical use is well documented and monitored. No limit is set by the standard, however, fertilizers must be used in accordance with professional recommendations. Agrochemicals listed in the Stockholm and Rotterdam Convention are not used. Drifting of agrochemicals is avoided. Safety measures in dealing with agrochemicals are given. Fertilizer is only used if the need for it is made evident by a professional soil/fertilization specialist. Fulfillment: yes. Detailed: yes.

A.5 Water availability and quality
5.1 The quality and supply of surface and ground water is maintained or improved.; 5.1.1 Good agricultural practices are implemented to minimize diffuse and localized impacts on surface and ground water quality from chemical residues, fertilizers, erosion or other sources and to promote aquifer recharge.; 5.1.3 Any direct evidence of localized contamination of ground or surface water is reported to, and monitored in collaboration with local authorities.; 5.1.4 Where irrigation is used, there is a documented procedure in place for applying best practices and acting according to legislation and best practice guidance (where this exists), and for measurement of water utilization.; 5.1.4 When using irrigation, attention should be paid to other potential uses such as household use or use by other food crops and if there is a lack of water priority should be given to human consumption. These criteria show that all the entire criterion of the FAO is taken into account. Fulfillment: yes. Detailed: yes.

A.6 GHG-emissions
1.2.5 GHG emissions from land use change, highly degraded or contaminated land and accumulation via improved agricultural management are calculated.; 1.3 Greenhouse gas (GHG) emissions from
transport of soybeans are calculated and recorded; The GHG emissions formed during the following stages must be taken into account:

- Production and cultivation process
- Harvesting of soybeans, and
- Chemicals and other products used (e.g. diesel).

Distribution phase is included. Energy balance and GHG savings are also incorporated.

**A.7 Air quality**
Pollution in general is minimized and burning of crop residues is prohibited. Air pollution is not mentioned explicitly. Nitrogen emissions are not considered. Fulfillment: partially. Detailed: no.

**A.8 Waste management**
4.2.4 Re-use and recycling are utilized wherever possible.; 4.2.5 There is a residue management plan including all areas of the property.; 4.2.2 There is adequate storage and disposal of fuel, batteries, tires, lubricants, sewage and other waste.; Agrochemical waste is handled with great care.

**A.9 Environmental sustainability**
4.1.1 A social and environmental assessment is carried out prior to the establishment of large or high-risk new infrastructure.
Note that it is only the case for large or high-risk infrastructure. Fulfillment: yes. Detailed: yes

**B.1 Land tenure/access and displacement**
1.2 Legal use rights to the land are clearly defined and demonstrable.; 3.2 In areas with traditional land users, conflicting land uses are avoided or resolved.; 3.2.1 The community rights assessment should aim to:
   a) identify the individual and collective uses and rights of traditional land users; and
   b) identify the places and landscape conditions needed to satisfy these rights.
   c) identify the places/issues where there is conflict between the property rights and the traditional land use rights
   d) reach a solution to resolve possible conflicting land uses and/or agree proposals for compensation.

**B.2 Rural and social development**
Open communication with community. Channels have been made known to the local community.; 3.4.1 Employment opportunities are made known locally, although this is not applicable to small farms.; 3.4.2 There is collaboration with training programs for the local population.; 3.4.3 Opportunities for supply of goods and services are offered to the local population. Also not applicable to small farms.; Impacts are taken into account through the social impact assessment.
Complaints are dealt with in a timely manner.

**B.3 Access to water and other natural resources**
3.2 In areas with traditional land users, conflicting land uses are avoided or resolved.; 3.2.1 The community rights assessment should aim to:
   a) identify the individual and collective uses and rights of traditional land users; and
b) identify the places and landscape conditions needed to satisfy these rights.
c) identify the places/issues where there is conflict between the property rights and the traditional land use rights
d) reach a solution to resolve possible conflicting land uses and/or agree proposals for compensation.
Possible impacts are included in the Social impact assessment.
5.1.4 When using irrigation, attention should be paid to other potential uses such as household use or use by other food crops and if there is a lack of water priority should be given to human consumption.

B.4 Employment, wages and labor conditions
2.5.1 Gross wages that comply with national legislation and sector agreements are paid at least monthly to workers.
2.5.2 Deductions from wages for disciplinary purposes are not made, unless legally permitted. Wages and benefits are detailed and clear to workers, and workers are paid in a manner convenient to them. The employer records wages paid.
Trainings are available. ILO standards are uphelded. This criterion is fulfilled. Detailed: yes.

B.5 Human health and safety
If employees live on the farm, they have access to affordable and adequate housing, food and potable water.; health and safety measures related to the work environment are dealt with to great extent. Partially through the ILO standards.

B.6 Energy security and access
Areas fundamental to meeting basic needs of local communities (e.g. subsistence, health). Implicitly medicines. 3.2 In areas with traditional land users, conflicting land uses are avoided or resolved.
Community rights assessment. These problems should be avoided. If it does happen complaints and grievances can be expressed. Fulfillment: partially. Detailed: no.

B.7 Good management practices and continuous improvement
1.3 There is continual improvement with respect to the requirements of this standard.; Good Agricultural practices are implemented.; 5.3 Soil quality is maintained or improved and erosion is avoided by good management practices.; 5.4 Negative environmental and health impacts of phytosanitary products are reduced by implementation of systematic, recognized Integrated Crop Management (ICM) techniques.
Improvement is covered. Good management practices are included. However, not all the points mentioned in the FAO criterion are covered. Fulfillment: partly. Detailed: yes, on the points covered.

B.8 Social sustainability
This is covered. Fulfillment: yes. Detailed: no.

B.9 Food availability
When a change in soybean production practices is introduced which could impact on neighboring production systems, it is the responsibility of the producer making the change to implement a buffer strip of 30 m. 3.2 In areas with traditional land users, conflicting land uses are avoided or resolved.; 3.2.1 The community rights assessment should aim to:
a) identify the individual and collective uses and rights of traditional land users; and
b) identify the places and landscape conditions needed to satisfy these rights.
c) identify the places/issues where there is conflict between the property rights and the traditional land use rights
d) reach a solution to resolve possible conflicting land uses and/or agree proposals for compensation.
This criterion is not covered explicitly. Fulfillment: partially. Detailed: no.

B.10 Food access
Comparable to water access. Community rights assessment includes this implicitly. Therefore: partially fulfilled. Detailed: no.

B.11 Food utilization
No criteria found. Fulfillment: no. Detailed: no.

B.12 Food stability
No criteria found. Fulfillment: no. Detailed: no.

B.13 Food security
No criteria found. Fulfillment: no. Detailed: no.

C.1 Compliance

C.2 Participation and transparency
The community is included in the process. Informed and documented consent is required. Community rights assessment and a social impact assessment are included. Fulfillment: yes. Detailed: no.
Appendix D: Assessment of monitoring mechanisms

The assessment of the monitoring mechanisms of the certification schemes is mostly based on the standards containing the principles and criteria. The information in this appendix is based on the standard unless specified otherwise. The reference to the standard is stated at the beginning of the assessment of a standard.

2BSvs (2BSvs, 2011a)
The monitoring mechanisms of the 2BSvs standard include the following criteria and indicators.

Principle 0: Internal management and monitoring system
The 1st gathering entity shall have available and up-to-date records of accurate data concerning the sustainability criteria and all information required to demonstrate conformity with the EU Directive 2009/28/EC.

Criterion 0.1: The 1st gathering entity shall have access to relevant and detailed information regarding the origin (country of origin and supplier) of the biomass and may perform a risk analysis and assessment.

Indicator 0.1.1: The 1st gathering entity shall define the data, documents and/or records needed for its suppliers of biomass covered by the certification unit to demonstrate that the biomass is in conformity with the European Directive and that the biomass can be considered as sustainable. Such evidence shall be based on relevant official records, official land registry, data or documents that can be independently verified.
- Verifier: List of official data, documents land registry and/or records, or
- Verifier: List of official documents currently in use.

Indicator 0.1.2: The 1st gathering entity shall establish a list of all its suppliers of biomass claiming sustainability with the approximate localization of the production area. Biomass producers included within the scope of the certificate shall be near each other and share similar characteristics. This list shall be kept as part of the records of the entity and shall be reviewed and updated at least once a year.

Indicator 0.1.3: The 1st gathering entity shall have a declaration, questionnaire, form or other document signed by its suppliers of biomass demonstrating their commitment to ensure that the biomass declared as sustainable has been produced in compliance with the requirements of the European Directive. The form used for this declaration may take different forms but shall contain an explicit statement regarding the sustainability requirements to comply with and a requirement to inform the 1st gathering entity of any possible change whenever it may occur.

Criterion 0.2: The 1st gathering entity shall have received and/or recorded relevant and detailed information regarding the type and volume of biomass supplied, including any sustainability and GHG characteristic

Criterion 0.3: The 1st gathering entity shall develop and implement a quality and monitoring system to monitor the biomass producers covered by the scope of the certificate and ensure that all information regarding biomass is accurate, reliable and trustworthy. This information should be
monitored by the 1st gathering entity to ensure it is accurate and reliable through internal monitoring and verification activities.

**Criterion 0.4:** The 1st gathering entity **shall** ensure that all suppliers of biomass covered under the certification unit (i.e. group members) and personal have received adequate information and/or training as needed to implement the system and ensure the sustainable characteristics of the biomass. The 1st gathering entity can choose its own preferred method to inform and train people but records of information and/or training shall be kept.

**Criterion 0.5:** The 1st gathering entity **shall** have and maintain up to date appropriate registries and records covering all requirements included in this document.

**Criterion 0.6:** Biomass from unknown country of origin or unclear origin **shall not** be considered and classified as sustainable.

**Criterion 1.1:** The 1st gathering entity **shall** have developed and documented a control system for the biomass received based on a mass balance system at the level of containers, processing logistical facilities or sites (defined as a geographical location with precise boundaries within which products can be mixed) to ensure that "sustainability characteristics" remain assigned to "consignments", in conformity with the European Directive.

To comply with the criteria in other criteria more documentation is needed. The 2BSvs standard requires thorough documentation, therewith aiding monitoring practices. (++)

**Bonsucro** (Bonsucro EU, 2011)
The Bonsucro standard includes the following criteria and indicators on monitoring:

3.1 To monitor production and process efficiency; to measure the impacts of production and processing so that improvements are made over time.

3.2 To monitor global warming emissions with a view to minimizing climate change impacts.

7.1 Traceability: Each economic operator in the chain of custody is responsible for the data supplied in the product declarations submitted to the next economic operator.

7.3 Control of Mass Balance System

7.4 Control of Consignments: Key for identification and traceability of sugarcane during the production stages, logistics and trading is to keep control over the consignments and keep records of production data including, volumes, weight, products specifications, sugar % and alcohol %, density etc. (minimum set of data as specified in the criteria) together with the records about the sustainability characteristics assigned to the consignment.

Monitoring or documentation is not mentioned excessively in the Bonsucro standard. Nevertheless, the criteria of the standard listed above do include many aspects. Criterion 3.1 includes sustainable improvement; the criteria of Principle 7 (7.1, 7.3 and 7.4) monitor the Chain of Custody. The Bonsucro standard requires thorough monitoring although the extent of it is not made explicit. (+)
The ISCC standard includes criteria and indicators requiring documentation and monitoring. The criteria and indicators stating these requirements are presented below.

4.1.6 The organization shall conduct internal audits at intervals of at least one year covering all requirements of this standard and establish corrective and preventive measures if required. The report from the internal audit shall be reviewed by the organization’s top management at least annually. (ISCC, 2011d)

4.2.3.2 Field cultivation techniques used to reduce the possibility of soil erosion
Evidence of measures of reduced soil erosion is available. Maps of fragile soils must be available. A management strategy should exist for plantings on slopes above a certain limit (needs to be soil and climate specific). A management strategy should be in place for other fragile and problematic soils (e.g. sandy, low organic matter soils).

4.2.6.3 Records of fertilizer application
Complete records of all fertilizer applications are available (where, what, how much, date).

4.2.7.1 Assistance with implementation of IPM systems has been obtained through training or advice
The technically responsible person on the farm has received formal documented training and/or the external technical IPM consultant can demonstrate their technical qualifications.

4.2.10.6 There is a farm waste management plan. Waste recycling avoids or reduces wastage and avoids the use of landfill or burning
A comprehensive, current, documented plan that covers wastage reduction, pollution and waste recycling is available. Air, soil, water, noise and light contamination must be considered.

4.3.1.5 There are records kept for training activities and attendees
A record is kept for training activities including the topic covered, the trainer, the date and attendees. Evidence of attendance is required.

4.6.1 A recording system is established for each unit of production. These records must be kept in an ordered and up-to-date condition for at least 3 years

4.6.3 In case of the engagement of subcontractors they must comply fully with the ISCC standard and provide the respective documentation and information.

In the ISCC standard many monitoring procedures on safety issues and on that topic the monitoring is mentioned explicitly. However, on other aspects the standard is not that explicit. The monitoring mechanisms are comparable with the Bonsucro and RSB standard. (+)

RSB (RSB, 2010a)
The criteria representing the monitoring mechanisms include:

Criterion 2a. Biofuel operations shall undertake an impact assessment process to assess impacts and risks and ensure sustainability through the development of effective and efficient implementation, mitigation, monitoring and evaluation plans.
9.b.1 Minimum requirements
The Participating Operator shall undertake annual monitoring of the effectiveness of the water management plan.

Criterion 2a. The screening exercise may be done by the Operator but its results have to be audited by an independent third party as determined by the RSB certification system (RSB, 2010b).

Through an appropriate management plan and sustainable practices, the operator monitors these ecosystem services and functions and ensure they are maintained (RSB, 2010b).

The ESMP requires that baseline data be collected as part of the management and monitoring activities in the plan, if this data is not already collected as part of the ESIA or RESA (RSB, 2010b).

The participating operator has to appoint and document for each site where RSB EU RED compliant product is acquired, handled and forwarded and where internal processing steps occur. There is to be a management representative having overall responsibility and authority for implementation of and compliance with the RSB standards at site. The operator shall document all changes to CoC tracking and management systems (RSB, 2010b).

Thorough continuous tracking of RSB certified product is required. Within the RSB standard monitoring is not covered extensively, comparable to the monitoring mechanisms in the Bonsucro standard. (+)

**RTRS** (RTRS, 2010a)
The criteria describing requirements on monitoring are presented below.

Monitoring: Where indicators require monitoring to be undertaken, a baseline should be established at the time of certification with monitoring and review of trends over time. Producers are expected to commit to a process of continual improvement. For group certification, monitoring at the group level should be used where appropriate.

1.3 There is continual improvement with respect to the requirements of this standard.
Note: For group certification - continual improvement should be recorded and monitored at the group level.

1.3.2 A number of indicators are selected and a baseline is established to be able to monitor continual improvement on those aspects where desired improvements have been identified.

1.3.3 The results of monitoring are reviewed and appropriate action is planned and taken when necessary to ensure continual improvement.

2.3.2 Relevant health and safety risks are identified, procedures are developed to address these risks by employers, and these are monitored.

4.3.1 Total direct fossil fuel use over time is recorded, and its volume per hectare and per unit of product for all activities related to soy production is monitored.
4.3.3 Soil organic matter is monitored to quantify change in soil carbon and steps are taken to mitigate negative trends.

5.1.2 There is monitoring, appropriate to scale, to demonstrate that the [good agricultural] practices are effective.

5.1.3 Any direct evidence of localized contamination of ground or surface water is reported to, and monitored in collaboration with local authorities.

5.3.3 Appropriate monitoring [of soil quality], including soil organic matter content, is in place.

5.4.4 Records of monitoring of pests, diseases, weeds and natural predators are maintained.

5.5 All application of agrochemicals is documented and all handling, storage, collection and disposal of chemical waste and empty containers, is monitored to ensure compliance with good practice.

5.7 The use of biological control agents is documented, monitored and controlled in accordance with national laws and internationally accepted scientific protocols.

5.8 Systematic measures are planned and implemented to monitor, control and minimize the spread of invasive introduced species and new pests.

For GHG emission values one option is to use default values. The other option is to monitor all emissions and calculate the GHG emissions.

The RTRS standard requires thorough monitoring on different subjects. These subjects are made explicit. (+++)