THE VIABILITY OF SOUTH AFRICAN SUGARCANE ETHANOL AS FEEDSTOCK FOR SUSTAINABLE AVIATION FUEL PRODUCTION

Part II: Sustainability gap analysis

Joint publication by the Roundtable on Sustainable Biomaterials (RSB) and the South African Canegrowers Association (SA Canegrowers), made possible with the support of Boeing's Global Engagement Portfolio.

FUELLING THE SUSTAINABLE BIOECONOMY

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Executive summary

The South African sugar industry makes an important contribution to the national fiscus and plays a significant role in supporting economic growth and development. However, the industry is struggling to maintain its profitability amidst ongoing challenges including drought, rising input costs, global overproduction of sugar, and the national sugar tax. Diversification is therefore an imperative to support the economic sustainability of the sugar industry. Sugarcane can be used as a feedstock for a number of bio-based materials, including fuels and plastics. Its use as an alternative to fossil-based feedstocks has significant emission saving potential and can contribute positively to the development of a sustainable bioeconomy.

The development of a truly sustainable bioeconomy is supported by the Roundtable on Sustainable Biomaterials (RSB). The RSB Principles & Criteria are an important component of the RSB Standard and describe how to produce biomass, biofuels and biomaterials in an environmentally, socially and economically responsible way. RSB's certification is already a goal for a great and growing number of alternative aviation fuel projects worldwide, with SAFUG members (Sustainable Aviation Fuel User Group, representing a third of global aviation fuel users) committed to the high level of social and environmental sustainability guaranteed only by RSB. As a recognised certification scheme under the European Commission's Renewable Energy Directive (RED), RSB certification also unlocks access to the incentivised European biofuel market.

This research provides an assessment of the "RSB-certification readiness" of the South African Sugarcane Industry, with a focus on farm level (sugarcane production). It feeds into the long-term goal of equipping the industry with the necessary knowledge to develop an effective market development strategy for diversification into the sustainable bioeconomy, and was developed in partnership with the South African Canegrowers Association (SA Canegrowers), which provided exclusive industry insight and information. The aim of this research was as follows: to understand the status quo of sugarcane farming in South Africa (supply chain mapping), assist the industry in understanding the overlaps and key differences between sustainability schemes applicable to South African sugarcane farming (benchmark of standards), and provide an indication of how well current industry practices compare against the RSB Principles & Criteria (gap analysis).

In South Africa, the majority of sugarcane (~80%) is produced by large-scale growers, with the balance made up by small-scale growers (~12.5%) and milling companies with their own estates (~7.5%). Although there is a strong overlap between these growers in terms of legislative requirements and industry best practice, there are several key differences that need to be considered. Most notably, differences exist in the respective capabilities of growers, particularly in terms of access to capital and internal administrative structures at farm level. While large-scale and commercial growers are generally similar, small-scale growers typically have reduced capabilities in this regard. In South Africa, small scale growers are defined as any entity producing < 225 tons of Recoverable Value (this translates to ~ 20 ha in irrigated areas and ~ 40 ha in rainfed areas).

In terms of sustainability, the industry is best supported by SUSFARMS: a continuous improvement system developed by the South African Sugarcane Research Institute. Although available to the industry at large, currently, the uptake and implementation of SUSFARMS is limited, with roughly 320 large-scale growers participating in the Eston, Noodsburg, and Dalton regions of KwaZulu Natal. With regards to certification, there are currently no farms producing cane that is certified by the RSB, Bonsucro or similar certification schemes.

The SUSFARMS system is relatively closely aligned with the RSB Principles & Criteria and follows a similar approach in terms of promoting sustainability and best management in the local context. With the exception of Principle 3 (GHG emissions) and Principle 6 (Local Food Security) which are not covered by SUSFARMS, all other RSB Principles are supported by this system, albeit to different extents. While the statements of intent in SUSFARMS are mostly equivalent in concept to the RSB Principles, the two systems generally differ slightly in the detail of the measures (SUSFARMS) and criteria/minimum requirements (RSB). There is a particularly strong overlap between the two systems in terms of legality requirements. The RSB Principles & Criteria require adherence to all relevant national

legislation and this is supported by SUSFARM's inclusion of all relevant national regulations as measures within the system.

From a certification perspective, there are currently no sugarcane farms in SA that are producing certified cane, however Bonsucro is a well-known standard within the industry. While RSB and Bonsucro have a number of similarities as organisations and both are recognized for their credibility and leadership as sustainability schemes, in terms of their standards and certification systems, RSB and Bonsucro have very different approaches. The RSB Principles & Criteria are qualitative, progressive in nature and holistic, whereas Bonsucro's Principles & Criteria are more quantitative and focused. The metric system and calculator methodology utilized by Bonsucro provides something of a "one-size-fits-all" approach, which contrasts with the RSB model of adapting to local consultations and involving a wide stakeholder network to ensure full local and regional relevance. Whilst there are a few areas of overlap between the two standards, the results from the benchmark found that the majority of RSB's minimum requirements are not covered by Bonsucro.

The gap analysis results showed that in terms of "RSB-certification readiness", growers actively engaging with the SUSFARMS system are advantageously positioned. Large-scale growers have an advantage over small-scale growers due to their respective capabilities, as well as the frequency of checks and inspections from government and other regulatory bodies, which promotes compliance with key legislative requirements. RSB accommodates this discrepancy by providing a separate Smallholder Standard, which enables small-scale farmers (feedstock producers whose total land does not exceed 75 ha) to access RSB-certified supply chains. The key difference in the Smallholder Standard is that it covers group certification and introduces a stepwise approach, allowing the group to become compliant with the RSB standard within 2 years after the initial audit.

For large-scale growers actively engaging with SUSFARMS, the implementation of the listed good management and legislative measures is generally high. Consequently, there are no major gaps anticipated for the RSB Principles that have a strong overlap with SUSFARMS (namely, Principles 1 (Legality), 4 (Human and Labour Rights) and Principle 9 (Water)). Although Principles 7 (Conservation), 8 (Soil) and 10 (Air Quality) are well covered by SUSFARMS, not all aspects of these are consistently enforced at farm level. For Principles 2 (Planning, Monitoring and Continuous Improvement), 5 (Rural and Social Development), 11 (Technology, Inputs and Management of Waste), and 12 (Land Rights), there are gaps both in SUSFARM coverage and farm level practice. Both Principle 3 (GHG Emissions) and Principle 6 (Local Food Security) are not covered by the SUSFARMS system. With regards to Principle 3, the lack of industry requirements for, and farm-level experience with, GHG reporting is an important gap and could hinder farmers supplying biomass into a RSB certified supply chain. With regards to Principle 6, there are no major gaps anticipated: sugar is currently produced in surplus in South Africa and sugarcane has been approved as a feedstock for ethanol in the Biofuels Industrial Strategy of South Africa. Moreover, with a score of 14.5, South Africa is currently only *moderately* food insecure[1], meaning that biofuel operations are not required to comply with Principle 6 in order to achieve RSB certification. Compliance is however advised given the unstable nature of food security in a region prone to droughts, and to anticipate pressure from investors, civil society and the general public.

As the development of a RSB certified sugar supply chain in South Africa is still in the exploratory stage, the gap analysis results were based on generic farms participating in the SUSFARMS initiative. While this specification was necessary to define the scope for the gap analysis, given that the analysis was based on a conceptual supply chain, it was undertaken at a relatively high level. It is therefore recommended that if certification of a specific sugar supply chain is pursued, the gap analysis should be reviewed and expanded upon following the definition of a certification scope and identification of farms included within this scope. Furthermore, given the differences in the respective capabilities of growers, and the allowances in the RSB Smallholder Standard, it is recommended that the exercise be repeated using these standards if engaging with SSGs.

[1] https://www.globalhungerindex.org/south-africa.html

About the RSB

The Roundtable on Sustainable Biomaterials Association (RSB) is a global, multi-stakeholder organisation that offers advisory, membership and certification services for the bioeconomy on a global scale. Together with our partners, members and certified projects, we represent best practice in sustainability and proactively drive the development of a sustainable bioeconomy.

The RSB Principles and Criteria are the most robust and comprehensive indicators of why a biomaterial is sustainable. They are a one-stop solution for sector pioneers who need guidance in developing innovative products for a new world founded on social, economic and environmental considerations. The RSB certification system includes regulatory standards for compliance with the European Union's Renewable Energy Directive (EU RED) and ICAO's CORSIA.

RSB enjoys wide NGO support and is aligned with the United Nations' Sustainable Development Goals (SDGs). RSB certification is recognised by WWF, IUCN and the Natural Resources Defence Council as the strongest and the most trusted of its kind. It has been endorsed by SAFUG (Sustainable Aviation Fuel Users Group), ATAG (Aviation Transport Action Group), and ICSA (International Coalition for Sustainable Aviation) for its high level of sustainability assurance and is increasingly being requested by airlines as an essential part of their biofuel procurement.

RSB certified Sustainable Aviation Fuels (SAF) have a minimum 50% GHG reduction compared to fossil fuels, do not compete with food security or cause deforestation, and actively promote human rights and healthy ecosystems.

For more information visit www.rsb.org

About SA Canegrowers

The South African Canegrowers Association was established in 1927 to create a common platform to address grower issues. Today, our mission is to play a leading role in growing sugarcane and diverse production opportunities for cane growers through innovation, research, specialised services and products throughout the value chain

For more information visit www.sacanegrowers.co.za/

Abbreviations

CCMA	*Commission for Conciliation, Mediation and Arbitration*
ESMP	Environmental and Social Management Plan
GHG	Greenhouse Gas
GHI	Global Hunger Index
Ha	Hectares
klaa	Kilolitres absolute alcohol/annum
KZN	KwaZulu Natal
RSB	Roundtable on Sustainable Biomaterials
RV	Recoverable Value
SAFUG	Sustainable Aviation Fuel User's Group
SASRI	South African Sugarcane Research Institute
SASRI	South African Sugarcane Research Institute
SSG	Small-scale growers
WHO	World Health Organisation

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1. Introduction

The R14 billion (~US$918 million) South African sugar industry consistently ranks in the top 15 out of ~120 sugar producing countries worldwide[2]. The industry is spread across two provinces, Mpumalanga and KwaZulu Natal, mostly operating in the rural areas of these provinces. The industry, which employs ~350 000 people, makes a significant contribution to both the national fiscus and economic growth and development. However, the profitability of the sugar industry is under threat amidst challenges including drought, rising input costs (notably electricity and labour), weak protection against cheap imports (a result of overproduction of sugar in major sugar-producing countries), and the national sugar tax implemented in April 2018[3].

Diversification and the identification of alternative uses for sugarcane is therefore an imperative to support the economic sustainability of the sugar industry. Sugarcane has a variety of uses, including the production of food and fuel grade ethanol, bioplastics, furfural (a chemical feedstock used in cements, adhesives, casting resins and coatings) and sugar by-products which can be used in the development and production of pharmaceuticals[4]. The use of sugarcane as an alternative to fossil-based feedstocks also has significant emission saving potential and can contribute positively to the development of a sustainable bioeconomy.

The development of a truly sustainable bioeconomy is supported by the Roundtable on Sustainable Biomaterials (RSB). Certification to the RSB Standard covers the production of any bio-based feedstock, biomass-derived material and any advanced fuel, as well as complete supply chains and novel technologies. The RSB Standard provides a user-friendly, comprehensive approach to certification, acknowledged as the strongest and most trusted of its kind by the WWF (World Wide Fund for Nature), IUCN (International Union for Conservation of Nature) and NRDC (Natural Resources Defence Council). It is also widely recognized by authorities in the EU, North America and elsewhere – allowing preferential market access to RSB certified biomaterials.

The RSB Principles & Criteria (Figure 1, overleaf) are an important component of the RSB Standard and describe how to produce biomass, biofuels and biomaterials in an environmentally, socially and economically responsible way. The RSB Principles & Criteria are based on a management and risk-oriented approach. Together with the RSB's online tools and related guidance documents, the RSB Principles & Criteria help operators to identify and manage sustainability issues in a specific context and therefore reduce risks for operators, brand owners and investors.

1.1 Research Objectives

The key objective of this research is to understand the "RSB-certification readiness" of the South African Sugarcane Industry. The research aims to assist the industry in understanding the overlaps and key differences between sustainability schemes applicable to South African sugarcane farming, and in so doing, asses how well current industry practices compare against the RSB Principles & Criteria. This research feeds into the long-term goal of equipping the industry with the necessary knowledge to develop an effective market development strategy for diversification into the sustainable bioeconomy.

The research is structured to address the following topics:

1. Supply chain mapping of the local sugarcane industry
2. Benchmark of Bonsucro and SUSFARMS against the RSB Standard
3. Gap Analysis of local sugarcane farms against the RSB Principles & Criteria

[2] https://sasa.org.za/the-sugar-industry-at-a-glance/

[3] https://www.engineeringnews.co.za/article/south-african-canegrowers-association-to-brief-parliament-committee-on-sugar-industry-crisis-2019-02-25

[4] https://www.dailymaverick.co.za/article/2018-03-14-op-ed-biofuel-from-sugarcane-why-is-sa-not-rushing-ahead/

Figure 1: The 12 RSB Principles & Criteria

2. SUPPLY CHAIN MAPPING

The supply chain mapping exercise is typically undertaken for a specific supply chain seeking RSB certification. This then provides a basis for identifying and understanding supply chain specific risks. However, in line with the exploratory nature of the current scope of engagement, this exercise was undertaken at a high level with the objective of understanding the current structure of the industry and the movement and transformation of sugarcane through this system.

2.1. Supply Chain Mapping Approach

The supply chain mapping exercise provides a high-level representation of the South African sugar industry, with particular focus on cane production at farm level. The focus of this exercise is to understand the current structure of the industry as a precursor to identification of a specific farm or supply chain that would be conducive to RSB certification.

The generic supply chain was developed through a combination of the following:

- Desktop research and review of South African Sugar Association (SASA) reports and data
- Conference calls with South African Canegrowers Association (SA Canegrowers) representatives
- Data collection sheet completed by representatives from SA Canegrowers

Key focus areas for the supply chain mapping exercise were as follows:

- Identification of farm types i.e. small-scale/large-scale/commercial
- Definition of farming practices i.e. dryland vs. irrigated
- Sustainability initiatives / certification schemes
- Cane supply chains
- Number of mills
- Mill products and by-products
- Current ethanol production facilities

2.2. South African Sugar Supply Chain

The high-level supply chain for the South African sugar industry is shown in Figure 4 on page 12.

Currently, the majority of sugarcane (~80%) is produced by large-scale growers, with the balance made up by small-scale growers (SSG) (~12.5%) and milling companies with their own estates (~7.5%)[5]. In South Africa, SSGs are defined as any grower who delivers < 225 tons of Recoverable Value (RV)[6]. For small-scale and large-scale growers, cane is supplied to the mill either directly or by contracted delivery. For commercial estates, sugarcane supply is directly controlled by the mill.

There are six milling companies in South Africa, operating 14 mills. The mills produce raw sugar, which is either refined on site, refined at a centralised refinery or sold to local and export markets. Bagasse produced by the mills is primarily used as a feedstock to generate steam, which conventionally powers a steam turbine generator and produces heat for the sugar production process and electricity[7]. The electricity produced is used to run the mill, and in the case of excess production, is provided to villages around the mill. Excess bagasse is used as a feedstock for animal feed and fertilisers.

[5] Based on 2018/2019 season data: https://sasa.org.za/cane-growing-in-south-africa/

[6] At 12% RV, this translates to roughly 1875 tonnes of cane. In irrigated areas, this equates to ~ 20 hectares and in rainfed areas ~ 40 hectares.

[7] https://www.ee.co.za/article/developments-in-co-generation-in-sugar-mills.html

There are three ethanol production facilities in South Africa. Collective capacity is ~120 000 klaa/a[8]. These facilities are either owned by, or have specific supply agreements in place with, milling companies for the provision of molasses as a feedstock. Ethanol products include extra neutral potable ethanol and rectified extra neutral alcohol (96.0%), which is supplied to the food and beverages industries, as well as anhydrous alcohol (99.95%) and industrial alcohol (95%) with various pharmaceutical and industrial applications.

2.3. Focus on Farm Level

In South Africa sugar producing areas are spread across two provinces, Mpumalanga and KwaZulu Natal (KZN), with the majority operating in rural areas of these provinces. Approximately 75% of the area of sugarcane harvested in South Africa is dryland (relying on rainfall) and 25% (concentrated in Northern KZN and Mpumalanga) is irrigated.

Sugarcane production is split between large-scale growers (~80%), SSGs (~12.5%) and commercial estates owned by sugar milling companies (~7.5%). Apart from the difference in the scale of the farming operation, an important difference between these systems is linked to their relative financial capacity and access to credit and investment capital. Typically, large-scale and commercial growers can access investment capital, which supports a higher level of technology and resource access on the farms. SSGs by contrast typically do not have access to the same level of financial reserves/support. However, in recognition of this challenge, the industry is actively engaged with supporting and promoting SSGs. Support from the industry includes the provision of mentorship programmes focusing on business skills, deployment of grower support extension services, in-field training, certified courses in sugarcane agriculture and the provision of technology transfer and extension services.

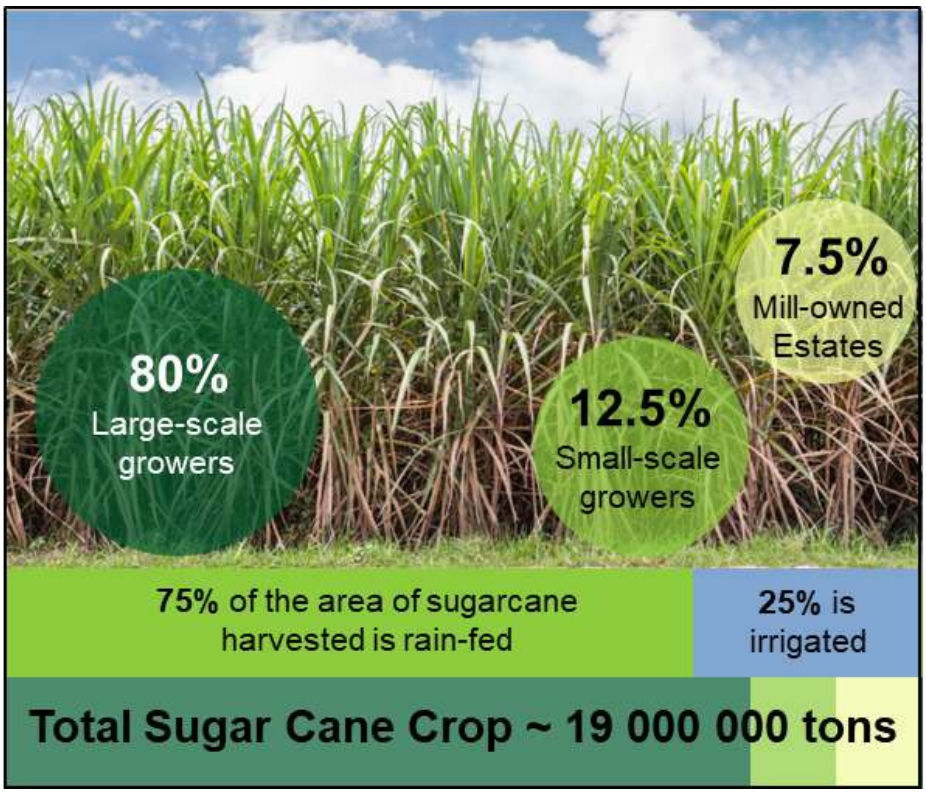


Figure 2 Overview of cane production in the South African sugar industry

[8] Kilolitres absolute alcohol/annum: http://www.epasa.org.za/about-us.html

Farm level sustainability for all growers is supported by SUSFARMS – a continuous improvement system developed by the South African Sugarcane Research Institute (SASRI) as a practical tool for the South African sugarcane industry to guide the implementation of better management practices in sugarcane cultivation. SUSFARMS is intended as a practical tool, containing a comprehensive collection of relevant legislative requirements and good management practices that promote worker's rights, profitable production and environmental stewardship. Currently, the uptake and implementation of SUSFARMS is limited, with roughly 320 large-scale growers participating in the Eston, Noodsburg, and Dalton regions of KZN (Figure 3).

From a certification perspective, there are currently no farms in South Africa certified as Bonsucro compliant, although one milling company (RCL Foods) is currently investigating certification for 50 000 tonnes of sugar.

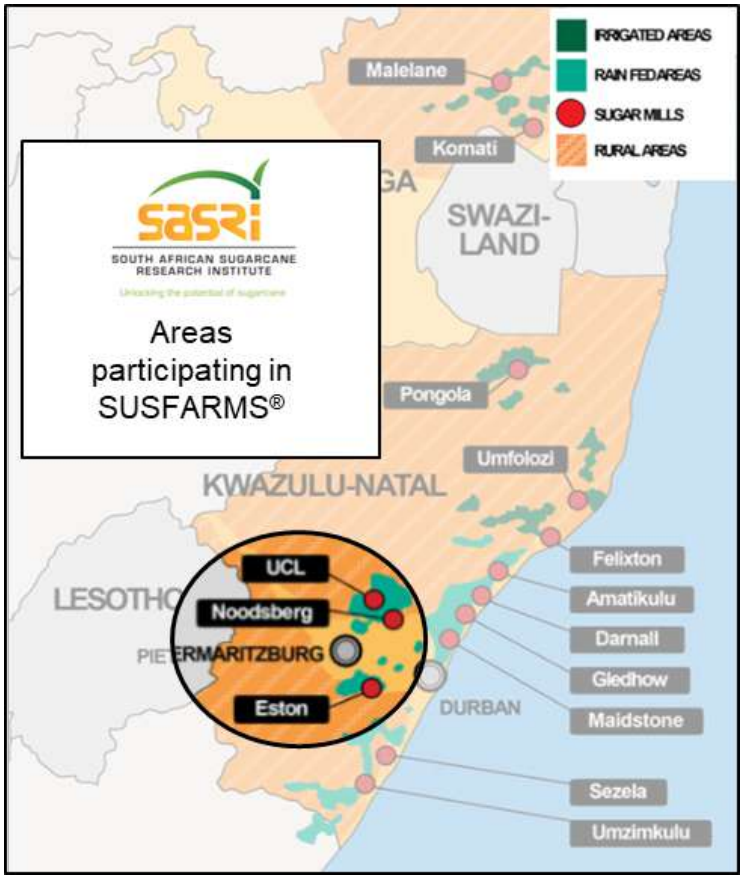
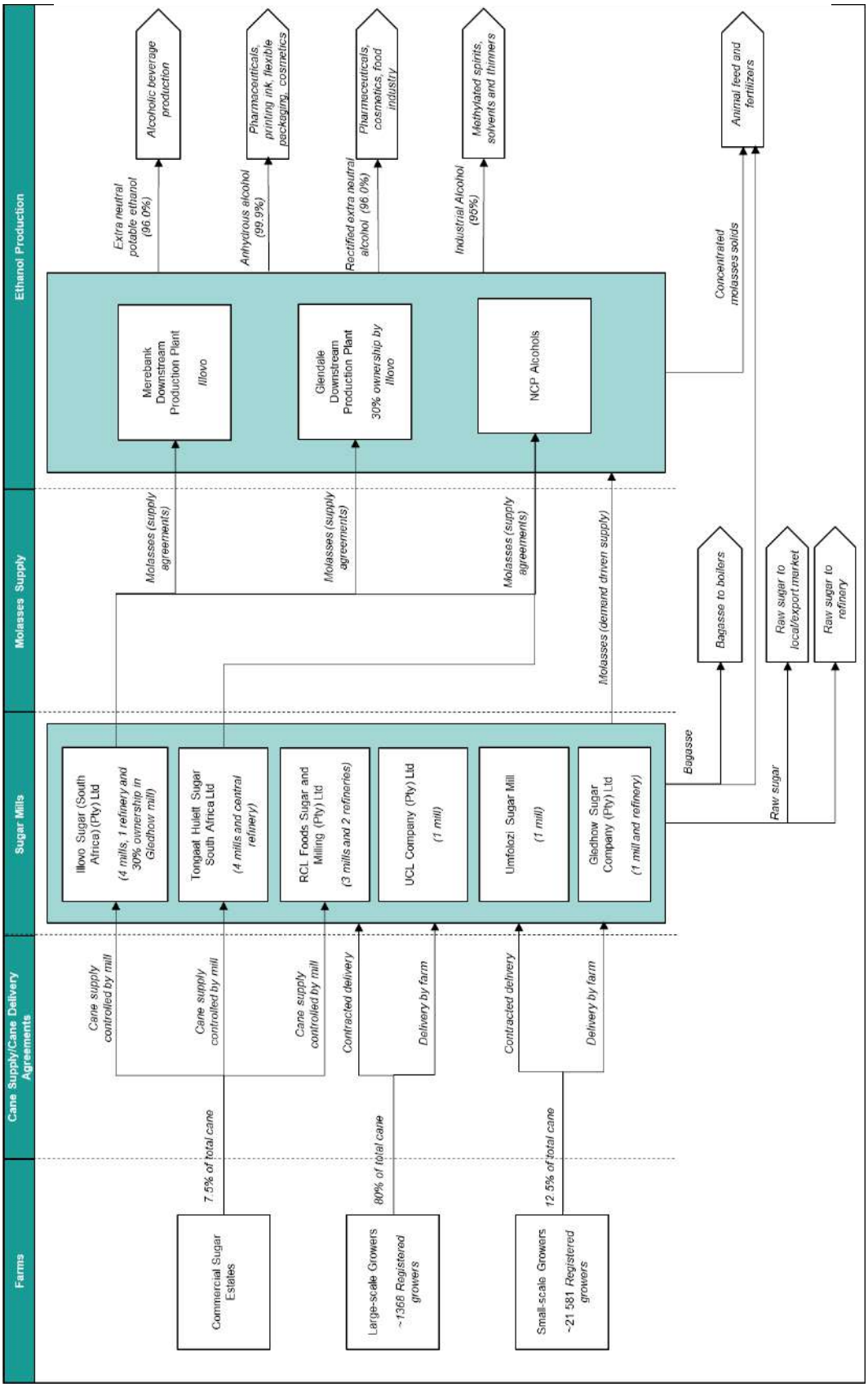


Figure 3: Sugar production areas participating in SASRI's SUSFARMS system[9]

[9] Figure adapted from SASA: https://sasa.org.za/the-sugar-industry-at-a-glance/

Figure 4: High level supply chain map of the South African sugar industry



3. BENCHMARK OF STANDARDS

In South Africa, sustainable sugarcane cultivation is best supported by SASRI's SUSFARMS initiative, and to a lesser extent, the Bonsucro Standards. With regards to SUSFARMS, although only a relatively small proportion of farms are actively engaging with this initiative, those that are provide a good indication of the uptake and implementation of sustainable practices into local farm management. With regards to the latter, although there are currently no sugarcane farms in SA that are producing Bonsucro certified cane, Bonsucro is a well-known standard within the industry.

The benchmarking process aims to understand the extent to which the RSB Standard requirements are already covered by either Bonsucro or SUSFARMS and identify any gaps.

This section is divided into the following sub-sections:

1. Benchmark of RSB Principles & Criteria against Bonsucro Standards
2. Benchmark of RSB Principles & Criteria against the SUSFARMS Sustainable Farm Management System

3.1. Benchmark results: RSB and Bonsucro

Context Information

In 2017, the RSB commissioned a study to compare and benchmark the following standards:

- RSB Principles & Criteria RSB-STD-01-001 (Version 3.0)
- RSB Standard for Traceability – Chain of Custody (Version 3.5)

vs

- Bonsucro Production Standard (Version 4.2)
- Bonsucro EU Red Mass Balance Chain of Custody Standard V4.1 2016

The study was undertaken by an independent contractor. It is not the intention of this report to replicate the benchmark findings in full, rather to provide a summary of the key results. Further detail on the study can be obtained by request from the RSB.

Comparative Overview

RSB and Bonsucro have several similarities as organisations, and both are recognized for their credibility and leadership as sustainability certifiers. Both are full members of the ISEAL alliance and are at the same level of compliance with ISEAL's assurance code. While RSB originally covered sustainable biofuels and has since been expanded to cover all biomaterials, Bonsucro was founded with the explicit mandate to reduce the environmental and social impacts of sugarcane production.

Despite their similarity as organisations, in terms of their standards and certification systems, RSB and Bonsucro have very different approaches to compliance criteria and requirements. The RSB Principles & Criteria are qualitative, progressive in nature and holistic, whereas Bonsucro's Principles & Criteria are more quantitative and focused[10]. The metric system and calculator methodology utilized by Bonsucro provides something of a "one-size-fits-all" approach, which contrasts with the RSB's model of adapting to local conditions and involving a wide stakeholder network to ensure full local and regional relevance.

Due to this difference in approach, direct comparison between the two systems is not straightforward. For example, the metric system applied by Bonsucro is at times difficult to compare with the language

[10] Although there are more detailed definitions and larger scope of compliance under the Bonsucro *Guidance for the Production Standards* document, these are typically non-binding and are not audited against.

of the RSB standard. As an illustration of this, for soil health, Bonsucro specifies ">30% ground cover of tops or leaves after harvest" while RSB stipulates "Operator's shall implement practices to protect soil structure, including the prevention of compaction, and maintain or enhance soil organic matter on the feedstock production site". Direct comparison of these standards requires the resolution of questions such as whether 30% ground cover can be considered a practice that enhances soil organic matter or indeed whether 30% is a sufficient quantity to protect soil health.

Despite these complications, the benchmark study was completed in full. A visual representation of the key results from the benchmark study (as represented in the study) is shown in Figure 5. In this diagram, the turquoise section contains areas that only the RSB focuses on, while the yellow section shows areas only focused on by Bonsucro. The green section where the two standards overlap shows areas where both systems work strongly (albeit with differences in the detail of the standards). An overlap between colours illustrates an area that is common to both RSB and Bonsucro, but with portions only covered under one system.

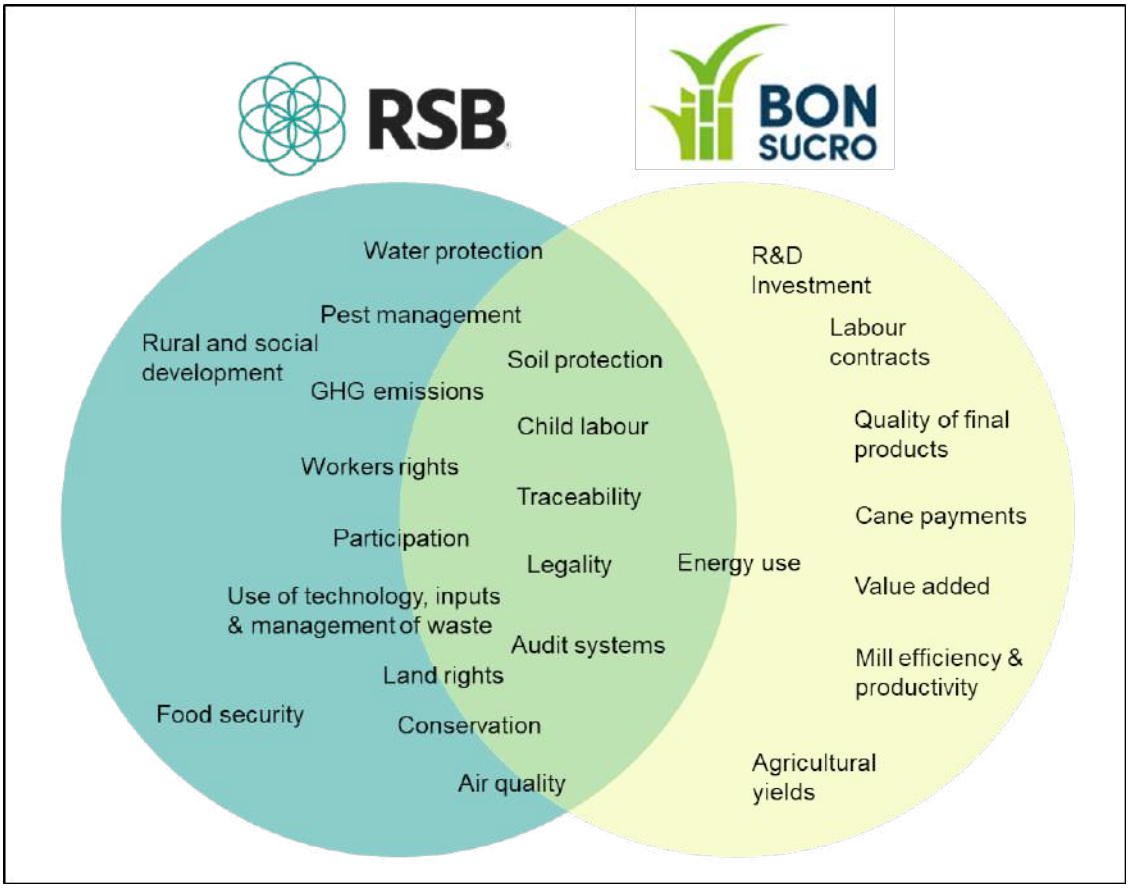


Figure 5: High level comparison of the RSB and Bonsucro standards

Despite the few areas of overlap shown in Figure 5, the results from the benchmark found that the majority of RSB's minimum requirements are not covered by Bonsucro. In general, the RSB requirements for each Principle were more detailed, covering a wider range of sustainability criteria. However, there were two key areas covered by Bonsucro for which there was no RSB equivalent:

- Sugar productivity metrics
- Economic sustainability and investment

With regards to sugar productivity metrics, because Bonsucro is a crop specific certification scheme, it goes much deeper than other standards in specifying sustainable levels of productivity and industrial efficiency. The standards provide quantified metric targets for yields, efficiency and productivity. There are two important implications associated with this approach. First, it is unclear how these target points were established and hence whether the "one-size-fits-all" approach has full local and regional relevance. Second, because the quantified productivity targets must be achieved alongside environmental and social compliance targets, if a factory or farm does not meet the required productivity thresholds — despite having strong environmental and social compliance levels — the production can't be considered sustainable.

Bonsucro is also unique in terms of the manner in which it measures, using concise indicators, the economic improvement and fore planning that a sugar mill can make. Investments in research and development and field extension services are essential for the long-term sustainability of an agribusiness. The inclusion of economic indicators in the Bonsucro standard therefore provides additional depth to the standard. However, as with the other quantified indicators, a lack of clarity around the origin of the numerical target does bring into question its full local and regional relevance.

Based on the benchmark findings, the two standards cannot be considered equivalent: Bonsucro certification does not guarantee compliance with the RSB Principles & Criteria or Chain-of-Custody standards, and vice versa, RSB certification does not guarantee Bonsucro compliance.

3.2. Benchmark: RSB and SUSFARMS

Context Information

No previous benchmark study has been undertaken that compares the RSB Standards with the SUSFARMS initiative. To address this gap, a study was undertaken under the scope of engagement between RSB and SA Canegrowers to provide an indicative benchmark of the RSB Standards against the SUSFARMS Sustainable Sugarcane Farm Management System. The scope of this study was to compare and benchmark the following:

- RSB Principles & Criteria RSB-STD-01-001 (Version 3.0)

vs

- SUSFARMS® Sustainable Sugarcane Farm Management System 4th Edition

An important consideration in this benchmarking exercise is the difference in purpose of the two systems being compared. The RSB Principles & Criteria form part of the RSB Standard and therefore provide explicit compliance criteria that operators would need to comply with to obtain RSB Certification. SUSFARMS by contrast, is a locally relevant continuous improvement system, developed by the SASRI as a practical tool for the South African sugarcane industry to guide the implementation of better management practices in sugarcane cultivation. While this does not prohibit the comparison of the two given the similarity in their objective of supporting sustainable sugarcane cultivation and processing, it should be noted that the benchmark results provide a comparison between a standards document and a guidance document for a management system.

RSB/SUSFARMS Benchmark Approach

The two systems are very different in terms of their structure and approach. The RSB Principles & Criteria are structured around 12 Principles, each of which contains a subset of compliance criteria and minimum requirements. The SUSFARMS Management System is structured around three principles (Prosperity, People, and Planet). Within each principle, content is categorized under two main headings – a "Statement of Intent" and "measures" (Figure 6).

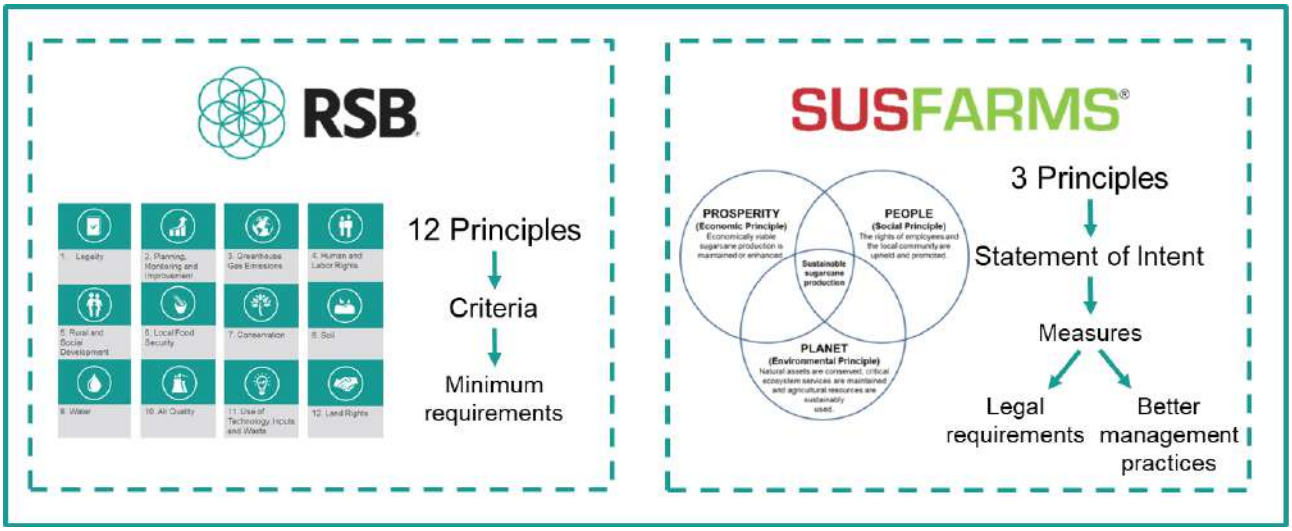


Figure 6 Overview of the structure of the RSB Principles & Criteria and SUSFARMS Sustainable Farm Management System

Within the SUSFARMS system, a **Statement of Intent** is "…a broad statement indicating the overall objective (or desired outcome) of the implementation of legal compliance or better management practices." Each Statement of Intent is presented in a separate module. The **measures** by contrast are defined as the "auditable" elements of the system, containing attributes that allow them to be good measures of sustainable agriculture. Measures are allocated to two main categories: "Legal Requirements" and "Better Management Practices". For each Statement of Intent, there are related measure/s that serves as an indicator as to whether legal requirements have been implemented or good management practices are in place.

Given the difference in the structure of the two standards, it was necessary to establish a basis for comparison. An independent biofuel sustainability framework was used for the purposes of this comparison. This framework is structured around eight principles and provides a comprehensive set of sustainability characteristics relevant to biofuel feedstock cultivation[11]. Each system was compared against this independent framework to obtain an understanding of the focus areas of each system. The resulting "heat map" for each system was then compared to identify key areas of overlap as well as focus areas unique to each standard. This result was used to determine a basis for comparison, highlighting key similarities and differences between the two systems. Areas of relative strength were then compared against each other directly. This approach is illustrated schematically in Figure 7.

[11] This framework is available in Appendix A

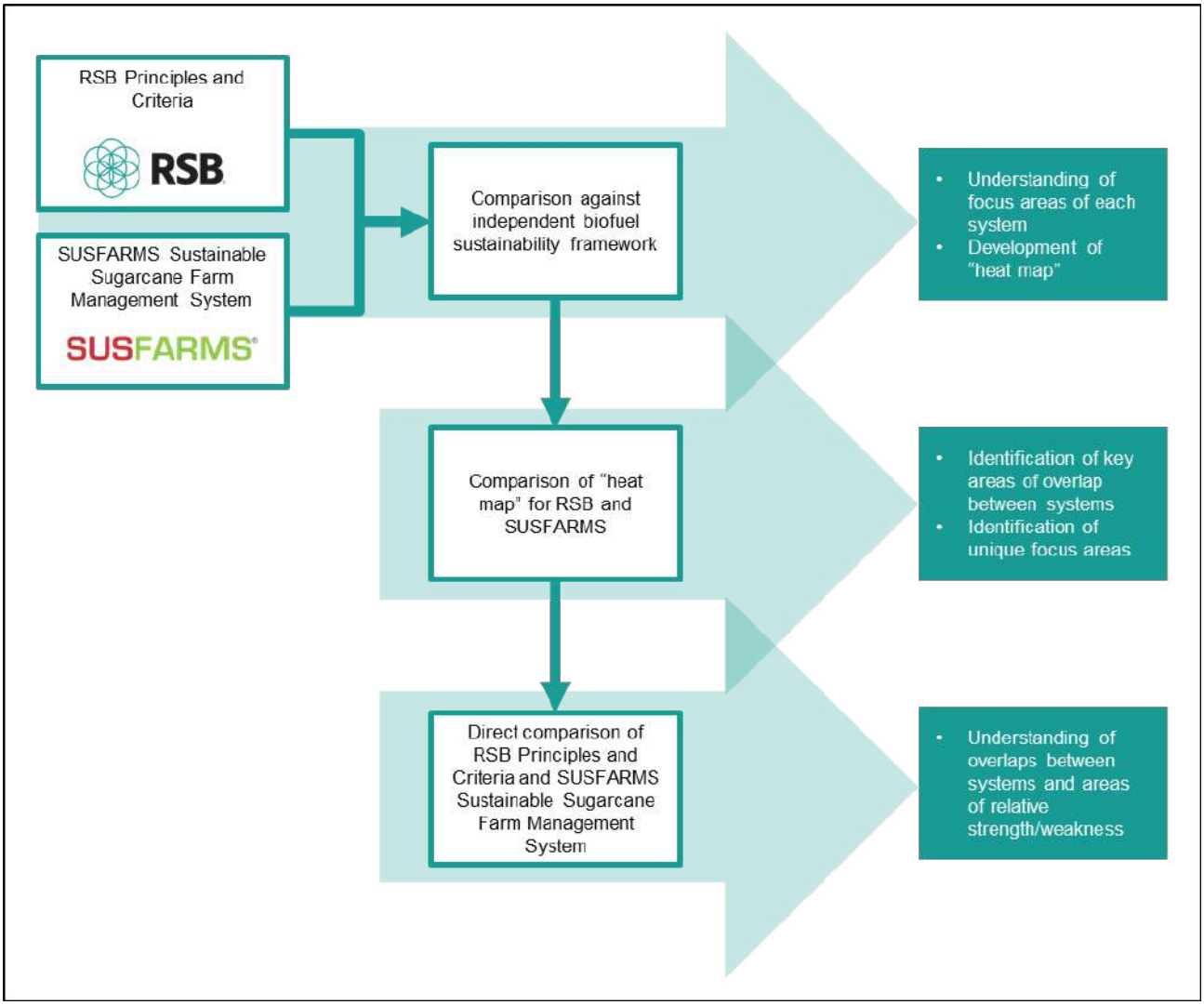


Figure 7: Benchmark approach for the comparison of RSB Principles & Criteria and the SUSFARMS Sustainable Sugarcane Farm Management System

Key methodological decisions in the benchmark process were as follows:

- The RSB Principles & Criteria were mapped against the independent framework based on the minimum requirements. Each minimum requirement was mapped separately and assigned one or more applicable characteristics. These characteristics were then grouped under each RSB Criteria.
- The SUSFARM Sustainable Sugarcane Farm Management System was mapped against the independent framework based on the measures. Each measure was mapped separately and assigned one or more applicable characteristics. These characteristics were then grouped under each Statement of Intent.
- The benchmark comparison was based on biomass production. Therefore, only RSB Criteria applicable to biomass producers were considered.

Comparative Overview

A high-level comparison of the two systems against an independent sustainability framework is shown in Table 1. This comparison aims to highlight key focus areas of each system (green) and areas with less emphasis (red).

Table 1 Comparison of the RSB Principles & Criteria and SUSFARMS Sustainable Farm Management System against a biofuel sustainability framework

Dimension	Principle	RSB	SUSFARMS
		Low Focus ... High Focus	
Economic	Profitability		
	Resource Use Efficiency		
	Financial Reserves		
	Productive Potential		
Social	Required Inputs from Society[12]		
	Outputs & Impacts on Society		
Environmental	Protecting Environmental "Sinks"		
	Protecting Environmental Sources		

In general, the results of the comparison show several similarities between the RSB Principles & Criteria and the SUSFARMS Sustainable Farm Management System. In both systems there is a strong focus on the environmental and social dimensions, particularly in terms of managing outputs and their impact on society and the protection of environmental sources and sinks. From an economic perspective, the major focus of each system is directed towards resource use efficiency and maintaining the productive potential of land. While both systems place comparatively less emphasis on the economic dimension, the SUSFARMS system is slightly more focused in this regard, with two Statements of Intent focused on financial planning and financial compliance.

For areas of relative strength, direct comparison of the two systems found that there was strong overlap between them. In terms of content relating to a specific area or topic, RSB and SUSFARMS were generally equally comprehensive, with the minimum requirements (RSB) and measures (SUSFARMS) covering similar aspects thereof. Unlike the Bonsucro Standards with their strong emphasis on quantified indicators, both RSB and SUSFARMS tend towards more qualitative, progressive in nature and holistic requirements/guidance structured around good management practices. Within the SUSFARMS system, under certain statements of intent there are specific quantified measures or targets in place. Where quantified indicators are provided, these are generally based on national regulations and requirements and formulated for local conditions and hence have strong local relevance.

However, not all areas were equally covered by the two systems. A visual representation of the key results from the benchmark study is shown in Figure 8. In this diagram, the turquoise section contains areas that only the RSB focuses on, while the red section shows areas only focused on by SUSFARMS. The purple section where the two standards overlap shows areas where both systems work strongly (albeit with differences in the detail of the standards). An overlap between colours

[12] This Principle covers the capacity/resources within society that the farm depends on, or requires, to be in place to operatre successfully (for example, technologies, human resources/skills, market demand, industry support etc). It also includes stakeholder engagement and the measures that a farm takes in order to meet the needs/expectations of society and ensure positive community engagement and legal compliance.

illustrates an area that is common to both RSB and SUSFARMS, but with portions only covered/covered in greater detail under one system.

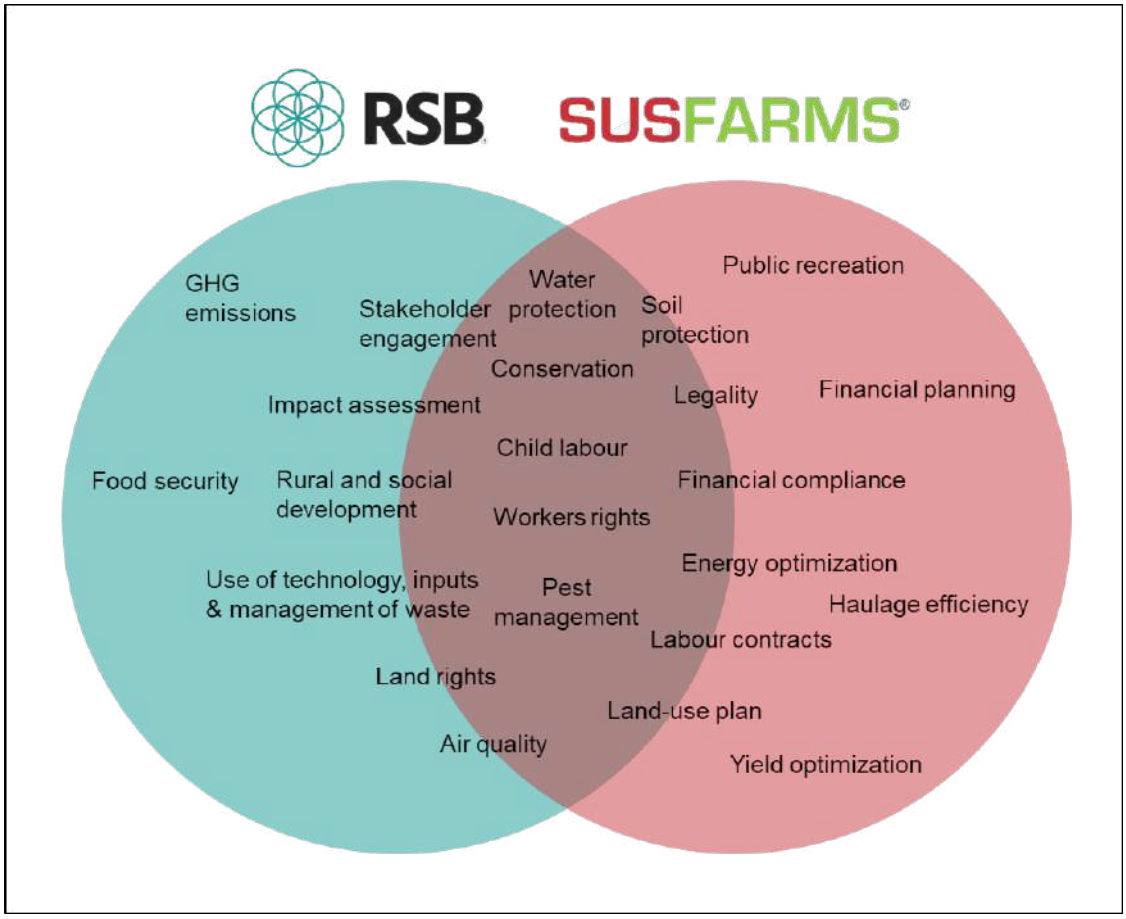


Figure 8 High level comparison of the RSB Principles & Criteria and the SUSFARMS Sustainable Farm Management System

Comparison of SUSFARMS System to RSB Principles & Criteria

The key results obtained in the benchmark study comparing the SUSFARMS system to each RSB Principle are summarized below.

Principle 1: Legality

The SUSFARMS system contains strong legislative guidance, providing the specific measures necessary to meet all regional and/or national legislative requirements applicable to each module. Although there is no equivalent 'legality' principle under SUSFARMS, legality requirements are integrated into each module. Amongst else, the SUSFARMS measures outline the systems that should be in place to ensure compliance with each legislative requirement and hence are comparable with the compliance criteria in RSB Principle 1.

Principle 2: Planning, Monitoring and Continuous Improvement

The RSB criteria are slightly stronger than the SUSFARMS equivalent in this area. In terms of impact assessment, the SUSFARMS standards only require an impact assessment if it is required in terms of national legislation. With regards to free, prior and informed consent (FPIC) forming the basis for stakeholder consultation, the SUSFARMS system contains specific measures relating to the

consultation and engagement with local communities and stakeholders (Module 2.4). While these measures cover the general principle of stakeholder engagement, they do not contain explicit guidance in this regard and lack the clarity of the RSB compliance criteria. The SUSFARMS system further lacks direct reference to the implementation and maintenance of a transparent and easily accessible grievance mechanism for directly affected local communities.

Principle 3: GHG Emissions

RSB compliance criteria relevant to biomass producers stipulate that all relevant local GHG reduction requirements are met, and emissions are calculated according to prescribed methodologies. The SUSFARMS system does not have any specific requirements around GHG emission calculation and reporting. Although there are currently no GHG reduction requirements in agriculture in South Africa, emission reporting and reduction is not included in the SUSFARMS system.

Principle 4: Human and Labour Rights

RSB's Principle 4 is to the most part mirrored by SUSFARMS' Modules 2.1 and 2.2 with the following exception:

- SUSFARMS does not make explicit reference to the development of transparent and easily accessible grievance mechanisms for contracted, out-contracted or sub-contracted workers.

In general, the SUSFARMS system is very strong in supporting this Principle and contains references to all relevant labour and human rights legislation. South African labour law is very comprehensive and covers occupational health and safety, fair labour practices, employment equity, labour relations and compensation to a comparable level to that contained in this RSB Principle.

Principle 5: Rural and Social Development

This Principle is partially supported by Modules 2.4 and 2.5 of the SUSFARMS system. The measures listed under these modules focus on the establishment of a sustainable local economy through preferential employment of local people, active engagement with community capacity building initiatives and a contribution towards local skills development. Although equivalent in concept, the SUSFARMS measures lack the detail of the RSB compliance criteria and do not provide explicit guidance around areas such as promoting the participation of women, youth, indigenous communities or the vulnerable, or specific measures to optimize benefits to local communities. In general, the RSB standard is stronger in terms of providing specific compliance criteria and the two systems are not equivalent for this Principle.

Principle 6: Food Security

There is no equivalent standard/principle under SUSFARMS.

Principle 7: Conservation

RSB's Principle 7 is to the most part covered by SUSFARMS' Modules 2.7, 3.1, 3.2, 3.5 and 3.15. In general, the SUSFARMS system is very strong in supporting this principle and contains measures relating to all relevant environmental management and conservation legislation. These legal requirements are very comprehensive and cover the protection of biodiversity, ecosystems, and conservation values to a comparable level to that contained in this RSB Principle. In addition to measures relating to the legal requirements, the SUSFARMS system also contains measures for good management practices that cover, amongst else, the maintenance of buffer zones, conservation of riparian zones, and establishment and maintenance of ecological corridors, which further support this Principle.

While both systems limit the conversion of certain land to feedstock production, the RSB Principles & Criteria provide more detailed and rigorous requirements in this regard. Under this standard, the cut-off for the conversion of "no-conversion" areas (see Principle 7.a.6) is January 2008. SUSFARMS by contrast does not stipulate a "cut-off" but stipulates that for any greenfield expansion (virgin/new land

incl. veld, pasture or timber) or conversion from dryland to irrigated land, a permit from the agricultural authority is required[13].

The major difference between the two systems lies in the management of “no-conversion” zones. However, besides this difference, there is generally good overlap between the two systems albeit the detail of certain minimum requirements.

Principle 8: Soil

A key difference between the SUSFARMS system and RSB Principle 8 occurs in the focus of the two systems. Where the RSB compliance criteria are focused on maintaining soil health and protecting against degradation by enhancing soil’s physical, chemical and biological conditions, SUSFARMS is primarily focused on physical aspects, preventing degradation, compaction and erosion.

Soil protection is covered by Modules 3.10, 3.11 and 3.12 of the SUSFARMS system. These modules provide comprehensive guidance on good management practices, as well as quantified indicators and targets for the protection of soil structure and prevention of erosion. SUSFARMS’ metric approach covers soil’s physical protection in a more detailed and prescriptive manner than the RSB compliance criteria and having been specifically developed for South Africa, provides values and indicators highly relevant to the local context. With regards to soil health, the SUSFARMS system promotes the reduction of fertiliser and/or ameliorants and encourages regular and comprehensive soil and leaf sampling. It also provides threshold values for heavy metal concentrations in soil. However, these measures are less prescriptive than those defined for the physical condition of soil.

In general, the SUSFARMS system is more comprehensive than the RSB requirements under this Principle. There are however exceptions to this generalisation, particularly regarding the implementation of Conservation Agriculture practices to improve soil health.

Principle 9: Water

In general, the SUSFARMS system (Modules 3.7, 3.8 and 3.9) is very strong in supporting this Principle and contains measures relating to all relevant water legislation in South Africa. Water is a critical resource in South Africa and enforcement of this legislation, particularly for for large- and commercial scale growers, is generally good. These legal requirements are very comprehensive and cover the areas of water rights, conservation of surface and groundwater resources, and water quality. In addition to measures relating to legal requirements, the SUSFARMS system also contains measures for good management practices which further support this Principle. In general, the SUSFARMS system contains more prescriptive measures around water management including quantified indicators and targets. Having been specifically developed for South Africa, these values and indicators are highly relevant to the local context.

While there are minor differences between the two systems in term of the detail of certain minimum requirements (for example, the SUSFARMS system does not fully cover the RSB requirements around the development of a water management plan), this Principle is generally well covered by the SUSFARMS system.

Principle 10: Air Quality

Air quality is covered in Module 3.4 of the SUSFARMS system. Legal measures refer to national requirements for operators to prevent significant pollution (or degradation) of the environment, and where pollution has occurred, to minimize and rectify that pollution or degradation. While similar in concept to the RSB requirements under this Principle, these measures lack specific requirements around the development and implementation of an emission-control plan.

There is a strong overlap between the two systems around the issue of burning of residues. Both systems require that burning should be avoided. The RSB requirements are slightly stricter in this regard, promoting the elimination of burning of all agricultural residues with a dedicated phase out plan.

[13] Additionally, under NEMA, environmental authorisation is required for the clearance of more than 1ha of indigenous vegetation, and for the physical alteration of virgin soil to agriculture if it exceeds 100 ha in extent.

Both systems make a provision that where burning cannot be avoided, it should be minimized as far as practically possible.

Principle 11: Use of Technology, Inputs and Management of Waste

This Principle was inconsistently covered by SUSFARMS, with some criteria having a strong overlap and others no equivalent. Areas well covered by SUSFARMS are as follows:

- Implementation and maintenance of good practices for the storage, handling, use and disposal of fertilisers and chemicals.
- Restrictions on the use of toxic agrochemicals[14]. It should however be noted that this list does not fully cover all chemicals prohibited by the RSB Standard[15].
- Management of waste and residues in a manner such that soil, water and air's physical, chemical and biological conditions are not damaged.

Areas for which there is no/weak SUSFARMS equivalent are as follows:

- Access to technologies and management of proprietary technology
- Requirements covering the use and management of risks related to genetically modified plants and micro-organisms
- Management and containment of micro-organisms

Principle 12: Land Rights

In terms of land use rights, this Principle is covered to a certain extent by Module 2.3 of the SUSFARMS system.

While RSB criteria 12a is comprehensively covered, criteria 12b (concerning free, prior and informed consent forming the basis for all negotiated agreements for any compensation acquisition, or voluntary relinquishment of rights by land users or owners) is not fully covered. This is in part due to the legal framework governing land rights and ownership in South Africa. For example, the Restitution of Land Rights Act, 22 of 1994, as amended, provides for the restitution of rights in land or communities disposed of such rights after 19 June 1913 as a result of past racial discriminatory laws or practices. Therefore, Principle 12 has no full equivalence under SUSFARMS, as the latter system must be compliant with national laws which cannot be fully reconciled with the requirements of criteria 12b.

[14] The SUSFARMS system explicitly prohibits the use of agricultural remedies containing the following in terms of the *Fertilisers, Farm Feeds and Agricultural Stock Remedies Act 36 of 1947*: 2,4-D (dimethylamine salt), 2,4-DB (sodium salt), dicamba (dimethylamine salt), any other salts or esters of 2,4-D (except APM salt), Monocrotophos, Chlordane, Lindane (gamma – BHC). For farms in KZN, the following additional restrictions apply: any agricultural remedy containing 2,4-D (isoactylesther), NCPA (potassium salt), MCPB (sodium salt), any salt or esters of triclopyr or salts of dicamba.

[15] The RSB Standard (Principle 11.d.2) stipulates that no chemicals used in the World Health Organization's 1a and 1b lists shall be used. These lists are available: https://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf

4. GAP ANALYSIS

A gap analysis was undertaken with the principle objective of understanding how current sugarcane growing practices in South Africa compare with the RSB feedstock production requirements. The gap analysis is a useful tool in understanding the "certification readiness" of the industry and aims to identify areas of weakness where current practices do not comply with the RSB requirements and hence pose challenges to certification.

The development of a RSB certified sugar supply chain in South Africa is still in the exploratory stage. Consequently, there is no defined supply chain identifying specific farms or areas to function as feedstock suppliers within the RSB certification scope. As a starting point in developing such a supply chain it would be useful to consider areas likely to be conducive to RSB certification. Within South Africa, a feasible starting point would be to consider farms already engaging with SASRI's Sustainable Sugarcane Farm Management System (SUSFARMS). SUSFARMS participation is largely concentrated in the Eston, Noodsburg and Dalton regions, with an estimated 320 farms actively engaging with the system.

For the purposes of this research, the gap analysis was undertaken from the perspective of large-scale growers actively engaging with SUSFARMS. Although there are currently no SSGs actively participating in the initiative, given the difference in the respective capabilities of growers, additional consideration was given to SSGs. This was necessary to understand potential gaps for SSGs adopting the SUSFARMS system and looking towards RSB certification. It should be noted that RSB does provide a Smallholder Standard[16], which enables small-scale farmers (feedstock producers whose total land does not exceed 75 ha) to access RSB-certified supply chains. However, due to the defined scope for the gap analysis, SSGs were not assessed directly against these specific standards, as they do not vary substantially in terms of auditable requirements[17].

While this specification serves to focus the scope for the gap analysis, it must be acknowledged that as the analysis is based on a conceptual supply chain it was undertaken at a relatively high level. The gap analysis should be reviewed and expanded upon following the definition of a certification scope and identification of farms included within this scope.

4.1. Gap Analysis Methodology

The gap analysis was based on information obtained from the following sources:

- RSB Screening Tool: completed by representatives from SA Canegrowers
- Self-evaluation of current practices based on the RSB Principles & Criteria: completed by representatives from SA Canegrowers
- In-person discussions: Skype calls between SA Canegrowers and RSB to provide feedback and further detailed discussion around the screening tool and self-assessment exercise
- RSB South African regional indicators report
- Other information and documents received from SA Canegrowers
- RSB/SUSFARMS benchmark results (see Section 3.2)

Gaps were evaluated against the RSB Principles & Criteria (RSB-STD-01-001). The analysis was limited to cane production and only those criteria relevant to biomass producers were considered.

[16] Standard for Certification of Smallholder Groups (RSB-STD-03-002) and RSB Principles & Criteria for Smallholder Groups (RSB-STD-03-001)

[17] Key differences in the smallholder standards as follows: 1.) The RSB P&C for Smallholder Groups introduces a stepwise approach, which allows the group to become fully compliant with the RSB standard within 2 years after the initial audit and 2.) Principle 5 (Rural and Social Development) is not applicable to SSGs.

Although the individual RSB Criteria and Minimum Requirements were considered during the analysis process, the results are presented at the Principle level.

4.2. Gap Analysis Results

Principle 1: Legality

The legality of operations is a strong focus of SUSFARMS and the legality of sugarcane farming is enforced by regular checks from relevant government authorities. These checks tend to prioritize large-scale and commercial farms, and hence large-scale farmers are most likely to be compliant with this Principle. While SSGs are expected to be compliant with most legal obligations, they are likely to have less systems in place and might not be aware of all legal requirements. SSGs are also typically subject to fewer inspections, which not only limits the opportunity for legislative gaps to be identified and amended but increases the chance of non-compliance and operating risks in environmental and social (i.e. labour rights and health and safety) areas.

Principle 2: Planning, Monitoring and Continuous Improvement

The RSB requirements are more detailed than the SUSFARMS measures for this Principle. Large-scale and commercial sugarcane farms are well established in South Africa and the majority of these are likely to have been established before any impact assessment requirements were developed and before positive community engagement could be confirmed. Consequently, these farms are unlikely to have undertaken these processes and as such, are not expected to meet the RSB requirements under this Principle. Furthermore, unlike the RSB Standards that require operations to be undertaken in accordance with an Environmental and Social Management Plan (ESMP) developed in accordance in the RSB ESMP Guidelines, sugarcane farms in South Africa are unlikely to have an ESMP in place, and limited formal impact monitoring and mitigation is undertaken. This therefore presents an important gap in current operations as compared to RSB requirements.

With regards to future expansion, large-scale and commercial growers are relatively confined and although the requisite impact assessment for greenfield expansion would likely be undertaken, the opportunities for such expansion is limited. SSGs growers typically operate on communal land and are more prone to expansion. Depending on the scale of the expansion this might incur the need for an impact assessment under South African law. However, due to limitations in accessing all relevant legal frameworks, SSGs growers could be unaware of specific requirements for expansion and hence risk full compliance to this Principle.

In terms of ensuring free, prior and informed consent forming the basis for all stakeholder consultation, this is generally well complied with in the industry. An important consideration under this principle is ensuring that relevant information is disseminated in a language that can be understood by all stakeholders. South African industry practice is to ensure that all relevant communications are available in both English and Zulu and where appropriate, translations are available at industry meetings. SSGs growers are represented by a well-structured mill cane committee who are involved in consultative processes. Due to the diversity of the industry, achieving consensus amongst all affected stakeholders has been highlighted as a potential challenge.

Principle 3: GHG Emissions

RSB compliance criteria relevant to biomass producers stipulate that all relevant local GHG reduction requirements are met, and (if delivering into a biofuel supply chain) lifecycle GHG emissions of the feedstock are calculated according to prescribed methodologies.

The SUSFARMS system does not have any specific requirements around GHG emission calculation and reporting. Given that there are currently no GHG reporting or reduction requirements applicable to agriculture in South Africa, the lack of industry practice around reporting cannot be considered a gap per se.

However, the lack of industry requirements to report GHG emissions could hinder biomass producers in a specific supply chain identified for RSB certification if they have no experience with GHG reporting

and calculations and are unable/unwilling to determine lifecycle GHG emissions for their biomass. It should however be noted that agriculture is expected to be included in phase 2 (2023 - 2030) of the recently promulgated carbon tax, and this could impose legal requirements on sugarcane farmers to report GHG emissions.

Principle 4: Human and Labour Rights

In general, the SUSFARMS system is very strong in supporting this Principle and contains references to all relevant labour and human rights legislation. South African labour law is very comprehensive and covers occupational health and safety, fair labour practices, employment equity, labour relations and compensation to a comparable level to that contained in this RSB Principle. Farm level compliance to national labour law and worker's rights is regularly checked by inspections from the National Department of Labour and the Commission for Conciliation, Mediation and Arbitration (CCMA). Workers are also generally considered aware of their rights and are free to approach the CCMA with any labour dispute.

With regards to occupational health and safety, while large-scale and commercial farms are generally strongly compliant with all legal requirements (and subject to regular inspection), SSGs are typically financially constrained with regards to providing workers with all requisite health and safety equipment. Furthermore, with limited financial capacity and limited inspections, there is the risk that remuneration does not meet all the RSB criteria (i.e. minimum wage etc.).

Principle 5: Rural and Social Development

In practice, this Principle should be well complied with. Although the RSB requirements are more detailed than the SUSFARMS measures for this Principle, the SUSFARMS measures promote and support the establishment of a sustainable local economy through preferential employment of local people, active engagement with community capacity building initiatives and a contribution towards local skills development. The uptake of SUSFARMS measures is generally high, as the sugar industry is primarily a rural based industry, and the rural communities linked to its operation are recognized as key stakeholders to its sustainability.

In addition, in order to promote and support rural development, the sugar industry has formulated a rural development strategy that proposes an inclusive rural development model for the cane growing areas of communal land. The strategy provides a framework to facilitate the coordinated implementation of interventions aimed at developing stable and prosperous rural communities. In addition, the industry actively promotes the participation of women and has focused initiatives for the development of women and youth.

While generally well covered, a possible gap in this Principle could occur around the RSB requirement for the preferential use of local labour. The use of migrant labour is relatively high in sugarcane farming and is flagged as such. Consequently, preferential procurement processes are in place and all labour laws strictly enforced to promote local labour. According to discussion with SA Canegrowers, while all due processes are followed during labour procurement, a lack of local interest in working in this sector is a major factor driving the high proportion of foreign workers and migrant labourers.

Principle 6: Food Security

According to the 2018 International Food Policy and Research Institute's Global Hunger Index (GHI), South Africa is classified as having a moderate level of hunger (14.5)[18]. According to the RSB screening tool, South Africa does not qualify as a food insecure region and does not require a food security assessment. However, the RSB Regional Indicators for South Africa found that although South Africa is relatively food secure, there are certain hotspots of food insecurity, namely areas with high unemployment and low income. It was therefore recommended that despite the GHI rating, Principle 6 should apply to all biofuel operations in South Africa.

[18] https://www.globalhungerindex.org/south-africa.html

Despite South Africa's moderate GHI rating, preventing risks to food security is a key focus of national policy around biofuel operations. Following an assessment of food security risks from biofuel crop cultivation, the Biofuels Industrial Strategy of South Africa identified sugarcane as one of two crops suitable for bioethanol production[19]. Furthermore, the current sugar surplus in the industry is a key driver for the industry's diversification and the use of excess sugarcane for ethanol production would pose no risks to food security.

Therefore, while sugarcane is an approved crop for biofuel production in South Africa, operators should be aware of the risks around food security and ensure that the relevant risk assessments are undertaken prior to developing new installations.

Principle 7: Conservation

The sugar industry is well established in South Africa with limited room for expansion. Consequently, the risk of conversion of protected areas, areas of conversation values of global, regional or local importance, or areas that serve to maintain or enhance such conservation values is low[20]. According to the results of the screening assessment, existing operations are well located away from restricted areas and key biodiversity areas. Sugarcane is a non-invasive species with no risks of invading areas outside of the operating site.

In general, the SUSFARMS system is strong in supporting this Principle and contains measures relating to all relevant environmental management and conservation legislation, including, amongst else, the maintenance of buffer zones, conservation of riparian zones, and establishment and maintenance of ecological corridors. South African legal requirements around conservation values are generally very comprehensive and cover the protection of biodiversity, ecosystems, and conservation values to a comparable level to that contained in this RSB Principle. According to discussion with SA Canegrowers, legislative requirements are relatively well enforced in the industry (typically, the enforcement of conservation legislation is stronger for large-scale and commercial scale growers than SSGs), with the exception of poaching. Although the industry is aware of this problem and actively trying to combat its occurrence (with the assistance of government and dedicated bodies such as the Blue Scorpions), poaching remains a challenge and should be flagged as a gap under this Principle.

Principle 8: Soil

Soil health and protection is well covered by SUSFARMS and the implementation of listed measures is generally high. Farmers are incentivized to take care of soil and have a strong awareness of the importance of good soil management practices. On large and commercial farms, farmers typically manage soil by means of regular soil sampling and analysis. For SSGs, good soil management has equal importance and emphasis, but due to the relative costs of sampling and analysis, management practices typically rely on other approaches and indicators of soil health.

The industry is generally supportive of conservation agriculture practices. For example, soil health and protection is encouraged through trashing where feasible (particularly in the rain-fed areas), as well as the use of roots and green cane as a soil cover. With regards to direct seeding and planting using non-mechanical means, according to feedback from the SA Canegrowers, the industry is strongly dependent on mechanical seedbed preparation. Currently, mechanical processes are favoured, as a very fine seedbed is required for the germination of sugarcane. The nature of the crop and current industry practice therefore results in a level of soil disturbance that appears to conflict with the

[19] The following crops are proposed for the production of biofuels in the country: for Bioethanol, sugar cane and sugar beet and for Biodiesel sunflower, canola and soya beans. The exclusion of other crops and plants such as maize and Jatropha is based on food security concerns.

[20] The RSB Standards prohibit the conversion of these areas after January 2008. Given the well-established nature of the majority of cane areas in South Africa, it is unlikely that conversion has occurred after this cut-off.

requirements under this Principle. However, the RSB requirements for this criteria should be understood as "when applicable"[21], and consequently this should not necessarily be regarded as a gap.

Principle 9: Water

South Africa is a water scarce country and hence water security and good management is an important criterion in the national context. According to the RSB Regional Indicators for South Africa, this criterion is likely to pose a risk to sustainable biofuel production as national water laws are generally weakly enforced in agriculture, and penalties for over-use are hardly enforced.

However, according to the SA Canegrowers, lawful water use, extraction and conservation are strongly promoted and supported by the SUSFARMS system. South Africa has a strong legislative framework around water planning and use, and this is well regulated, and compliance strongly enforced within sugarcane growing regions, by the local Impala Water Board and the National Department of Water and Sanitation. Furthermore, sugarcane farming in South Africa is generally considered to have a relatively low water impact. Approximately 75% of cane is rain-fed and with limited run-off volumes, is considered to have low impact on surrounding ecological compartments. Water is recognized as a valuable commodity within the industry and legislative requirements are generally well adhered to and there is strong uptake of good management practices around water conservation.

For sugarcane growing regions specifically, there are currently no major gaps expected under this Principle, as water conservation is well covered by South African law and the SUSFARMS system. However, there are some differences between these requirements/measures and the detail of certain minimum requirements (for example, the SUSFARMS system does not fully cover the RSB requirements around the development of a water management plan). Furthermore, given the scarcity of water in South Africa and the general lack of enforcement around water use and good management practices in agriculture, there is the potential for gaps to exist in individual cane growing operations (despite generally good industry practices). It is therefore important that water management is closely monitored to avoid gaps.

Principle 10: Air Quality

The practice of burning sugarcane before harvesting is widespread in South Africa (currently, around 90% of the crop is burned at harvest, while the rest is harvested green[22]). This is strongly related to current harvest practices: ~ 90% of cane is manually harvested. Although the negative environmental effects of open burning have been recognised, and guidelines for growers incorporating a Code of Burning Practice have been formulated[23], burning remains the most efficient and viable method for harvesting for a large proportion of the industry.

Where burning is prohibited by law or industry regulations (i.e. along highways) this is generally complied with. However, the RSB minimum requirements under this Principle promote the phase-out of burning within three years following certification. Although this requirement does allow for limited burning to continue beyond the three year phase-out period where no viable alternative is available, given the prevalence of burning within the industry, and local conditions (i.e. the geography of many cane growing areas and the resistance to mechanization of an industry that provides a high number of jobs), the phase out of burning is unlikely and as such, this should be flagged as a significant gap. Compliance with this principle could require intervention from government or industry bodies to incentivise greencane harvesting (see Figure 9).

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[21] i.e. RSB Principle 8.a.5 mentions a list of good management practices but does not require the implementation of all of these

[22] https://sasri.org.za/storage/Information_Sheets/IS_4.8-Guidelines-for-burning-sugarcane.pdf

[23] The Codes of Burning Practices form part of an initiative to promote Better Management Practices (BMP's) in the industry.The codes differ between regions in practice, but focus on minimising atmospheric pollution, preventing runaway fires and ensuring that farmers are well equipped in the event of such, minimising smut deposits from cane fires in residential or otherwise sensitive areas, and preventing heat and smoke from being blown across public roads or affecting power lines.

A CASE FOR GREEN CANE HARVESTING?

For manually harvested sugarcane, the advantages of burning before harvest are numerous: besides making the sugar cane easier to harvest, the flames also drive away cane rats and snakes that can pose a threat to workers. Burning also reduces the weight of the harvested crop, which means transport costs are lower and it improves the quality of the sucrose within the sugar cane stalk. However, greenhouse gas emissions and air quality issues consequent of burning are key drivers to eliminate this practice.

Manual harvesting without burning is notoriously difficult and time consuming. This practice, known as "greencane harvesting" requires workers to cut the stalk in specific places and manually remove the leaves. However, there are a number of benefits to this practice and with the correct incentives, this could become more feasible, increasing its uptake in the industry.

What is needed to promote greencane harvesting?

- **Buy-in/support from mills:**
  - Farmers are paid for the sugar potential of the cane delivery. Greencane harvesting increases harvesting and transport costs, and if no adjustment is made to purchasing arrangements, there is no net benefit to farmers.
  - If the mill is able to use the excess fibre for net benefit (i.e. electricity production etc.) this benefit needs to flow back through the value chain to the farmers.
- **Incentives and support:**
  - Farmers are assisted in the purchase and operation of biogas and/or electricity generation technologies to utilise harvesting residues at farm level.
  - Support is provided to farmers around the benefits of greencane harvesting.

What are the advantages of greencane harvesting?

- Reduction in GHG emissions
- Reduction in air pollution
- Residues can be used as a trash blanked to improve soil health
- Residues can be used for biogas or electricity generation at farm

Figure 9 Overview of greencane harvesting challenges and opportunities

Principle 11: Use of Technology, Inputs and Management of Waste

The RSB criteria and minimum requirements under this Principle are inconsistently covered by SUSFARMS. The system is very strong with regards to the implementation and maintenance of good practices for the storage, handling, use and disposal of fertilisers and chemicals, and the management of waste and residues. The implementation of these measures is supported by a strong regulatory framework and in addition, the sugar industry has developed its own governance mechanisms around pest, disease and variety control[24]. While the uptake of, and compliance with, these measures is generally high amongst large-scale and commercial growers, there is a risk of non-compliance amongst SSGs who lack access to sufficient infrastructure and equipment to fully implement these measures.

Key areas under this Principle for which there is no/weak SUSFARMS equivalent are centered around Criteria 11a, 11b and 11c. However, the use of technologies and other inputs (such as micro-

[24] See: The Sugar Act, 9 of 1978 and the Sugar Industry Agreement, 2000

organisms) is strongly controlled and regulated within the industry. The SASRI plays an integral role in the development and dissemination of technologies and knowledge in various areas relevant to sugarcane farming including variety improvement, crop protection, crop performance and management, and system design and optimization. SASRI has been conducting research on GM sugarcane since the 1990s, and although no GM-sugarcane is currently being grown at commercial scale, SASRI has been given the green light to proceed along a commercial track for GM-sugarcane. The release and deployment of GM-varietals is governed by strict legislation and this is generally well enforced in South Africa.

With regards to Principle 11d (good practices for the storage, handling, use and disposal of biofuels, fertilisers and chemicals), although generally well covered by SUSFARMS, there is gap concerning prohibited chemicals. According to the RSB standard, none of the chemicals recorded in the WHO's 1a and 1b lists can be used, and all substances listed in Annex III of the Rotterdam Convention, in the Stockholm Convention on Persistent Organic Pollutants (POPS), and the Montreal Protocol on Substances that Deplete the Ozone Layer must be listed and a plan to phase out the use of these within three years should be in place. Although SUSFARMS contains equivalent measures with regards the storage, application and handling of chemicals, the list of prohibited chemicals is not as extensive as the RSB requirements[25].

Besides from the discrepancy around the allowed chemicals for pest management, in other respects, the current legal requirements and good management practices around Integrated Pest Management (IPM) are closely aligned with the RSB requirements. South Africa has strict legal requirements around IPM, supported by industry specific governance and standards[24,26]. SUSFARMS also provides comprehensive good practice guidelines that are closely aligned with the RSB criteria in this regard.

Through a combination of the SUSFARMS measures, SASRI support and other industry initiatives, farmers are generally well supported in terms of this Principle, although there are some compliance gaps expected.

Principle 12: Land Rights

Land rights and ownership is a highly contentious issue in South Africa. The current socio-political climate and uncertainty around constitutional land reform, combined with historical inequalities in land distribution and ownership, poses a number of potential compliance issues around this Principle.

In terms of land rights, although large- and commercial scale growers will typically hold all relevant title deeds to the land currently under cultivation, large areas of this land falls under formal land claims[27]. Currently, there are many statutory instruments that regulate the expropriation of property by the state[28]. However, in 2018 following a public-participation process, parliament resolved that in a bid to expediate land reform, the Constitution should be amended to expressly allow for expropriation without compensation. Although the proposed "Expropriation Bill" has not been signed into effect, it has raised the profile of land claims and has been the subject of heated debate. Large areas of commercial sugarcane land – including mills – currently fall under "legitimate dispute", and it is uncertain as to how these claims will be managed under the new Bill, placing pressure on land rights.

In addition to this, there are various land tenure arrangements in the sugarcane farming industry in South Africa, not all of which are equally conducive to certification under this Principle. Whilst large and commercial farmers typically hold title deeds to their land, the majority of SSG occupy "Communal

[25] The SUSFARMS system explicitly prohibits the use of agricultural remedies containing the following in terms of the *Fertilisers, Farm Feeds and Agricultural Stock Remedies Act 36 of 1947*: 2,4-D (dimethylamine salt), 2,4-DB (sodium salt), dicamba (dimethylamine salt), any other salts or esters of 2,4-D (except APM salt), Monocrotophos, Chlordane, Lindane (gamma – BHC). For farms in KZN, the following additional restrictions apply: any agricultural remedy containing 2,4-D (isoactylesther), NCPA (potassium salt), MCPB (sodium salt), any salt or esters of triclopyr or salts of dicamba.
[26] Agricultural Pests Act 36 of 1993
[27] Land claims were introduced by the South African government to address historical inequalities in land ownership and restore land to people who were forcibly disposed of land in the past.
[28] For more information, refer to: https://www.grainsa.co.za/unpacking-the-various-forms-of-land-ownership

land". Communal land refers to the former homeland areas, covering ~13% of South Africa. This land is owned by government but managed through a tribal authority. Tenure on communal land is typically characterised by a "permission to occupy" document. This document, although common in former homeland areas, does not currently hold any legal status. Furthermore, this permission can be revoked by the relevant authority, and does not equate to land ownership (although it is frequently interpreted as such).

4.3. Summary of Findings

An overview of the findings from the gap analysis combined with the RSB/SUSFARMS benchmark is shown below. Each RSB Principle is evaluated within the local context using the "traffic light" system to provide an indication of 1.) how well each Principle is covered by SUSFARMS, and 2.) the level of compliance of farms engaging with SUSFARMS to each RSB Principle, taking into account compliance with relevant SUSFARMS measures in additional to current industry standards and other regulatory requirements.

Table 2 Gap analysis results for South African cane farms actively engaging with SUSFARMS

RSB Principle	Covered by SUSFARMS?	Level of Compliance		Summary of Gaps
		Large Scale	SSGs	
	No	Low		
	Partially	Medium		
	Mostly	High		
1. Legality				• Possible constraints in internal administrative structures at farm level for SSGs and lack of awareness around certain legal requirements.
2. Planning, monitoring & continuous improvement				• Established large/commercial farms unlikely to have undertaken an impact assessment at time of establishment. • Greenfield expansion by small-scale growers might not be supported by impact assessment.
3. Greenhouse Gas Emissions				• Currently no national GHG reporting requirements exist for agriculture.
4. Human & Labour Rights				• Possible gaps for SSGs in terms of occupational health and safety structures and equipment.
5. Rural & Social Development			N/A	• Use of migrant labour is relatively high. It is important to ensure that all preferential procurement processes are in place and labour laws strictly enforced to promote local labour.
6. Local Food Security				• South Africa has "moderate" level of hunger on the GHI. However, sugarcane approved as an ethanol feedstock in the Biofuels Industrial Strategy of South Africa and is currently produced in surplus in the country.
7. Conservation				• Poaching game and fish prevalent throughout the industry.
8. Soil				• Possible limitations in capabilities of SSGs to fully implement all requirements under this Principle.
9. Water				• South Africa is water-scarce and water management in cane growing areas is generally good and no major gaps are anticipated.
10. Air Quality				• High prevalence of burning across the industry.

11. Use of Technology, Inputs & Management of Waste				• Possible limitations in capabilities of SSGs to fully implement all requirements under this Principle. • RSB restricted agro-chemicals are more extensive than national prohibitions.
12. Land Rights				• Large areas of commercial land under formal land claims • Communal land tenure “Permission to occupy” does not hold legal status

5. Conclusions and Recommendations

When considering sugarcane production in South Africa, it is important to be cognisant of the operations of large-scale and commercial growers, and SSGs. While there is a strong overlap between these growers in terms of legislative requirements and industry best practice, there are several key differences that need to be considered. Differences exist in the respective capabilities of growers, most notably in terms of access to capital and internal administrative structures at farm level. While large-scale and commercial growers are generally similar, SSGs typically have reduced capabilities in this regard. The implication of this lies in how different farm-level practices are undertaken and how these should be interpreted and audited against the RSB framework or similar certification schemes. RSB accommodates this discrepancy in relative capabilities by providing a separate Smallholder Standard[29], which enables small-scale farmers (feedstock producers whose total land does not exceed 75 ha) to access RSB-certified supply chains. The key difference in the Smallholder Standard is that it covers group certification and introduces a stepwise approach, which allows the group to become fully compliant with the RSB standard within 2 years after the initial audit.

In general, sustainable sugarcane production in South Africa is well supported by the SUSFARMS system, national legislation and industry requirements. The SUSFARMS system is relatively closely aligned with the RSB Principles and follows a similar approach in terms of promoting sustainability and best management in the local context. With the exception of Principle 3 (GHG emissions) and Principle 6 (Local Food Security) which are not covered by SUSFARMS, all other RSB Principles are supported by this system, albeit to different extents. While the statements of intent in SUSFARMS are mostly equivalent in concept to the RSB Principles, the two systems generally differ slightly in the detail of the measures (SUSFARMS) and criteria/minimum requirements (RSB). There is particularly strong overlap between the two systems in terms of the legality of operations: SUSFARM's inclusion of all relevant national regulations as measures is particularly valuable in supporting the legality requirements of the RSB Principles & Criteria.

The results of the gap analysis found that for farms actively engaging with SUSFARMS, uptake and implementation of the listed good management and legislative measures is generally high. Consequently, there are no major gaps anticipated for the RSB Principles that have a strong overlap with SUSFARMS. In particular, there were no major gaps identified for Principles 1 (Legality), 4 (Human and Labour Rights) and Principle 9 (Water). Although Principles 7 (Conservation), 8 (Soil) and 10 (Air Quality) are well covered by SUSFARMS, not all aspects of these are consistently enforced at farm level, and hence there could be gaps with regards to how certain operations are undertaken. For Principles 2 (Planning, Monitoring and Continuous Improvement), 5 (Rural and Social Development), 11 (Technology, Inputs and Management of Waste), and 12 (Land Rights), there are gaps both in SUSFARM coverage and farm level practice. Although Principle 6 (Local Food Security) is not covered by SUSFARMS, there are no major gaps anticipated for farm level operations. Despite South Africa's classification as having a "moderate" level of hunger on the GHI, sugarcane has been approved as a feedstock for ethanol in the Biofuels Industrial Strategy of South Africa. Furthermore, due to the current surplus of sugar, the industry is actively investigating diversification strategies. The use of surplus cane for biofuel/biomaterial production therefore reduces the risk of greenfield expansion to meet this demand. Principle 3 (GHG Emissions) is also not covered by SUSFARMS. Although there are currently no national GHG reporting requirements for agriculture, the lack of industry requirements for, and farm-level experience with, GHG reporting could hinder farmers supplying biomass into RSB certified supply chains who need to report emissions.

The RSB standards are structured to ensure regional relevance, and with SUSFARMS specifically designed for the South African sugar industry, engagement with SUSFARMS provides a good indication of what construes good management in the local context. Therefore, in terms of "certification readiness", farmers actively engaging with the SUSFARMS system are advantageously positioned.

[29] Standard for Certification of Smallholder Groups (RSB-STD-03-002) and RSB Principles & Criteria for Smallholder Groups (RSB-STD-03-001)

Large-scale and commercial growers have a particular advantage over SSGs due to their respective capabilities as well as the frequency of checks and inspections from government and other regulatory bodies, which promotes compliance with key legislative requirements. Given the scope of the gap analysis, the focus of this research was placed on farms actively engaging with the SUSFARMS initiative. Currently, these farms are all large-scale operations. However, the contribution of SSGs to the industry is notable and given the RSB small-holder standard which allows for step-wise compliance, with the support of industry, these farms could form part of a RSB certified supply chain. Given the good overlap between SUSFARMS and the RSB Principles & Criteria, it is recommended that the industry provide support to SSGs to engage with and implement the SUSFARMS measures. This would provide a good foundation for SSGs to engage with RSB and implement, over the allowed time period, the additional measures that are required to achieve RSB certification.

It should be noted that as SUSFARMS is a management system rather than a standard, farms that are engaging with this system are not subject to audits and cannot prove compliance to the SUSFARMS measures through a formal certification procedure. Therefore, although there is a strong overlap between the RSB Principle and Criteria and the SUSFARMS system, all RSB requirements would have to be verified during an independent audit.

The results in this study were based on generic farms participating in the SUSFARMS initiative. As the development of RSB certified sugar supply chains in South Africa is still in the exploratory stage, the principle objective of this exercise was to gain a high level understanding of the “certification readiness” of the industry and identify areas of weakness where current practices do not comply with the RSB requirements and hence pose challenges to certification. It is recommended that if certification of a specific sugar supply chain is pursued, this exercise be repeated on the specific farm/supply chain included in the certification scope.

6. Appendix A

Table A. 1 Independent biofuel sustainability framework used in the RSB/SUSFARMS benchmark

Principle	Characteristic	Summary	Detail
Economic Principle 1 - Profitability	*E.1.a*	*Sufficient ROI*	The Return on Investment (ROI) achieved is at a level that meets the requirements of the business owner(s) given the risks associated with producing biofuel feedstocks
	E.1.b	*Sufficient Working Capital*	The cash-flow/working-capital position of the business is at a level that support current and planned business expenditure.
Economic Principle 2 - Resource Use Efficiency	*E.2.a*	*Efficient Energy-use*	Direct energy use is optimized and cost-effective.
	E.2.b	*Optimized Fertiliser use*	Fertiliser use is optimized and cost-effective
	E.2.c	*Optimized Agrochemical use*	Agrochemicals use is optimized and cost-effective
	E.2.d	*Optimized Water - use*	Water use is optimized and cost effective
	E.2.e	*Productive Workforce*	The use of the feedstock production business's workforce is optimized and cost-effective
Economic Principle 3 - Financial Reserves	*E.3.a*	*Sufficient Financial Reserves*	The feedstock production business has sufficient financial reserves to protect it from unforeseen and/or lengthy disruptions to its operations and/or market-access.
	E.3.b	*Access to Investment Capital*	The farm has the financial means to make the investments necessary to sustain its productivity and output.
Economic Principle 4 - Productive Potential	*E.4.a*	*Long term Suitability of Site*	Feedstock production sites are selected on the basis that they are inherently suited to long-term viable feedstock production and on the basis that their development incurs the lowest social and environmental costs
	E.4.b	*Optimized Crop Potential*	The specific plant material is selected such that the long-term productivity and viability of the feedstock production business is maximized.
Social Principle 1 - Required Inputs from Society	*S.1.a*	*Required Human Resources*	The feedstock production business has sufficient access to the quality and quantity of human resources (both management and labour) that it requires to operate successfully.
	S.1.b	*Required Know-how/Technology*	The business has sufficient access to the technology and technical know-how that it requires to operate successfully.
	S.1.c	*Viable Markets*	The business has sufficient access to viable markets (of a size and financial performance to support the business's economic viability).
	S.1.d	*Supply-Chain Compliance*	The behaviours and practices of the business operations in the up-stream and down-stream supply-chain (for example, their labour management, resource use and management of their environmental & social impacts) enhance (pose no risk to) the feedstock production business's ongoing economic viability.
	S.1.e	*Enabling Institutions & Governance*	The institutional and governance arrangements* within which the business operates are sufficiently enabling and supportive of the achievement of sustainable feedstock production at the level of the sector/industry and the individual feedstock production business. * including the policies, laws, conventions and codes of practice adopted by the industry and the institutions and mechanisms that promote and enforce their adoption.
Social Principle 2 - Outputs & Impacts on Society	*S.2.a*	*Ethical Conditions of Employment*	The conditions of employment for all employees (permanent and temporary) meet the highest standards of fair and ethical employment.
	S.2.b	*Human Rights Respected*	The fundamental human rights of all employees are acknowledged and respected.
	S.2.c	*Required Health & Safety*	The Health & Safety of all employees engaged in any activity within the boundary of the feedstock production business is protected at all times.

	S.2.d	*Skill Development*	The knowledge, expertise and skills of employees are developed in line with the needs of the business and to grow the socio-economic potential of each individual employee.
	S.2.e	*Quality & Low embodied GHG feedstock*	The bioenergy feedstock produced meets the quality & technical requirements of customers and enables the manufacture of biofuels with significantly reduced lifecycle GHG emissions as compared to fossil-fuels.
	S.2.f	*Fair Wages*	Wages are at a level that, at a minimum, contribute meaningfully to the socio-economic development of workers and their communities.
	S.2.g	*Community Contributor*	The business enjoys a transparent, constructive and positive relationship with the local community and contributes positively to the local community's social stability & economic well-being.
	S.2.h	*Regulatory Compliance*	The business is up-to-date and compliant with all relevant conventions, legislation and regulations governing bioenergy feedstock production in the region as well as any certification & standards schemes required by the industry and/or markets.
	S.2.i	*Environmental Externalities & Food Security Managed*	The business and the collective efforts of the industry contribute to sustaining the environmental resources shared with the local community and to protecting food security in the region.
	S.2.j	*Ethical business Practices*	The business works against all forms of corruption or practices that undermine healthy and fair market functioning.
Environmental Principle 1 - Protecting Environmental "Sinks"	*P.1.a*	*Minimized Contamination*	The risk to the environment related to the storage and use/application of agro-chemicals, fertilisers, fuel and any ingredients used in biofuel production is minimized.
	P.1.b	*Water Quality Protected*	Risks to water quality related to run-off, leaching and any wastewater from biofuel production facilities, dwellings or any other infrastructure on the feedstock production site, are minimized.
	P.1.c	*Soil Degradation Minimized*	The degradation of soils through erosion and/or compaction and/or water-logging and/or salinization is minimized.
	P.1.d	*Land-use Change Curtailed*	The conversion of natural forest and other areas of high conservation values for bioenergy feedstock production is curtailed
	P.1.e	*Fossil-fuel independence - Energy*	The dependence of feedstock production on fossil-fuel based energy is decreasing (the use of renewable energy is increasing).
	P.1.f	*Fossil-fuel independence - Fertilisers*	The dependence of feedstock production on inorganic fertilisers is decreasing (reliance on the ecosystem's natural nutrient cycling & supply capability to meet its crop-nutrition needs is increasing)
	P.1.g	*Fossil-fuel independence - Agrochemicals*	The dependence of feedstock production on agro-chemicals is decreasing (reliance on the ecosystem's natural pest & disease suppression capability is increasing).
	P.1.h	*Waste Impacts Minimized*	The wastes generated in feedstock production, processing and/or biofuel production do not cause damage to the physical, chemical or biological conditions of the site's soils, water or air.
	P.1.i	*Emissions & GHG's Minimized*	Emissions-to-air (pollutants) and Greenhouse Gas Emissions related to bioenergy feedstock production and on-site operations are minimized.
	P.1.j	*Alien Invasive Plants Controlled*	The risk of negative environmental impacts associated with the occurrence and spread of invasive plant species is minimized.
Environmental Principle 2 - Protecting Environmental Sources	*P.2.a*	*Soil Health*	The diversity of soil fauna and flora (soil-food-webs) associated with biologically healthy soils is being restored and/or conserved.
	P.2.b	*Sustainable Water Resources*	The withdrawal of Water for irrigation and other on-site uses is within the sustainable capacity of the hydrological system (above and below ground)
	P.2.c	*Aquatic System Health*	Watercourses, riparian area and/or wetlands arising on or passing through the feedstock production site are being conserved and/or restored
	P.2.d	*Native Ecosystem functioning is Conserved*	The ecological structure and functioning of healthy native ecosystems are being conserved and/or restored across the site and the broader landscape.
	P.2.e	*Species Diversity*	Natural species diversity and fauna and flora species of special ecological value (such as keystone species, endangered or endemic species) are being restored and/or conserved.