

Sustainability Measurement of the American Sugarcane Industry



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Abstract

The heart of the United States sugarcane industry spans across Louisiana and Florida, contributing significantly to state economies and impacting local social and environmental issues. With increasing market demands from consumers and NGOs for sustainably sourced products and ingredients, consumer packaged goods companies are seeking a way to measure sustainability of American-grown sugarcane. At the same time, state-level sugarcane industries want to improve their ability to highlight positive initiatives across the farm, mill, and refinery levels.

This paper chronicles a year-long capstone project at the University of Michigan School of Environment and Sustainability, in which three students facilitated collaboration between Kellogg Company and key players in the Louisiana sugarcane industry to pilot a sustainability measurement tool for sugarcane cultivation. The background research explores the key social and environmental issues in sugarcane production, mechanisms for sustainability measurement (including certifications and audits, as well as regulation), and opportunities for collaboration among stakeholders. Next, it details the process and challenges of creating, implementing, and analyzing a sustainability survey and proposes a path forward in measuring sugarcane's social and environmental impact from the buyer and supplier levels. The scope of this research is centered around Louisiana production due to the willingness to collaborate by industry stakeholders in the state, but the survey could be adapted and replicated for Florida should its industry desire to do so.

Introduction and Background

Sugarcane is a tall perennial grass that thrives in tropical and semitropical climates.¹ In the United States, it has traditionally been grown in Florida, Louisiana, Hawaii, and, to a very limited extent, Texas. However, production has recently halted in Hawaii due to rising labor costs and inability to match demands and quotas without advanced mechanization.² Annually, around 900 thousand acres of sugarcane are harvested in the US, representing about 45% of total domestic sugar production.³ In 2016, 32.5 million tons of sugarcane were produced, with Florida producing approximately 17.6 million tons and Louisiana producing approximately 12.5 million tons.⁴ Similar to other agriculture commodities, the US sugarcane industry has consolidated over the years, decreasing the total amount of farms but increasing the average area harvested per farm.⁵ According to the 2007 Census of Agriculture, sugarcane farms have decreased from 952 to 692, while average area harvested per farm rose from 1,027 to 1,224 acres.⁶ The scale and size of operations vary from state to state, with Florida having fewer but larger-sized farms, while Louisiana has a higher volume of smaller-sized farms. Furthermore, the number of sugar mills

¹ Sugarcane. Retrieved April 27, 2017, from <http://www.agmrc.org/commodities-products/grains-oilseeds/sugarcane/>

² Solomon, M. (2016, December 17). The Final Days Of Hawaiian Sugar. Retrieved April 24, 2017, from <http://www.npr.org/sections/thesalt/2016/12/17/505861855/the-final-days-of-hawaiian-sugar>

³ Total area of sugar cane harvested in the U.S. from 2000 to 2015. Retrieved April 22, 2017, from <https://www.statista.com/statistics/191938/total-area-of-sugarcane-harvested-in-the-us-from-2000/>

⁴ Sugar cane production in the U.S. from 2010 to 2016, by state. Retrieved April 22, 2017, from <https://www.statista.com/statistics/191975/sugarcane-production-in-the-us-by-state/>

⁵ U.S Sugar Production. The United States Department of Agriculture Economic Research Service. Retrieved April 26, 2017, from <https://www.ers.usda.gov/topics/crops/sugar-sweeteners/background/>

⁶ Huntrods, D. Sugarcane Profile. Retrieved April 26, 2017, from <http://www.agmrc.org/commodities-products/grains-oilseeds/sugarcane-profile/>

and refineries has also decreased, mostly due to improved efficiencies. In 2005, there were 21 sugarcane mills dispersed throughout the US with a combined daily milling capacity of 293,930 tons.⁷ However, at least three mills have closed since then, both in Louisiana and Hawaii. Additionally, only eight sugar refineries remain, a drop from the 1980s when there were more than 20 in operation.⁸

In Louisiana, sugarcane is deeply entrenched in the local community and culture. It remains a vital part of the economy with a more than 200-year history and is the state's leading agricultural commodity. More than 400,000 acres of sugarcane are harvested annually on nearly 500 farms throughout 23 of 64 parishes, generating over \$2 billion each year and providing an average of 38% of total US sugarcane production.⁹ In 2007, the market value for Louisiana raw sugar and molasses (a byproduct of sugarcane harvesting) was \$666.9 million, more than twice the value of other leading agricultural products such as cotton (\$224.5 million) and rice (\$298.6 million).¹⁰ Furthermore, through new efficiencies and technology, average yields per acre have increased 10% from 2006-2008, as well as average sugar recovery.¹¹ Since family farms dominate Louisiana agriculture, it is estimated that there are more than 2,200 workers in the state's sugarcane industry.¹² In 2011, Louisiana Sugar Refining (LSR) was formed, representing the largest single investment in the US sugarcane industry in 40 years.¹³ LSR is a joint venture between Cargill and a cooperative of sugarcane producers, encompassing 700 sugarcane growers and eight mills.¹⁴ The refinery has the capacity to refine two billion pounds of white sugar annually and employs more than 180 local residents, amassing more than \$15 million in payroll and benefits.¹⁵

Through supportive US sugar policies and Americans' taste for sugar (a typical American consumes 66 pounds of refined sugar per year),¹⁶ the sugar industry is poised for continued high-scale production. However, with increasing fuel and nitrogen fertilizer costs, as well as irregular weather events, production must be managed effectively to remain profitable. For example, sugarcane production costs in Louisiana increased from \$447 per acre in 2005 to \$615 per acre in 2008, mostly due to increased diesel and nitrogen expenses.¹⁷ Although the US climate and positioning north of the equator leads to shorter growing seasons than in other sugarcane producing countries and despite the increasing likelihood of extreme weather events sugarcane yields have gradually increased in recent years due to new varieties, improved harvesting technologies, and use of agro-economic techniques such as cover crops.¹⁸

⁷ Huntrods.

⁸ Huntrods.

⁹ Gravois, K. (2011). Sugarcane Environmental Best Management Practices. Louisiana State University . Retrieved April 27, 2017, from http://www.lsuagcenter.com/NR/rdonlyres/27AA7189-F3AC-4FEA-A51D-E5D8E2B16505/82493/pub2833_SugarcaneBMP.pdf

¹⁰ Benedict, L. (2008, July 8). Economics of sugarcane production: What does it take for this industry to survive? Louisiana State University. Retrieved April 26, 2017, from <http://www.lsuagcenter.com/portals/communications/publications/agmag/archive/2008/spring/economics-of-sugarcane-production-what-does-it-take-for-this-industry-to-survive>

¹¹ Benedict.

¹² The Economic Importance of Sugar Industry to U.S Economy- Jobs and Revenues. (2011, August). Retrieved April 25, 2017, from <https://sugaralliance.org/wp-content/uploads/2015/08/LMC-Jobs-2011.pdf>

¹³ About LSR. Retrieved April 26, 2017, from <http://www.lsrugar.com/about.php>.

¹⁴ Huntrods.

¹⁵ About LSR.

¹⁶ Huntrods.

¹⁷ Benedict.

¹⁸ U.S Sugar Production.

Project Beginnings: Meetings with Louisiana Sugarcane Industry

On February 27, 2017, members of our team met in Thibodaux, LA with representatives of LSR, Lafourche Sugar (a local mill), Cargill, and a local sugarcane grower. We toured a sugarcane farm, the Lafourche Sugar mill, and learned from our hosts about the Louisiana sugarcane industry and current efforts to increase sustainable practices throughout the cultivation and refining processes. Specific sustainability initiatives undertaken by LSR include efforts to limit greenhouse gas emissions, manage water discharge, reduce energy use in production and transportation, contribute refinery byproducts to agriculture reuse, and support grower livelihoods by integrating them into the economics of the industry through the LSR joint venture.

The industry representatives expressed their desire to build stronger relationships with customers like Kellogg by employing an assessment mechanism that will promote their responsible practices and satisfy customer needs. We also discussed their frustration that no adequate platform or survey exists to satisfy all parties' needs and that has been agreed upon by the US sugarcane industry and its customers. Representatives from LSR believe a successful assessment tool would:¹⁹

- Be tailored to reflect the unique elements of US sugarcane production
- Help to tell the growers' story to consumers while not being administratively burdensome
- Provide commercial benefits for survey participants
- Incorporate a tiered system that reflects responsible efforts at the refinery and mill level in addition to farms
- Take into account that growers and mills will be largely unavailable to complete surveys during the harvest season (typically from September through December, depending on weather)

Sustainable Sourcing and Consumer Packaged Goods Companies

By 2017, most Consumer Packaged Goods (CPG) companies have adopted aspirational goals for sustainably sourcing ingredients and product components.²⁰ Likewise, with increasing public awareness and growing consumer preferences for sustainable products, companies across industries are experiencing new demands for responsible sourcing mechanisms. While CPG companies face growing scrutiny from customers, NGOs and the media in their sourcing practices, these pressures come to a head at the farm level for growers. Measuring social and environmental impact has proven to be an administrative burden for suppliers and producers alike.

The Network for Business Sustainability (NBS) synthesized data from 194 studies over 25 years to identify best practices for managing sustainable supply chains.²¹ Researchers identified four

¹⁹Nolan, Greg., Van Timmeren, Joel., Richard, Seth., Muenzmaier, Marty., Harrang, Brian. (2017, February 27). In-person interview.

²⁰ Grady, B. (2016, July 27). From Kellogg's to Unilever, a quiet revolution in sustainable farming. Retrieved April 27, 2017, from <https://www.greenbiz.com/article/kelloggs-unilever-quiet-revolution-sustainable-farming>

²¹ Brammer, S., Hojmosse, S., & Millington, A. (2009). Managing Sustainable Supply Chains. Retrieved April 27, 2017, from <http://www.nbs.net/wp-content/uploads/Supply-Chain-Report.pdf>

baseline practices occurring across industries: certification, strategic selection of suppliers, monitoring and auditing, and codes of conduct. However, un-negotiated expectations and codes of conduct can lack legitimacy with stakeholders; certification imposes substantial costs on suppliers; auditing can undermine trust in buyer-supplier relationships, as well as promote unethical practices; and lack of contract security undercuts suppliers' willingness to invest in sustainability. The plethora of supplier audit and certification mechanisms provides a useful starting place for sustainable sourcing, and the lack of a resource specific to sugarcane in the United States calls for a new solution. For supply chains in general, NBS proposes a more integrated approach to buyer-supplier collaboration on sustainability (see Figure 1).

Figure 1: Best Practices Framework for Sustainable Supply Chains²²



Sugarcane Social and Environmental Impacts

Key Environmental Issues

Agrochemical Use and Runoff

Pesticides and herbicides are commonly used during sugarcane cultivation and pose risks to local waterways and workers' health and safety. If the agrochemicals runoff to adjacent lands, they can pollute the water, putting aquatic species (especially endangered species) and neighboring communities in jeopardy. During the 1990s, agrochemical runoff was a major threat to the sugarcane industry but has since been alleviated due to continuous research and education. For

²² Ibid.

example, atrazine is a common herbicide that has historically damaged watersheds in Louisiana, resulting in its eventual restriction, as well as 2-4D, which caused damage by drifting to non-targeted areas.²³ Azinphos Methyl is another insecticide that was commonly used in the 1990s along the borders of sugarcane fields, which ran off into the bayous via rainfall, resulting in numerous fish mortalities.²⁴

As a result of research, education and public-private partnerships, several water runoff issues have been mitigated over the years in order to improve local watersheds. For example, the Louisiana Department of Agriculture partnered with Syngenta, a global agribusiness, to modify agrochemicals being used as well as application methods, such as optimal times to spray to prevent drift or runoff.²⁵ Moreover, after atrazine was detected in waterways, the manufacturer developed a voluntary monitoring program which established working relationships with stakeholders to better manage atrazine in source water, successfully solving the issue.²⁶ Furthermore, through extensive research from the Louisiana State University (LSU) Agricultural Center and Rohm and Hass Company, Tebufenozide was identified as a minimum risk alternative to toxic insecticides that were causing local fish and bird mortalities. Through their extensive evaluation, Tebufenozide was recognized as low concern for pesticide resistance as well as low risk for non-target or beneficial organisms within the sugarcane fields.²⁷ Following additional research and education, Tebufenozide was labeled under the trade name Confirm and was granted the Green Chemistry Challenge Award from the Environmental Protection Agency (EPA) in 1998. These examples highlight how through research, education, and extension initiatives, the sugarcane industry is engaged in providing tools and resources to solve some of the most pressing agrochemical and related watershed issues.

The Louisiana Department of Agriculture and Forestry is responsible for training and certifying pesticide applicators in the state, providing important education around safe application and storage. While there are no specific state-level regulations for pesticide use for sugarcane, the farms adhere to federal laws and always abide by package labels for both application and storage in order to minimize risks.²⁸

Water

Since sugarcane is a water-intensive crop, irrigation is important. However, the magnitude of irrigation is influenced by geographic location and climatic conditions. For example, farms in northern Louisiana require more irrigation than farms down south that are closer to the Gulf and thus experience more rainfall.²⁹ Growers in Louisiana utilize furrow irrigation, building trenches in between rows in order to move water efficiently, while preventing erosion and uncontrolled runoff. In most cases, irrigation water is pumped from surface water or from deep water wells with minimal impact on the aquifers due to plentiful rainfall.³⁰ As part of their sugarcane BMPs,

²³ Schexnayder, Harry. (2017, April 3). Phone interview.

²⁴ Schexnayder, Harry. (2017, April 3). Phone interview.

²⁵ Gravois, Kenneth. (2017, May 22). Phone interview.

²⁶ Gravois, Kenneth. (2017, June 2). Phone interview.

²⁷ Benedict, L. (2016). Search for a Narrow-range, Minimum-risk insecticide for Sugarcane Borer Control. Retrieved May 26, 2017, from <http://www.lsuagcenter.com/profiles/lbenedict/articles/page1476199679186>

²⁸ Davalos, Ricardo. (2017, April 20). Phone interview.

²⁹ Gravois, Kenneth. (2017, June 2). Phone interview.

³⁰ Gravois, Kenneth. (2017, June 2). Phone interview.

the LSU Agricultural Center recommends growers to test the quality of their irrigation water to ensure the appropriate salinity levels.³¹

In addition to irrigation, focus is also placed on drainage techniques to prevent water-bogged farms and runoff. Due to heavy rainfall, growers in Louisiana and Florida are provided with ample water for irrigation, but unpredictable weather events can lead to flooded fields and volatile harvests. One of the biggest threats is from tropical storm surges, as the salt water can inundate the crop, causing a buildup of sodium in the soil.³² To combat flooded farms and mitigate soil loss, growers can develop and implement water management plans, focusing on water use efficiency, reduction of runoff, appropriate drainage solutions, and groundcover crops during the fallow year.

Prescribed Burns

Burning of sugarcane fields before or after harvest is a common agricultural management tool used in both Louisiana and Florida. Through prescribed burns, leafy residue is removed, helping to keep the soil fertile, reduce the weight of cane for transportation to the mill, and improve efficiency of sugar recovery at the mill level. Additionally, burning helps control pest infestations.³³

While burning is an effective soil management technique, it can also face local opposition due to air quality concerns and community complaints of smoke and ash. A study in Southern Brazil assessing greenhouse gas emissions from sugarcane cultivation estimated the release of 241 kg of CO₂ per ton of sugar produced. The study showed that 44% of total emissions resulted from residue burning, 20% from synthetic fertilizers, and 18% from fossil fuel combustion.³⁴ Burning also releases soil carbon from soil organic matter, affecting future fertility.³⁵

While the EPA has regulations for air emissions, management of prescribed burns and air quality typically happens at the state level through a State Implementation Plan (SIP) and voluntary programs. For example, the Louisiana Department of Agriculture and Forestry and LSU Agricultural Center provide training and education for landowners to become certified prescribed burn applicators through their smoke management plan, a requirement for SIP. The trainings are focused on best practices as well as important safety measures to minimize risks to the landowner and local community. While these trainings are voluntary, participation is high among sugarcane growers due to both liability and insurance purposes. Additionally, the Louisiana Department of Agriculture and Forestry, LSU Agricultural Center and the American Sugar Cane League created the Louisiana Smoke Management Guidelines for Sugarcane Harvesting, which are promoted through the certification trainings and are the focal point of the

³¹ Gravois.

³² Gravois, Kenneth. (2017, June 2). Phone interview.

³³ Legendre, B. (2005). Prescribed Burns Help the Sugarcane Industry and Reduce Smoke and Ash Problems. Retrieved May 22, 2017, from http://www.lsuagcenter.com/topics/environment/conservation/burn_smoke/sugarcane/prescribed-burns-help-the-sugarcane-industry-and-reduce-smoke-and-ash-problems

³⁴ De Figueiredo, E. B., Panosso, A. R., Romão, R., & La Scala, N. (2010). Greenhouse gas emission associated with sugar production in southern Brazil. *Carbon balance and management*, 5(1), 3.

³⁵ Corradi, M. M., Panosso, A. R., Martins Filho, M. V., & La Scala Junior, N. (2013). Crop residues on short-term CO₂ emissions in sugarcane production areas. *Engenharia Agrícola*, 33(4), 699-708.

state's voluntary smoke and ash management program.³⁶ To date, these voluntary, state-managed programs have been successful as evidenced by a decrease in the number of complaints from neighboring communities, but there is always room for improvement.

Although burning is considered by sugarcane experts to be the most cost-efficient method to control post-harvest residue and manage the soil, some growers in Louisiana have adopted an alternative practice known as "sweeping."³⁷ Row sweeping occurs after harvest using a hay rake or street sweeper to sweep residue into the furrows between rows. While research on sweeping is limited, existing studies suggest that sweeping may be an adequate alternative to burning for farms that are more likely to create disruptions with prescribed burns, such as those in high density areas or near schools and hospitals.³⁸ A 2012 study from LSU AgCenter found that burn treatments, as compared to sweeping, were 10.9% and 9.0% more effective in increasing can and sugar yields, respectively.³⁹ The study found that sweeping, however, is more effective than burning in protecting against soil erosion and maintaining the integrity of field drainage systems, promoting optimal field conditions for sugarcane growth.⁴⁰ Burning and sweeping are comparable methods for management of weeds such as bermudagrass.⁴¹ Although burning remains a common practice among most sugarcane growers, officials in Louisiana report anecdotal accounts from growers that sweeping technique is effective in increasing soil organic matter (SOM) and is more cost efficient than burning.⁴²

Seasonal and Migrant Workers

Seasonal labor is utilized at both the farm and mill level, with temporary employees who work at various domestic and international farms and mills, depending on the harvest season. Reliance on temporary workers is mostly due to the fact that the US has a shorter harvesting season (three months), leaving little time to train new staff. Due to a revolving workforce, it is important to ensure worker rights and safety are applied to both permanent and seasonal workers.

Seasonal farm labor is fulfilled through the H-2A visa program, whereas mill employees, or non-agricultural workers, are provided through the H-2B program. The H-2B program puts the Louisiana sugarcane industry in a pinch because due to more efficient, but fewer mills, they need to start grinding the sugarcane earlier in September, as opposed to October.⁴³ However, the applicants for H-2B are not approved to work until October 1st, leaving a time gap in between when the season starts and employees are contracted. Furthermore, both visa programs are subject to new legislation, leaving a bit of uncertainty year after year.

Combustible Dust

³⁶ Louisiana Smoke Management Guidelines for Agriculture. Retrieved May 25, 2017, from <http://www.lsuagcenter.com/NR/rdonlyres/EC7D865A-9BA3-4C5A-9BCC-F800DF664A71/90040/pup3246louisianasmokemanagementguidelinesforagricu.pdf>

³⁷ Breaux, Joey. (2017, April 10). Phone interview.

³⁸ Arceneaux, A. E., & Selim, H. M. (2012) Mulch management strategies and sugarcane yield. *Journal American Society of Sugar Cane Technologists*, 32, 28-37.

³⁹ Ibid.

⁴⁰ Kornecki, T. S., & Fouss, J. L. (2011) Sugarcane residue management effects in reducing soil erosion from quarter drains in Southern Louisiana. *American Society of Agricultural and Biological Engineers*. 27(4), 597-603.

⁴¹ Dalley, C. D., Viator, R. P., & Richard Jr., E. P (2013). Integrated management of bermudagrass (*Cynodon dactylon*) in sugarcane. *Weed Science of America*. 61, 482-490.

⁴² Coreil, Chris. (2017, April 17). Phone interview.

⁴³ Gravois, Kenneth. (2017, June 2). Phone interview.

Sugar dust is very combustible, posing risks to workers at sugar refineries. After a large explosion at a sugar refinery in Georgia in 2008, the Occupational Safety and Health Administration (OSHA) strengthened its position on the hazard by implementing new requirements and standards to ensure compliance and safety of workers. As production continues to increase, it is crucial to minimize future risks.

Mechanization and Fuel Usage

Sugarcane farming is an equipment-intensive operation at the farm, mill and refinery level, using a variety of machinery at each stage. As planting and cultivation techniques have advanced and become more mechanized, harvesting combines are more commonly used at the farm level. Moreover, during harvest season, mills operate without pause for 3 months straight, relying mostly on natural gas to fuel their operations. The remaining months are reserved for repair and maintenance, another major energy demand. Due to the reliance on numerous machines and equipment, growers, millers and refiners need to ensure proper fuel storage and be cognizant of their greenhouse gas emissions. However, the increased use of equipment lends the opportunity to invest in energy efficiency measures as well as to create plans to reduce energy usage in other areas of operations, which are already in development throughout the industry. Not only will efficiencies improve the overall energy performance and footprint of the farm, mill and refinery, but it will reduce operational costs as well.

Sugar mills have indeed become more efficient over the years, which is evidenced by a decrease in the total number of mills but consistent, or increasing, sugarcane production.⁴⁴ Sugarcane mills around the globe, including all of the mills in Louisiana, are burning bagasse (pulpy fiber byproduct from the extraction process) in order to run their boilers, cutting down on natural gas use.⁴⁵ If mills have extra bagasse, they convert it into steam to cogenerate both electricity and heat, offering an opportunity to reduce their footprint through renewable energy production and offsets.⁴⁶ For example, three mills in Louisiana burn extra bagasse to produce electricity for their operations and a few mills in Texas even sell their excess electricity back into the electrical grid.⁴⁷

Best Management Practices for Louisiana Sugarcane

The LSU AgCenter offers Sugarcane Environmental Best Management Practices (BMPs) endorsed by the Louisiana Farm Bureau, Louisiana Department of Agriculture, and the United States Department of Agriculture's (USDA) Natural Resources Conservation Service.⁴⁸ The BMPs are intended to be used by producers to reduce agricultural pollutants in surface and groundwater, as well as to aid growers in soil nutrient management.

Nutrient Management

⁴⁴ Raw Sugar Factories. Retrieved May 27, 2017, from <http://www.amscl.org/factories>

⁴⁵ Gravois, Kenneth. (2017, June 2). Phone interview.

⁴⁶ Richardson, W. (2006). Biomass Energy Resources. Retrieved May 28, 2017, from <http://www.lsuagcenter.com/NR/rdonlyres/79EA5231-C815-433A-8031-BC84CAC423B8/32124/RIS102BiomassEnergy.pdf>

⁴⁷ Gravois, Kenneth. (2017, June 2). Phone interview.

⁴⁸ Gravois.

The guide highlights sediment runoff as the most important issue from an economic and environmental perspective, as nutrient-rich soil leaving the farm is a financial loss and environmental risk. Runoff of nitrogen and phosphorus impairs photosynthesis and alters oxygen availability for aquatic organisms (hypoxia). Losing nutrients from organic matter can have a negative impact for future yield.

The BMPs advocate for profitable farming businesses to be built around a soil fertility program, in which nutrients are applied in the correct amounts and forms at the optimal times. Moreover, the EPA and USDA encourage a voluntary approach to managing nonpoint-source issues, as in the case of agriculture. A grower-driven nutrient management plan includes an evaluation of nutrient needs, maps and field information, locating of critical areas, soil testing, determining nutrient need for each field, an inventory of supply, determining nutrient balance between supply and need, and preventative maintenance and periodic inspection. The LSU AgCenter offers growers support in developing a nutrient management plan.

Primary Conservation Practices

While the BMPs highlight all Natural Resources Conservation Service (NRCS) codes relevant to growing sugarcane in Louisiana, the two main conservation issues for sugarcane in Louisiana are reduced/minimum tillage and post-harvest residue management.⁴⁹ Fallow and seedbed management are discussed in detail under NRCS Code 329, as well as recommendations for burning practices under NRCS Code 344. In addition, the BMPs reference improved nutrient and yield outcomes by using field borders and filter strips, precision land forming, surface drainage, irrigation canals, corridors, and buffers. Finally, the BMPs highlight pesticide management best practices for application, selection, storage, and safety.

Some growers participate in the NRCS Environmental Quality Incentives Program (EQIP), which provides a financial incentive for implementing on-farm conservation practices.⁵⁰ This programs promote biodiversity and energy initiatives, soil health, and watershed protection, among other environmental solutions.

Methodology: Employing a Collaborative Approach

Theory of Collaborative Management

Collaboration can be defined as the pooling of tangible resources by multiple stakeholders to solve a set of problems that none can solve individually.⁵¹ As is the case with many issues involving multiple stakeholders, collaborative management was key to the success of this project. The impetus for a collaborative approach can arise from a variety of circumstances, including rising costs of the status quo, desires to overcome feelings of mistrust, and recognition

⁴⁹ Coreil, Chris. (2017, April 17). Phone interview.

⁵⁰ Environmental Quality Incentives Program. NRCS Louisiana. Retrieved June 8, 2017 from <https://www.nrcs.usda.gov/wps/portal/nrcs/main/la/programs/financial/eqip/>

⁵¹ Gray, B. (1985). Conditions Facilitating Interorganizational Collaboration. *Human Relations*, 38(10), 911 - 936. doi:10.1177/001872678503801001

that direct engagement is the most effective path forward to achieve successful outcomes.⁵² These conditions for collaboration were displayed during our visit to Louisiana.

Louisiana's sugarcane industry perceives an economic cost to the status quo, because the lack of a broadly recognized sustainability assessment strains relationships with customers and may fuel misperceptions about the US sugarcane industry.⁵³ Meanwhile, the industry is skeptical both of existing assessments that don't adequately reflect US sugarcane production, as well as past efforts by customers to develop new assessments, which have been perceived as disingenuous and only serving the needs of food companies.⁵⁴ Industry representatives understand the need to track the impact of sugarcane production, however. They expressed interest in engaging our team to create an assessment tool that would both support the sustainability needs of Kellogg and its peer companies, as well as the industry's desire to promote its efforts to advance sustainable practices.

With foundational elements for a collaboration in place, our team employed a collaborative management approach based on the teachings of Julia Wondolleck, professor of collaborative management at the University of Michigan. An effective collaborative approach emphasizes:⁵⁵

- Early engagement with stakeholders for ongoing and substantive involvement
- Inclusive decision-making that seeks consensus among stakeholders wherever possible
- Shared ownership of the process and its outcomes (i.e., the survey)

A successful implementation of collaborative management would establish a process by which Kellogg, its peer companies, and its suppliers can collectively respond and adapt to new issues related to sustainability reporting of US sugarcane production, in addition to achieving outcomes perceived as successful by all interested parties.

Project Objective Statement

Agreeing on an objective statement establishes shared goals and a common vision across stakeholders. We coordinated with Kellogg and LSR to establish a shared set of goals for the survey and six key principles for sustainable sugarcane production in the United States, based on the environmental and social challenges discussed in the previous section. Though the partners' goals may differ, this process seeks to develop compatible ways to achieve them.⁵⁶ See Appendix A for the complete objective statement.

⁵² Wondolleck, J. M., & Yaffee, S. L. (2000). *Making Collaboration Work: Lessons from Innovation in Natural Resource Management*. Washington, DC: Island Press.

⁵³ Nolan, Greg., Van Timmeren, Joel., Richard, Seth., Muenzmaier, Marty., Harrang, Brian. (2017, February 27). In-person interview.

⁵⁴ Nolan, Greg., Van Timmeren, Joel., Richard, Seth., Muenzmaier, Marty., Harrang, Brian. (2017, February 27). In-person interview.

⁵⁵ Wondolleck, J. M., & Yaffee, S. L.

⁵⁶ Wondolleck, J. M., & Yaffee, S. L.

Sustainable Agriculture Certification and Auditing

Metrics and Continuous Improvement Standards

Metrics are a useful provision for accountability, as they allow companies and suppliers to evaluate themselves based on particular qualifications that best represent their work. Sustainability standards and certifications have grown in popularity over the last three decades, and industry-specific multi-stakeholder initiatives have sought to measure continuous improvement on social and environmental impact.⁵⁷ Since the 1990s, certifying and audit organizations have emerged as “non-state governance systems... to certify mass-market trade in everything from soybeans to sugar, and biofuel to beef.”⁵⁸ Beginning with the creation of the Marine Stewardship Council – a collaboration between Unilever and the World Wildlife Fund (WWF)– organizations aim to show that “commodities can be produced at affordable costs with measurably reduced environmental impacts, and by creating a significant demand for such products, entire commodity markets can be moved towards greater sustainability.”⁵⁹ From the CPG company/buyer perspective, such tools are useful ways to demonstrate dedication to particular sustainability issues to the public and their stakeholders. From the supplier position, growers and cooperatives are reacting to demand from their customers – the CPG companies – for evidence of sustainability in production. In the global sugarcane industry, Bonsucro is at the forefront of certifying the commodity in the developing world, aiming to create incentives for better performance via standards for pesticide use, labor, and other social and environmental factors.⁶⁰

Academics and industry voices today debate the value of costly certifications vs. individualized metrics for improved traceability and capacity building. A 2010 study of 37 certifications for agriculture commodities, tourism enterprises, and fish and forest products found “very weak evidence for the hypothesis that sustainable certification has positive socioeconomic or environmental impacts.”⁶¹ WWF acknowledges the limitations of certifications, noting from its 2012 review:

- *Certification is driving social, environmental and economic improvements in specific commodity regions and targeted areas.* However, there is a clear lack of evidence of broader, longer-term improvements. To date, very few certification programs have standards that measure reduced impacts.
- *While there seemed to be tangential benefits from certification, it was hard to attribute positive outcomes directly to certification.* This means more data is required to quantify the benefits. Those that administer the certifications systems should do a better job of collecting such information, or the data should be generated as part of the overall certification process.

⁵⁷ Sneyd, Adam. "When governance gets going: Certifying 'better cotton' and 'better sugarcane'." *Development and Change* 45.2 (2014): 231-256.

⁵⁸ Ibid.

⁵⁹ How WWF Wants to Transform Markets. (2012). World Wildlife Fund. Retrieved April 26, 2017, from http://wwf.panda.org/what_we_do/how_we_work/businesses/businesses/transforming_markets/

⁶⁰ Sneyd.

⁶¹ Blackman, A., & Rivera, J. E. (2010). The evidence base for environmental and socioeconomic impacts of 'sustainable' certification. *Environment for Development*. March 2010

- It's currently far too expensive for outsiders to evaluate the impacts of certification.
- *The indirect positive impacts of certifications may be far greater than the direct impacts.* With that in mind, these types of programs are most effective as complements to regulatory policies and private sector initiatives. Put simply, as standalone instruments, voluntary certification programs won't get us where we need to be as they tend to reward the best producers rather than motivate the worst. When designed and paired within the framework of effective government policies and land use planning, they can leverage the kind of change needed on the ground.⁶²

Recognizing these limitations, it is necessary for suppliers and buyers across the supply chain to collaborate on metrics schemes that deliver positive social and environmental outcomes. Both actors stand to benefit from alignment on metrics for continuous improvement compared to blanket certifications.

Benchmarking the Certification Landscape

In order to understand the current landscape of various certifications, assessments and standards, we benchmarked the following: Bonsucro, ProTerra, Kellogg Grower Survey, Field to Market, FieldPrint calculator, SAI Farm Sustainability Assessment (FSA), SASB, Unilever Sustainable Agriculture Code (SAC), Sedex Self-Assessment Questionnaire (SAQ), and Ceres. Specific attention was placed on guiding principles and main criteria in order to identify any common themes or trends. See Appendices A and B for the complete benchmarking chart of current certifications and surveys.

The benchmarking chart compares the criteria included in questionnaires for each survey or certification, distinguishing commonalities between the assessment tools. The criteria are organized according to the six principles of sustainability in US sugarcane production as defined in the project objective statement (Appendix A), and are color coded based on the frequency with which an individual criteria appears in multiple questionnaires.

Figure 2 illustrates the comprehensiveness of each certification or survey, based on the number of topics covered in the questionnaire. Although the number of topics may be a good indicator of comprehensiveness, it does not necessarily reflect overall quality. Some surveys – particularly the Field to Market Fieldprint Calculator – may ascertain the same depth of information with less breadth (example.g., asking for the location and organic matter content of soil vs. asking for details about soil management). As a jumping off point, the chart below benchmarks each survey's coverage of an issue against the principles for sugarcane sustainability for the purposes of this project.

⁶² Clay, J. (2012, December 14). A Hard Look at Sustainability Certifications. Retrieved April 27, 2017, from <https://www.worldwildlife.org/stories/a-hard-look-at-sustainability-certifications>

Figure 2: Comprehensiveness of Existing Certifications and Audits

	Bonsucro	ProTerra	Kellogg Grower Survey	Field to Market Supplement for FSA Equivalency	Field to Market Fieldprint Calculator	SAI/FSA	SASB	Unilever SAC	Sedex SAQ	Ceres
Principle I: Land	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Land Use	✓	✓	✗	✗	✗	✓	✗	✓	✗	✗
Promotion of Healthy Ecosystems	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
Soil Management	✓	✓	✓	✗	✓	✓	✗	✓	✓	✗
Crop Protection Products	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Planting Practices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗
Waste Management	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓
Principle II: Water	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water Use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Waste Water	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓
Principle III: Air	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prescribed Burns	✗	✓	✗	✗	✓	✗	✗	✓	✗	✗
Energy Use and Emissions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Principle IV: People	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
Workforce Management	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓
Fair Treatment of Employees	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓
Health and Safety	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
Promotion of Healthy Lifestyles	✓	✗	✓	✗	✗	✓	✗	✓	✓	✓
Principle V: Community	✓	✓	✓	✓	✗	✓	✗	✓	✓	✗
Principle VI: Livelihoods	✓	✓	✓	✓	✗	✓	✓	✓	✓	✗
Economic Viability	✗	✗	✓	✓	✗	✓	✗	✓	✓	✗
Production Outcomes	✓	✓	✓	✗	✗	✓	✓	✗	✓	✗
Long-term Investments	✓	✗	✓	✓	✗	✓	✗	✓	✗	✗

See Appendix B for descriptions of each certification and Appendix C for a more detailed benchmarking.

Common Trends

Throughout the 10 benchmarked tools, issues related to use of crop protection products and treatment of employees were most commonly highlighted. While each tool differed in the extent of topics covered, as well as best practices suggested, there was a consistent focus and depth on issues related to crop protection products, employee health and safety, workforce management and fair treatment of employees. Moreover, water use was consistently measured across surveys. Since each of the tools differed in scope, many of the questions were framed vaguely to be applicable to several agricultural commodities. Therefore, some tools focused on the more specific farm-level criteria, while others focus more on social and/or economic components. See Appendix C for a benchmarking of common trends.

State and Federal Regulations

Current state and federal regulations provide a strong baseline for many issues related to the treatment of workers and environmental impact from agriculture. Many criteria covered in surveys and certifications targeted at agriculture in developing nations already exist as federal regulations from the USDA, EPA, and OSHA. See Appendix D for a breakdown of relevant

federal and Louisiana federal regulations that apply to sugarcane production, as well as Appendix E for an overview of Louisiana voluntary resource management programs.

The final survey can be streamlined by consolidating common metrics that overlap with federal and state regulations. Rather than asking growers and refineries/mills about each criteria individually, the survey can simply verify compliance with the appropriate regulations.

Additionally, our team’s conversations with officials in the Louisiana Department of Agriculture and Forestry (LDAF) revealed potential criteria to promote best practices and continuous improvement that are not explicitly covered by regulations. For example, the LDAF and LSU AgCenter facilitate a certification program for prescribed burn managers. Though not required under state law, the certification program is widely used by sugarcane growers to learn best practices. Certificate holders are also protected under Louisiana state law, which provides the “presumption of nonnegligence.”⁶³

SGR Survey Creation

Background: Survey Development

Our team approached creating a successful pilot Sugarcane Growers Report (SGR) survey with a focus on both meeting the goals of the objective statement and satisfying stakeholder needs. Understanding these interests, we aimed to craft a survey that was concise yet comprehensive, used simple language, reflected production at the cultivation and refining/milling level, and established a clear framework for continuous improvement. This process resulted in two surveys – a mill/ refinery survey and a farm survey – that reflect the most common criteria and trends from the benchmarked surveys and certifications. The surveys also consolidates additional criteria that are most relevant to US sugarcane production while adding new elements that are specific to Louisiana sugarcane production and the objective statement’s principles. The survey avoids jargon, is written in simple language that is tailored for US production, and can be easily understood by third parties. Moreover, the process for creating the survey continued to rely on the collaborative management approach, including further consultation with partners in Louisiana and Kellogg’s peer companies to refine survey questions and essential survey elements.

Survey Development Process

After benchmarking the Bonsucro, ProTerra, Kellogg Grower Survey, Field to Market, FieldPrint calculator, SAI FSA, SASB, Unilever SAC, Sedex SAQ, and Ceres surveys (see Appendices B), our team solidified the six focus areas agreed upon by the parties in the Objective Statement (see Appendix A). Each topic area’s relationship to sugarcane cultivation (land, water, air, etc.) was researched and identified, utilizing the information from the “Sugarcane Social and Environmental Impacts” section of this document. Leveraging this knowledge, we generated questions based on indicators that assess adoption of best practices in

⁶³LA Rev Stat § 3:17 (2013).

the industry. The farm survey, for example, inquires about field burning before or after harvest as a way to assess both community and atmospheric impact. Additionally, we referenced the other industry surveys and our previous benchmarking to align our questions with other commonly used methods of assessing sustainability.

Review and Iteration

The first draft of the survey – completed in mid-July – was the foundation for an iterative process over the coming months. Our team liaised with Dr. Kenneth Gravois at the LSU AgCenter, Bill Costello at Cargill, Seth Richard at LSR, and Amy Braun and Mary Tate at Kellogg Company to ensure the survey was comprehensive and useful for all stakeholders. Moreover, we gained feedback from agriculture researchers at Michigan State University (Dr. Doug Bessette), Ohio State University (Dr. Robyn Wilson), and University of Michigan (Dr. Joe Arvai) with extensive experience in working with growers. Additionally, Dr. Gravois socialized the survey within his network of growers to ensure it was an appropriate length and struck a positive tone. Conscious of the possibility that the survey could be implemented industry-wide at some point, we also sought feedback from major players and thought leaders in the sugarcane sustainability space, including Coca-Cola and World Wildlife Fund. Following numerous discussions with these stakeholders, the survey was approved for implementation by LSR in December and a version was finalized in January as the Sugarcane Growers Report (SGR). See Appendices F and G for the complete farm and mill surveys (the mill survey was not implemented).

Implementation and Data Collection

For the inaugural SGR, we created an online survey using Qualtrics survey software for growers to use on a mobile or desktop device in order to collect data expediently from Michigan. Following extensive discussions with Cargill and LSR regarding the company's long-term sustainability strategy, Dr. Gravois at LSU generously agreed to be the point-person for distribution of the survey in Louisiana, and announced the initiative at the Louisiana Growers' Meeting on February 21. His reputability in the state's sugarcane industry was critical to the survey's success. Although the survey was distributed to sugarcane growers across the state – not only LSR members – the stakeholders agreed that this would still provide a representative sample for the supply chain. In total, 73 growers completed the survey online between February 21 and March 10.

Ultimately, the mill/refinery survey was not implemented due to a change in LSR's strategy for sustainability measurement. They may choose to add the mill/refinery survey in future years to assess holistic continuous improvement of the industry.

Data Analysis

For the pilot survey, which collected information about the 2017 harvest season, the intention was to collect baseline primary data that could be used to observe trends year over year in future iterations of the survey. After collecting survey responses for three weeks, we began to analyze the 73 responses. We first anonymized all the qualitative and quantitative data to protect the

identities of individual respondents, and began to identify any obvious trends or variability. From this exercise, we identified questions with the most variable responses, such as the existence of a nutrient management plan, crop insurance and alternative methods (row sweeping), which influenced our more granular investigation. We also identified categorical and numerical variables, such as acreage, employee count, permanent to seasonal worker ratio and risk preparedness, to compare across growers' responses.

In order to glean insights, the team downloaded raw data files from Qualtrics into Excel, where they were cleaned and coded, allowing us to seamlessly integrate quantitative and qualitative data. We accomplished this through coding answers into numerical categories in order to better compare across questions. For dichotomous answers, "No" was always coded as 0, with "Yes" appearing as a 1. We used a similar coding exercise for non-dichotomous responses.

Once the coding was complete, the team ran correlations between various variables to examine potential relationships. For example, we looked at the correlation between land size and nutrient management plan as well as the correlation between rowing practices and risk preparedness. For numerical answers, we calculated means, ranges and standard deviations. For questions with multiple options, we calculated the percentage breakdown for each response. All the analysis was completed in Excel without any support from additional software or platforms.

Survey Results

The inaugural SGR survey provided valuable insights into Louisiana sugarcane cultivation, creating a baseline for future analysis. Specifically, the survey offered a lens into land management, water management, air quality, people management, community development and grower livelihoods.

Across 73 respondents, the survey captured a total of 177,032 cane acres with an average of 2,425 acres per grower. Within that, the minimum cane acreage was 350 acres with a maximum of 10,200 acres, clearly providing a useful spread of smaller and larger-sized farms. Out of the 73 farms surveyed, one farm was women-owned, with 20 jointly-owned by men and women. The farms varied in location and district, providing a good geographic spread of all perceived issues and risks associated with different microclimates and locations.

The team gathered key insights related to grower-specific challenges, yield loss concerns, air quality and conservation methods. While 85% of growers said they felt at risk for various weather events, only 9% identified weather as the biggest challenge facing future generations. Instead, access to qualified and available labor, economic viability and land grabs/environmental conditions were the top challenges identified.

Flooding was a major contributor to yield loss (44%, with drought contributing 27% and severe wind 14%) and was directly connected to the most common water management strategy: drainage. While sugarcane burns can be a source of air emissions, the survey revealed that complaints from burns were very minimal. The survey also revealed that the most commonly used conservation practices (used by >90% of growers) were land forming/precision grading, pesticide management, and nutrient management (basic soil testing program).

Land Management

Sugarcane is often not the only crop cultivated on farms. 69.4% of sugarcane growers grew more than just sugarcane; 63.9% of sugarcane growers also grew soybeans, and 6.9% of farmers also grew wheat or raised crawfish (other crops included rice, corn, peanut hay, sweet potatoes and cotton). On average, growers used 80% of their land for growing sugarcane. While the average nitrogen rate applied in 2017 was 132.2 lbs/acre, the standard deviation of nitrogen application was 111.2 lbs/acre, indicating a substantial degree of variation in application rates by growers.

Only one grower expressed a direct concern about environmental impact due to climate change, but seven expressed concerns over changing weather and its impact on growing conditions. Of these growers, 80% had nutrient management practices (20% above the average) and 90% had Integrated Pest Management Plans (1% above the average). However, growers who expressed concerns over weather were 18.5% less likely to rotate pesticides and 9.7% less likely to have an enhanced nutrient management plan. Growers who expressed a concern over weather on average used 13 lbs/acre less fertilizer than their peers, a 9.9% reduction.

The survey revealed both good land management practices as well as highlighted areas for improvement. In terms of good practices, 89.1% of growers managed nutrients with a basic soil testing plan and 91.8% of growers practiced land forming and/or precision grading, which the NRCS highlighted as a best practice for improving nutrient and yield outcomes. Furthermore, 90.4% of growers managed pesticide use with drift control agents, rotations, precision application systems, or low-drift nozzles and 89.0% of growers used Integrated Pest Management.

Survey data identified nutrient management plans, crop insurance and additional tillage practices as areas for improvement. For example, only 60.3% of growers claimed to have a nutrient management plan consistent with best management practices from a credible institution and only 16.4% of growers used cover crops. Moreover, less than 50% of growers rotated crops, had an enhanced nutrient management plan or used reduced tillage practices, a leading conservation issue for sugarcane in Louisiana according to NRCS.

Water Management

Consistent with the typical rainfall patterns of Louisiana, 94.5% of growers used no irrigation last year and of those who did irrigate, the average size of acres irrigated was 28.5 acres. Of growers who irrigated, only 50% quality tested the water before irrigation. In future iterations of the survey, understanding if irrigation water is used from private wells or municipal sources would provide greater clarity as to the need to quality test water sources (municipal sources do not require quality testing).

On average, 85% of growers felt no threat to their water sources. 75% of growers included drainage in their water management plans, but less than 50% considered conservation or runoff prevention. Moreover, 53.5% of growers suffered some yield loss last year from damage caused by weather events, with flooding and drought being the biggest contributors (45% and 27%

respectively). 84.5% of growers considered themselves at risk from volatile weather events, and 73.4% of those growers felt prepared to address the risks.

Farm size had no bearing on the likelihood of yield loss due to flooding or drought, but the data showed that growers were more confident to address concerns of flooding than drought. There was a slight negative correlation between how often growers examined in-field drainage and whether the grower suffered yield loss. The data suggested that growers did not tend to examine their in-field drainage proactively, but instead only after some yield loss was expected. The existence or contents of a water management plan had no noticeable impact on yield loss. There was a slight negative correlation between the thoroughness of a water management plan and the existence of yield loss. These results raise questions as to what factors led growers to include certain components within their water management plan and if growers acted proactively or reactively to water management issues.

Air Quality

The other major conservation issue identified by the NRCS was post-harvest residue management, which has typically been managed by burning after harvest. 96% of growers conducted controlled agricultural burns last year, with 61% conducted them post-harvest and 37.5% pre and post-harvest. To note, no growers burned only before harvest. Growers who burned cane pre and post-harvest were 15% more likely to have a nutrient management plan than those who burned just after harvest. 99% of growers were certified as a prescribed burn manager by the local and/or state agency, highlighting a best practice for safe burns. For the grower not certified, he/she did notify the community in advance of any burns. Furthermore, only 2% of growers received complaints from the surrounding community after a burn, but they had also notified the community in advance of the burning.

Only 47% of growers practiced alternative methods, such as row sweeping. Farms larger than 2,000 acres were two times more likely to practice this method.

People

The average number of farm employees was 14, with a minimum of 2 and maximum of 50. On average, a farm's workforce was comprised of 53% seasonal workers and 47% permanent workers. For farms that felt more confident in being prepared to address risks, they had on average 19% more seasonal workers in their employee mix. For the 60 farms that considered themselves at risk for from volatile weather events (floods, droughts etc.), 73% said they felt prepared to address those risks.

In line with best practices, 97% of sugarcane farms provided personal protective equipment to workers and 74% of farms held health & safety trainings within the last year. Furthermore, 100% of the farms properly maintained equipment to minimize risks to employees and 88% of farms had a platform for employees to provide feedback. When asked about specific actions taken to promote a safe working environment, responses included additional training from LSU Ag Center, daily safety meetings, additional worker protection seminars and a no cellphone policy.

Livelihoods and Community

84.5% of sugarcane growers surveyed had crop insurance. For those growers with insurance, they felt 5% more prepared to address risks from volatile weather events. 100% of sugarcane farmers attended grower meetings, showcasing a great place for educational interventions. 95.6% of growers were satisfied with their current system for bookkeeping and 75.5% were able to acquire financing resources in the last year for farm operations or improvements.

When asked about challenges facing the industry, many farmers expressed concerns about the emerging generation's interest in agriculture. Furthermore, when asked about the biggest future challenge, 23% of growers said labor, 10.1% said weather, 24.6% said economics, 24.6% said land/environmental issues, 11.6% said the government/regulations/future of sugar policy and 12% said other. To note, other concerns included: public perception, loss of interest among next generation, and inefficient equipment. Moreover, land/environmental issues included environmental concerns (flooding, hurricanes etc.) as well as concerns over urban sprawl, subdivisions and land grabs, which constituted 65% of enviro/land responses.

Challenges

Survey and Question Efficacy

The survey development phase was a major work steam, ridden with challenges along the way. While we initially drafted questions though benchmarking several commodity crop surveys (as explained in the methodology section), we went through multiple iterations to ensure the language was simple and clear, the questions were appropriate and easy to answer, and the survey flowed in a logical but concise format.

To gain feedback on the survey and improve its efficacy, the team met with Consulting for Statistics, Computing and Analytics Research (CSCAR) department on University of Michigan's campus. Through our initial appointment with Shyamala Nagaraj, a CSCAR consultant, it became clear that our survey had limitations. First, the team had not formed a hypothesis before drafting the survey to guide the survey and provide a mechanism for analyzing the data (did it prove what we had initially considered or perceived?) However, it was challenging to form a hypothesis since the survey was intended to collect baseline data on several different metrics and variables in the form of a self-reporting survey. Thus, deriving a concise yet exhaustive hypothesis would have been challenging prior to analyzing the baseline data on current grower practices.

Moreover, Shyamala provided valuable insights on the actual verbiage and language used throughout the survey. Most importantly, we needed to remove additional verbose that could intimidate or confuse the growers. We also added leading context, such as "to the best of your knowledge" in order to lessen the pressure of not having complete and exact information on hand.

Additionally, CSCAR illuminated the importance of framing survey components as a question with specific time frames. For example, the survey originally asked: “What is your total irrigated water use in gallons per acre?”. This wasn’t nearly as effective as rephrasing it with a more specific ask such as: “Approximately how many acres were irrigated last year?” This minor stylistic tweak helped to keep our survey in a consistent format and made it more streamlined for the respondents. However, it prevented us from collecting completely precise and accurate data points. While exact numbers would have been ideal, we knew this would be a tedious process for participants (especially coupled with sensitivity of information, growers may not have wanted to disclose information) so we intended to make it as user friendly and painless as possible.

In addition to having appropriate language that was relatable to growers, it was also important to make the survey as succinct as possible. Farmers are constantly asked to complete various surveys, often leading to fatigue. Thus, we wanted to make the survey exhaustive but not too lengthy or time consuming, as this would lead to lower completion rates. Thus, we had to be conscious about how many questions we were asking and be comfortable to eliminate ones that were less of a priority. Furthermore, it became apparent that we should move the most important questions to the beginning to prevent fatigue, a common insight from the primacy effect.

Through whittling down the survey, the team eliminated a few questions which would have been valuable. For example, we removed a question about identifying the source of irrigation water. This would have been useful to understand what water sources they were using, as well as provide insight into an additional question regarding testing water quality. For example, if the growers used city water, then the city would conduct the testing, not themselves. During the iteration phase, we also shortened the questions to make them less daunting. Through this process, some questions lost their specificity. For example, when we asked what percentage of the farm was used for sugarcane, it wasn’t clear if this included fallow land or only tillable land.

To make the survey less daunting, we included “I Don’t Know” and “N/A” as an option for several questions. This allowed the growers to feel less pressured to choose a response if they were unsure or uncertain about. While this made the survey more realistic and allowed growers to feel more comfortable with their input, it created difficulties in the data analysis phase. Adding the third option made it difficult to accurately use a binary coding during analysis. Depending on the question, we would either treat “I don’t know” as a “No”, or discard the data points from the analysis.

Incomplete Data

While we went back and forth, the team decided to not make all survey questions mandatory. Since we were concerned about grower participation as a result of audit fatigue and potential hesitation regarding credibility from unknown students, we decided to err on the side of caution. Thus, the team decided to only make the most important questions mandatory, such as acreage and conservation practices. This resulted in blank responses sprinkled throughout the survey, clouding our eventual data analysis. In hindsight, we should have made more questions required, especially average nitrogen rate and employee size, as these are important metrics to collect year after year. Moreover, while we initially omitted it due to a sensitive nature, we should have asked about grower yields, as this would have been an interesting variable to analyze, especially

in relation to other practices to measure any correlation or impact. All in all, it was challenging to balance the reality of making the survey as simple and non-intimidating as possible, but also rigorous and exhaustive to make the analysis robust and impactful.

While our survey collected geographic data, it wasn't completely accurate. For example, Qualtrics automatically collected IP addresses. When we collected all the coordinates and mapped them out, there were a few that were appearing in Arkansas, Texas and Missouri. Thus, it wasn't the most precise data measurement tool. However, we purposefully did not directly ask for farm addresses as this information is sensitive and the survey was intended to be anonymous. Moving forward, the team will have to brainstorm methods to receive a more accurate geographic spread, perhaps leveraging GIS mapping.

Mill Buy-in

While the project was intended to highlight both the farm and mill activities, the team had difficulty gaining buy-in from the mills. This was mostly due to the fact that the mills are owned by the cooperative, not necessarily run and operated by many individual farmers. Additionally, we were able to coordinate the farmers survey via growers meetings, and since there isn't a similar gathering for mill operators, introducing and gaining credibility for the survey would have been arduous. In the future use of the survey, our team would prefer to include the mill portion since it provides a lens into the industrial side of sugarcane, with a big opportunity to understand energy usage and consumption. To do so, a path forward for engaging the mill operators is vital.

Bonsucro

While Bonsucro is the international standard for assessing and certifying sustainable sugarcane, it is not fully applicable in the United States as it is more geared towards the developing world. Specifically, Bonsucro offers a lens into the social component of sugarcane by ensuring proper labor standards are upheld. Due to stricter regulations in the US, the labor questions (especially around child labor and abuse) are often viewed as offensive by domestic growers.

Overall, Bonsucro is not widely accepted by the US sugarcane industry and is often look upon unfavorably. Most of this stems from the insensitive perceptions around labor, as well as the perception that Bonsucro is a tool that potentially puts growers in a bad light. It is also seen as a tedious and expensive audit that only makes their lives harder through additional costs without any incremental revenue increase. While we used Bonsucro in our benchmarking phase, we were fully aware of its flaws and limitations as well as stigma from growers, and thus did not want our project to be fully associated with the accreditation platform.

Due to this, the team is still uncertain where the survey will live beyond the pilot phase. While Bonsucro was initially identified as a possibility to help ensure widespread use and recognition, due to its inconsistencies and reputation among American growers, we concluded that it may not be the most ideal platform. The question still remains as to where the survey will be housed once we pass on ownership at the end of spring 2018.

Losing Momentum with Key Stakeholders

Despite our early success with earning the trust of stakeholders and creating the survey through a collaborative management process, our team faced many roadblocks managing the relationships with key stakeholders over the course of the project. As a result, our influence with stakeholders diminished, making it difficult to pursue our goal of developing an industry-wide measurement tool.

After investing much of our focus early in the project on establishing alliances with our partners, staffing changes at both LSR and Cargill created inconsistency in our relationships. In April 2017, our senior contact at LSR took a new position within the organization and was unable to continue on our project. Several months later, in September 2017, our partner contact at Cargill was also promoted into a new role within his company and no longer worked on our project. Both contacts made handoffs for the project to others within their organizations, but the transition periods slowed our progress and stunted our ability to further grow our relationships with partners.

The effects of the staffing shake ups were perhaps felt most with LSR. We had lost an influential advocate within the organization and, as a result, enthusiasm for our project among its upper ranks appeared to diminish. After securing LSR's commitment to a three-year pilot of our survey in July 2017, we failed to maintain ongoing and substantive engagement with our contacts over the following months as we transitioned our focus to securing partners in the CPG industry to adopt the survey during the pilot period.

Pivoting the Survey

When we re-established contact in November 2017, LSR informed us that the company had decided to move forward with a different sustainability assessment – the Sustainable Agriculture Initiative (SAI) Platform – and was ending LSR's support of the University of Michigan's survey. LSR had concluded that attaching itself to two surveys related to sustainability may confuse its growers and cause frustration among this group of important stakeholders. The solution was therefore to suspend support for our project.

Caught off guard and with our project seemingly on the brink of unraveling, we moved to pivot the positioning of our survey and reframe it to regain the support of LSR. With help from our partners, we made a compelling case for LSR to return conditional support of the survey, reframed as a “research pilot” and not mentioning “sustainability.” Other conditions for the research pilot included that it would have to be distributed by a third party and could not mention LSR by name.

In need of another trusted authority within Louisiana's sugarcane grower community, our team turned to Dr. Gravois at LSU. A long supporter of and resource to the project, Dr. Gravois agreed to introduce the survey to growers at their annual meeting and distribute the survey to his contact list of growers with his personal endorsement to complete. Additionally, Dr. Gravois previewed the survey with several growers and provided feedback for last minute adjustments

before the full roll out in February 2018. With Dr. Gravois' support, our survey was able to reach several hundred growers, with 73 filling out the survey.

Lessons Learned

The challenges our team faced that resulted in the pivoting of the survey taught our team many lessons about how we managed and mismanaged partner relationships over the course of our project.

Early in the project, we correctly prioritized trust-building with an in-person trip to Louisiana to meet with LSR and our Cargill contact, during which we demonstrated our commitment to work with them and established a strong foundation for a mutually beneficial relationship.

As the project continued, however, we strayed from the tenants of a collaborative management approach. We relied too heavily on the progress made from the initial trip and became complacent about deepening the relationship with substantive engagement. In addition, we did not fully understand the internal decision-making structures at our partner organizations. As a result, we allowed shared ownership of the survey to diminish and struggled to identify how best to restore it once decisions had been made.

After we received LSR's commitment to pilot the survey, we allowed months to go by without contact as we shifted our attention to securing additional CPG partners for the survey's data. We should have continued to engage LSR regularly during that critical period, providing updates on our progress and seeking input. Status updates would have reinforced to LSR our commitment, demonstrated the demand for the survey among LSR's customer base, and given visibility to the project at the highest levels of LSR. Though we feared constant check-ins may have fatigued our partners, if we had maintained constant relationship building with LSR over the course of the project we may have never jeopardized their support.

Ultimately, for each of the stakeholders within the alliance, our team should have regularly re-evaluated their distinct goals and objectives – which at times may be at odds with those of other stakeholders – and determine how we could better align stakeholders and our work to support their desires.

Challenges with CPG Industry Stakeholders

To accomplish our goal of creating an industry standard by which to measure the responsible production of sugarcane in the US, it was clear the survey would require widespread adoption and use by CPG companies in addition to Kellogg. After securing the Louisiana sugarcane industry's commitment in July 2017 to pilot our survey, we shifted our focus to securing key CPG partners.

Our strategy to achieve such support among CPG companies was to target large CPG companies with sustainability commitments on par with Kellogg and secure their participation in the survey's pilot. By securing several partners in high profile CPG companies, we hoped to further validate the survey for additional CPG companies and the sugarcane industry itself, which had

expressed concerns over whether our survey would be recognized as credible. Widespread adoption by CPG companies would simultaneously assuage the sugarcane industry's concerns and provide our team with valuable insights and best practices from CPG partners to improve and strengthen the survey tool.

Leveraging contacts from Kellogg in the sustainability departments of peer companies, we began outreach to a major CPG company and beverage company to secure their participation. As we engaged in conversations with contacts from the sustainability departments of the two companies, new challenges became apparent.

Our contact at the CPG company, after reviewing the survey, expressed concern that survey may not be thorough enough for the company to accept the results and that it could not replace their current sustainability standard.

The CPG company's concern over the thoroughness of the survey highlighted an inherent tension in our project. We had aimed to create a survey for sugarcane growers that would be tailored for US sugarcane production and eliminate many of the generalized questions associated with many international sustainability certifications. As our project attempted to incorporate more stakeholders, it would become increasingly difficult to balance everyone's priorities and needs for sustainability reporting.

In our outreach with the beverage company, we encountered a different issue to highlight the complexity of achieving an industry-wide standard. We received positive feedback regarding the survey but learned that the company currently did not source any sugarcane from Louisiana, therefore rendering unusable the data our survey would collect. Our team realized that despite Kellogg's close ties to many peer companies, it did not know other companies' upstream supply chains, and was legally prevented from discussing it.

Although we were unable to secure additional CPG partners, our interactions with two peer companies taught us that companies need an enormous amount of education to adopt new sustainability measurement tools. The companies were only able to view the survey from the frameworks of the various certifications and standards there were already using. Many of these frameworks rely on international surveys that can be widely applied by skewing towards more generic variables, the exact issue our survey sought to correct for US sugarcane.

Even though the survey we created was tailored specifically for US sugarcane, companies initially found it difficult to fit within their reporting systems. While we devoted much effort to educate companies on the purpose and development process of the survey, the focus should have been on teaching companies how to use the information gathered within the survey. This education process is the only way to demonstrate to companies how a new tool adds value greater than status quo it will replace in a company's portfolio of sustainability measurement tools.

The challenge remains, however, that CPG companies do not take a uniform approach to measuring sustainability or responsible production, and therefore to sufficiently demonstrate the

full value of a new measurement tool to a company requires an in-depth understanding of that company's current measurement practices and reporting goals.

Next Steps and Recommendations

Following the completion of the pilot survey, several questions remain about its future and next steps for the stakeholders: How can the survey be improved? What entity provides the best platform to measure sustainability over time? What are the next steps for Kellogg and the Louisiana sugarcane industry?

Survey Improvement

Piloting the survey with a portion of Louisiana growers offered insight into its limitations and potential areas for improvement. First, the survey did not include a question on individual farm yield because of sensitivity around growers providing this information. There was concern about data being perceived as too invasive or potentially misused; however, lacking this variable limited the conclusions that could be drawn from the data that was collected. A future survey could include a question on yield in order to reveal correlation and causation between production and overall management practices.

Second, the survey should be specific about “farm acres” vs. “tillable acres” when asking about land use. Understanding acreage usage in a more detailed way would help provide more clarity on sustainability and land management.

Third, lack of information on equipment left out additional data on emissions. The mill survey was created but not implemented, and this could provide additional insights into sugarcane processing environmental impact.

Finally, on the water portion of the survey, it would be helpful to ask about irrigation water sources (city water, well, etc.) to better understand if growers take actions to manage their water supply based on jurisdiction. This would further reveal conclusions about proactive vs. reactive water management, nutrient runoff, and yield. Our team recommends that future surveys can be more effective by including questions on these areas.

Most importantly, continuous improvement can only be measured if the survey is implemented year after year. Below are several options to ensuring longevity of the survey for future implementation.

Longevity and Future Implementation

Now that the initial proof of concept of the survey has taken place, the invested parties will need to determine if and how there is means for measuring sustainability in the sugarcane industry over time. Several potential options – or combination of options – could provide a path forward.

1. *Use the survey to assess sugarcane production on an ad hoc basis across American producers.* In this scenario, producer companies such as LSR could use the survey as an alternative to SAI and other certification platforms. Individual companies may see a benefit to using the survey on their own. However, this route presents major drawbacks for consistency and broad applicability. It would be difficult to draw conclusions about the overall environmental impact of sugarcane in the United States if producers implement the survey on a situation-by-situation basis. Adding to this challenge is the utilization of the information by customers: if, for example, a CPG customer receives several differently-implemented survey results from across their supply chain, they will be unable to make realistic claims about their products' impact.
2. *Host the survey at Bonsucro, Field to Market, or another agriculture sustainability organization.* Housing the survey at an established sustainability metrics organization would provide credibility, administrative resources, and consistency. Doing so would elevate the legitimacy of the data collected and even improve the survey overall, since some agriculture sustainability organizations are engaged in work on multiple crops. The main drawback to this option, however, would be frustration from and possible alienation of growers, the most critical stakeholders in terms of survey completion. There is widespread skepticism of Bonsucro across the industry, and growers feel audit fatigue from platforms like SAI and Field to Market. These platforms also generally imply a high cost to producers. Growers' concerns may be mitigated if the survey has oversight from a board of industry professionals and growers.
3. *Partner with another university on academic research.* Given the success of the partnership with the LSU AgCenter, it could be productive to partner over a period of years on measuring sugarcane environmental impact. Academic leaders like Dr. Gravois have credibility in the industry and interest in measuring sustainability in scientific way, highlighting two important factors to growers. Universities in both Louisiana and Florida could collaborate on an initiative to gather continuous data over time.
4. *Create a coalition of customers, including CPG companies, that agree on the survey as an appropriate sustainability measurement tool.* A major sustainability measurement challenge for both customers and producers is agreeing on one tool that is accepted across the industry. Producers do not want to ask their growers to fill in multiple surveys, and customers struggle to draw conclusions from inconsistent information. Currently, producers are left to decide which measurement tool works best for them independently. If a coalition of customers were to gather and agree on one standard – either this survey or another platform – it would ease the burden on producer companies and streamline their data collection. Over the course of our project, it became clear that many CPG companies are unsatisfied with the current state of sustainability measurement with US sugarcane. This creates an opportunity for industry first movers – like Kellogg – to lead an initiative that brings CPG companies and stakeholders together for non-competitive collaboration on a tool that would address the root problem. The SGR survey provides a solid foundation for such conversations to begin.

Next Steps

The UM team recommends convening Kellogg and LSR to discuss benefits from the survey and the future of sustainability measurement for sugarcane, detailed above. Armed with the proof of concept and pilot survey data, these two organizations have the potential to lead others in their respective spaces – including other states’ sugarcane industries, NGOs, and CPG companies – toward a comprehensive solution for assessing environmental impact. Through a combination of the above options, we are hopeful that a new era for the American sugarcane industry is upon us.

Appendix

Appendix A: Objective Statement

Sugarcane has been a vital component of Louisiana's economy and culture for the last 200 years, with dedicated growers and multi-generational farms enabling the industry to thrive.

The goal of this survey is to demonstrate sustainability outcomes for Louisiana sugarcane growers and their customers throughout the value chain. The sustainability survey will help achieve this goal by providing a fair and accurate assessment of the sustainable practices of Louisiana sugarcane producers. Moreover, it will establish a baseline for continuous improvement, helping to promote and highlight responsible sugarcane production consistent with the three pillars of sustainability: environmental, social, and economic.

The survey is organized around six sustainability principles:

- **Land:** Stewardship of the land and promotion of healthy soil
- **Water:** Improvement of water quality outcomes for local waterways
- **Air:** Care for air quality and aggregate reduction of greenhouse gas emissions across production
- **People:** Commitment to safe working conditions and promotion of employee well-being
- **Community:** Support of local community development
- **Livelihoods:** Mitigation of economic and environmental risks for growers and producers across the value chain

Appendix B: Existing Certifications and Audit Mechanisms

Bonsucro

What first started as the Better Sugarcane Initiative, a global NGO focused on minimizing environmental and social externalities of sugarcane production, has since evolved into the Bonsucro Standard. Officially launched in 2011 as the first global metric-based sugarcane standard, its purpose is to transform the sugarcane industry by introducing a market-driven solution that encourages compliance around best practices for farm management and agricultural production. Currently, there are over 480 members, embodying a multi-stakeholder network of suppliers, traders, NGOs, producers and sugar retailers.⁶⁴ The Bonsucro standard has gained credibility over the years, encompassing 25% of global sugarcane land and certifying nearly 3 million tons of sugar.

The Bonsucro certification stands as a market-based commitment to responsible production and purchasing strategies as well as a brand identity to consumers. Through third party auditors, mills receive certification based on if they are adhering to certain criteria. While Bonsucro is a global platform, it falls short of being applicable in the United States because of its focus on developing countries. Additionally, the standard struggles to scale, as it has only certified 3.66% of global sugarcane, short of the organization's goal of 20%.⁶⁵

The Bonsucro Standard is designed around five main principles: obey the law; respect human rights and labor standards; manage input, production and processing efficiencies to enhance sustainability; actively manage biodiversity and ecosystem services; and continuously improve key areas of the business. Under each of these driving principles are specific criteria, indicators and metrics, varying from core to less essential specifics. Certification requires a third-party audit to assess if the 16 core indicators are met, as well as 80% of the other less essential items. Moreover, Bonsucro includes a production standard for millers and growers, as well as a chain of custody for all actors along the supply chain. The production standard focuses on protecting workers' rights, minimizing environmental harms, increasing efficiency, lowering energy use, and reducing waste at the mill and farm level. The Chain of Custody is more focused on the traceability of the supply chain, with technical and administrative requirements for tracking products.

ProTerra

The ProTerra foundation is a NGO focused on transparent and traceable agricultural commodities systems, largely designed off the Responsible Soy Program. Unlike Bonsucro, ProTerra is expansive beyond a single crop and measures performance based on thresholds instead of specific metric values. Whereas Bonsucro certifies mills, ProTerra provides certification along three distinct levels: producers, transporters and processors. ProTerra has very similar guiding principles as Bonsucro, including: compliance with law, international accords and ProTerra standard; human rights and responsible personnel policies and labor practices; responsible relations with workers and the community; environmental services, effective environmental management plan; avoidance of GMOS; pollution and waste managed effectively;

⁶⁴ Bonsucro. Retrieved April 26, 2017, from, <https://www.bonsucro.com/en/what-is-bonsucro/>

⁶⁵ Smedley, Tim. (2014, September 15). Sustainable Sugar: Coca-cola and BP signed up, but will it go mainstream? The Guardian. Retrieved April 25, 2017, from <https://www.theguardian.com/sustainable-business/2014/sep/15/sustainable-sugar-can-coca-cola-bp-shell-bonsucro>

water managed conservatively; GHG and energy managed effectively; good agricultural practices adopted; and traceable and segregated Chain of Custody. To achieve certification, the entity needs 100% compliance with CORE indicators and 80% with other indicators, similar to Bonsucro's strategy. Since ProTerra is designed for a variety of crops, it is not always applicable to sugarcane. However, ProTerra certified its first sugarcane producers in South Africa and Guadeloupe in 2008, and to date, represents 309,000 acres of farms growing 8 million metric tons of certified sugar.⁶⁶

Kellogg Grower Survey

As part of Kellogg's 2020 targets for Responsible Sourcing, the Kellogg grower survey was created in 2014 as a mechanism to better understand practices at the farm level. The survey was based off of four other benchmarks, with a strong focus on collecting quantitative data in order to measure a farm's performance over time. Kellogg designed the survey to be administered to suppliers in their 6 main ingredients groups (corn, wheat, rice, wheat potatoes, fruits and sugar beans), with the goal to engage a minimum of 80% of volume in a particular region. Since it is unrealistic to provide surveys to each of their suppliers, the goal is to take data from a sample of farms to get a general understanding of management practices and where Kellogg can provide additional support. The intent is for Kellogg to provide the surveys to their suppliers, who will then work with growers supporting their mills/refineries to complete the survey.

The Kellogg Grower survey is composed of 60 questions, separated into 5 distinct categories: general questions about farm logistics; environmental questions focused on soil health, irrigation practices, energy use, seed varieties and fertilizer use; social questions focused on worker rights; economic questions focused on yields and livelihood of growers; and questions specifically designed for growers in developing nations, mostly on access to markets and information as well as labor rights. Overall, the survey is meant to gather general information about the farms and its practices, with no binding requirements, but rather to create a baseline snapshot of where they are at now. From here, Kellogg can identify where they can provide additional support, especially through connecting growers to agronomic supervisors. In its initial year, the survey did not require responses to all the 60 questions, resulting in only half the suppliers submitting the survey, with several blank responses. Moving forward, Kellogg wants to have the ability to track and measure data and improve completeness and accuracy of responses.

SAI Farm Sustainability Assessment (FSA)

The Sustainable Agriculture Initiative (SAI) was originally launched by Nestle, Unilever, and Danone to improve global food and drink value chains. The NGO has over 90 members (the majority being food and beverage organizations) and is designed as a platform to share best practices and move the needle throughout the whole industry. The Farm Sustainability Assessment (FSA), which was launched in 2014, is a tool for growers to assess their own farm's sustainability and since it is an assessment tool, there is no certification or formal audit. FSA is specific to US growers and is mostly focused on corn, cotton, potatoes, rice, soybeans and wheat crops. However, sugar beets, barley, peanuts and alfalfa are being added soon. The FSA is

⁶⁶ The ProTerra Foundation. Retrieved April 25, 2017, from <http://www.proterrafoundation.org/>>

completely free to use and is not limited to just one commodity. Currently, FSA is used in 24 countries.⁶⁷

In 2015, FSA was benchmarked against Bonsucro to identify similarities, redundancies and gaps in topics. Unlike the metric based Bonsucro, FSA has three different thresholds: Bronze, Silver and Gold. FSA certification is valid for three years, with annual surveillance visits, although third party verification is not necessary. If a supplier adheres to state and federal laws, it automatically has SAI Bronze status.⁶⁸ Additionally, FSA is compatible with other standards and certifications, reducing the burden on suppliers. FSA includes a 80-120 questionnaire, using the following 8 sustainability indicators: Land Use, Irrigated Water Use, Water Quality, Energy Use, Greenhouse Gas Emissions, Soil Carbon, Soil Conservation and Biodiversity. The FSA was benchmarked against 60 global and regional standards to limit redundancies on other assessment tools.⁶⁹

[Field Print Platform](#)

Field to Market is a global alliance of diverse stakeholders (growers, agribusinesses, restaurants, universities, conservation groups etc.) collaborating to continuously improve agricultural supply chains. Through their efforts, they developed Fieldprint® Platform, an assessment framework for growers that allows brands, retailers, suppliers, and growers to measure the environmental impacts of commodity crop production and identify opportunities for continuous improvement.⁷⁰ Through the platform's metrics and algorithms, an individual can enter their field and input data to gain a complete picture of the farm's sustainability impacts. Compared to the Bonsucro and ProTerra metrics, the Fieldprint Calculator is strictly focused on ecological components, while additionally accounting for crop rotation, cover crops, compost/ manure use and conservation practices such as borders and strip cropping. Furthermore, the FieldPrint Calculator is more focused on improving baseline conditions instead of reaching performance thresholds, a major difference between the FSA.

[Field to Market Supplement for FSA Equivalency](#)

As of March 2017, Field to Market and the Sustainable Agriculture Initiative (SAI) announced that due to their similarities, alignment and complimentary nature, the Field to Market FieldPrint Platform is formally recognized as the equivalent of fulfilling requirements for SAI's FSA's bronze status. Through this equivalency agreement, the two programs can be assessed side by side, providing a more harmonized approach for suppliers and retailers and also preventing suppliers from filling out multiple, yet similar, performance measuring tools. Thus, this new agreement is a way to coordinate and support each organization's efforts. In order for growers to qualify for FSA Silver or FSA Gold, they can answer an additional self-assessment survey composed of 15 questions focused on water and waste management, worker health and safety and farm-level risks.

[Sustainability Accounting Standards Board](#)

The Sustainability Accounting Standards Board (SASB) provides sustainability accounting standards for use by publicly listed corporations in the U.S. in disclosing material sustainability

⁶⁷ The Farm Sustainable Assessment Tool. Retrieved April 25, 2017 from <http://www.fsatool.com/>

⁶⁸ Grant, Stefani. (2017, April 18). Phone interview.

⁶⁹ Thomas, Ruth. (2017, April 19). Phone interview.

⁷⁰ Field to Market. Retrieved April 26, 2017, from <https://fieldtomarket.org/our-program/fieldprint-platform/>

information for the benefit of investors and the public. The SASB agricultural products metrics provide blanket guidelines across the industry for greenhouse gas emissions, energy management, water withdrawal, land use and ecological impacts, food safety, fair labor practices, workforce health and safety, climate change impacts on crop yields, environmental and social impacts of ingredient supply chains, and political spending. The metrics are targeted at CPG companies for public disclosure, rather than growers or cooperatives, but cover some of the same topics as other grower-level surveys. SASB differs from other mechanisms by additionally accounting for political activity, occupational injuries, seasonal workers, raw materials and wastewater, renewable energy and climate change effects on yields.

Unilever Sustainable Agriculture Code (SAC)

Initially implemented in 2010 and revised in 2015, the SAC is a metric-based tool used by Unilever's suppliers and growers to assess progress toward sustainable sourcing strategies. The code provides targets for farms and suppliers to work toward, with the goal to continuous improvement. The newest version reflects the CPG company's evolving understanding of sustainability, with a larger focus on land use changes and the associated environmental and social challenges, as well as safeguards around community land rights. Unilever also prioritizes women's empowerment and fair income and wages within the gender gap, though these issues are not included in the survey.⁷¹

The code is divided into three key issues- business, environment, and people- and is color coded to reflect the topic category. Criteria apply to either the grower or supplier and are categorized as mandatory (compliance is required), expected (compliance is expected but there are some exceptions; these are more in tune with best practices or ideal actions) and leading (new caveats that have the potential to upgrade to expected in the future). The code is split into 10 sections: Crop and Pasture Nutrient (Fertilization) Management; Pest, Disease and Weed Management; Soil Management; Water management; Biodiversity and Ecosystems; Energy and Greenhouse Gas (Carbon) Emissions; Waste management; Social; Animal Husbandry; and Value Chain. In order to achieve compliance, suppliers either self-assess their performance against the code or have comparable external certification standards.

Sedex SAQ

Sedex is a global NGO with over 40,000 members that offers a platform to simply manage and share sourcing data with others. The Self-Assessment Questionnaire was designed around four main pillars: labor standards, health and safety, environment and business ethics. The SAQ collects data on ethical, quality, financial and environmental information and is to be filled out by suppliers, with support from growers. The SAQ is not meant to audit or certify entities, but is an independent framework to assess business practices. A lot of focus is around business ethics and worker's rights.

Ceres

Ceres is a global, sustainability-focused non-profit, tackling issues such as pollution, water scarcity, clean energy and human rights abuses. The organization's main focus is on providing research and tools to further promote sustainability initiatives, as well as mobilizing investors to

⁷¹ Sustainable Agriculture Code 2015. Unilever PLC. Retrieved April 26, 2017, from https://www.unilever.com/Images/sac-2015_tcm244-427050_en.pdf

scale their efforts. Within this lens, Ceres works on food and agriculture issues, with a focus on making social and environmental risks more transparent. Furthermore, Ceres works directly with companies to reduce farm level impacts, such as deforestation, forced labor and water scarcity. It also works with CPG companies, such as Kellogg, Unilever, Mars, and General Mills to bolster local and federal climate policies. Through their work, they aim to reduce risks around agricultural supply chains, while maintaining safe and fair working conditions for growers.

The Ceres Supplier Self-Assessment Questionnaire (SAQ) enables suppliers to measure performance for companies, investors, and other stakeholders on three key topics: environment, social, and governance.

Certification Criteria	Certification / Survey										
	Bonsucro	ProTerra	Kellogg Grower Survey	Field to Market Supplement for FSA Equivalency	Field to Market Fieldprint Calculator	SAI/FSA	SASB	Unilever SAC	Sedex SAQ	Ceres	Federal Regulation
Key High Frequency (7+) Medium Frequency (4-6) Low Frequency (1-3)											
Regular maintenance performed on equipment and machinery				X		X		X	X		
Identification of priority crops and discussion of risks and/or opportunities presented by climate change							X				
Amount of crop losses, percentage offset through financial mechanisms							X				
Waste Management											
Waste management plan in place to minimize waste								X	X		
Use of waste materials and pollutants minimized and disposed of properly		X		X		X		X	X	X	
Non-biological waste segregated and recycled (where appropriate)	X	X		X		X					
Composition tests for manure and other wastes applied to				X		X					
Use of manure/compost					X			X			
Non-hazardous solid residues per tonne of cane	X										
Options investigated for value creation from current waste								X			
Principle II: Water											
Water Use											
Water is not legitimately contested by other users	X							X			
Site located in a water stress/shortage area									X		
Conservation of quality/quantity of natural water resources		X				X	X	X	X		
Total fresh water withdrawn; percent recycled							X	X			
Water infrastructure is in good working condition								X			
Water use efficiency	X	X	X	X	X	X	X	X	X	X	
Drainage management to minimize soil erosion and prevent discharge directly into surface waters			X					X			
Percentage of agricultural raw materials sourced from regions with High or Extremely High Baseline Water Stress							X				
Wastewater											
Dissolved oxygen in receiving streams/pollutants in nearby waterways	X	X				X					
Volume of wastewater generated, percentage (1) reused and (2) discharged to the environment							X	X		X	
Effluent ponds, silage clamps or manure pits are fenced/locked and limited to trained personnel		X									
Number of incidents of non-compliance with water quality permits, standards, and regulations							X		X	X	
Treatment of wastewater prior to off-site discharge, identification of water sources, and assessment of related external supply and quality risks										X	
Principle III: Air											
Prescribed Burns											
No burning to clear areas for cultivation UNLESS allowed by law AND prescribed as experts as optimal ecological option IF burning is acceptable, trained people apply the technical procedure and employ all required safety and environmental measures		X						X			X
Development of alternative methods for future, even if burning is acceptable		X				X					
Energy Use and Emissions											
Risk of noise and/or pollution to affect neighboring communities and efforts to minimize impact				X		X		X	X		
GHG emissions efficiencies	X	X					X	X	X	X	
Identifies sources of GHG and measures emissions						X	X	X	X	X	
Facility reports GHG to the Carbon Disclosure Project										X	
Facility tests air emissions and has targets for reducing emissions									X	X	
Monitor air quality (e.g. for solvent and dust levels) as part of Health and Safety risk assessment									X		
Concentrations of contaminants emitted through smoke pipes, etc. do not exceed established limits		X									
Energy used in cane transport per tonne of cane transported	X					X	X	X		X	
Transportation distance to refinery/mill								X			
Atmospheric acidification burden per unit mass of product	X							X		X	
Total net primary energy usage per kg product	X	X	X				X				
Primary energy use per tonne of sugarcane	X						X	X	X		
Percent renewable energy used			X				X	X	X		
Energy management plan in place to reduce consumption and increase efficiency								X	X		
Principle IV: People											
Workforce Management											
Minimum age of employees: no child labor	X	X				X		X	X		X
Evidence of employee dates of birth									X		
Nationalities and languages of employees									X		
Employees above legal age but under 18									X		
Employees aged 15-18 do not conduct hazardous work						X		X	X		
Percent of female vs male employees			X							X	
Records of permanent vs part time employees			X							X	X
Employment of prisoners									X		
Written policy that requires all employees/employees to have employment agreements/contracts									X	X	X
Percent of employees with contract or equivalent document	X	X	X			X		X	X		X
Employee job descriptions, including necessary skills and legal status, and salary range are set in written form		X				X				X	
Employees' right to form and join trade unions and/or to bargain collectively are respected	X	X				X		X	X	X	X
Working hours lost as percentage of total hours worked	X										
Employees entitled to lowest entry level wage including benefits to minimum wage and benefits required by law	X	X				X		X			X
Total number of hours worked	X	X				X		X	X		
Maximum number of hours of worked	X	X				X		X	X		
Overtime is paid at a premium rate or equally compensated	X	X		X		X		X	X	X	X
All overtime work is voluntary		X				X		X	X		X

Certification Criteria	Certification / Survey													
Key High Frequency (7+) Medium Frequency (4-6) Low Frequency (1-3)	Field to Market Supplement for FSA						Field to Market Fieldprint Calculator					Federal Regulation		
	Bonsucro	ProTerra	Kellogg Grower Survey	Equivalency	SAI/FSA	SASB	Unilever SAC	Sedex SAQ	Ceres	SAI/FSA	SASB	Unilever SAC	Sedex SAQ	Ceres
Existence of a written corporate responsibility policy or statement defining the workplace's approach to labor, health and safety standards, including benefits, discipline, grievance procedures, harassment, overtime hours												X	X	
Maintains and implements a personnel management program		X										X		
Assigns a staff member to implement and manage the personnel management program		X										X		
Effective and timely system of communication with all employees and with the local communities, and an effective and timely system to receive, investigate and respond to all complaints from these parties		X							X		X		X	
Plan to communicate labor requirements, laws and standards to suppliers									X			X		
Fair Treatment of Employees														
Absence of forced or compulsory labor	X	X						X	X	X	X	X		X
Absence of discrimination	X	X						X	X	X	X	X	X	X
HIV status does not affect management decisions									X					X
Coercive disciplinary or control methods are not permitted (including harassment)		X						X					X	X
Pay is not withheld		X						X		X		X		
Loans or advances on pay to employees / employees allowed											X			
Employees are not required to lodge their identity papers with their employer or any third party		X								X	X			X
Employees are not required to deposit money or valuable items to secure work or in return for any work related items												X		X
Accompanying family members (children and spouses) are not required to work on the farm		X												X
Employee / employee representatives democratically elected by the workforce												X		
Considers language and cultural barriers in communication on farm				X		X		X		X	X			
Health and Safety														
All employees, regardless of age or gender, enjoy appropriate, legally compliant working conditions		X						X	X	X				X
All employees living on site have appropriate, fairly priced, and safe food, water and housing		X	X					X				X	X	X
Access to hygienic toilets and clean drinking water	X	X	X					X		X				X
Separate toilets for men and women												X		
Main health and safety risks assessed and measures implemented for mitigation of risk	X	X						X		X	X		X	
Program to prevent/ reduce occupational health risks to employees												X		
Description of efforts to assess, monitor, and reduce exposure of full-time and migrant/seasonal employees to pesticides									X			X		
Emergency evacuation plans and alarms are practiced often												X		
Appropriate emergency exits and alarms										X				
Number of occupational injuries (accidents)	X									X				
Number of fatal injuries	X											X		
Appropriate personal protective equipment supplied to and used by all employees	X	X	X					X		X	X			
Staff trained for health and safety	X	X	X	X						X	X	X	X	X
Safety sheets on chemicals												X		
Ensure employees are meeting the required standards of housekeeping and hygiene												X		
All employees present on the field and/or mill have access to first aid and provision for emergency response	X	X	X	X				X		X	X			X
Medical checks provided for works with higher risks of health issues associated with work			X					X		X				
All accidents are reported, appropriate treatment received and corrective measures taken								X				X		
Promotion of Healthy Lifestyles														
Healthy lifestyles and awareness around health issues promoted among employees and in wider community											X			
Employees supported and encouraged to have health insurance			X					X		X				
Support for employees who wish to remit money to families										X				
Schooling opportunities are ensured for children under 15 living on the farm								X						
Children living on site have access to schools, childcare and/or medical care												X	X	
Employee training investments	X		X							X			X	
Principle V: Community														
Support demonstrated for local community development		X	X					X		X	X			
Contributions to education next generation of farmers			X	X						X				
Job opportunities made available first to qualified members of the local community		X												
Existence of a recognized grievance and dispute resolution mechanism for all stakeholders	X										X			
Percentage of projects involving multi stakeholders where agreement has been reached by consensus driven process based on Free Prior Informed Consent	X													
Principle VI: Livelihoods														
Economic Viability														
Farming as only source of income			X	X				X						
Financial records for farm								X		X				
Financial safeguards to protect against losses (e.g., crop insurance)				X										
Access to financing options			X											
Access to agronomic advice			X									X		
Access to market information			X											
Production Outcomes														
Records kept of high season months (harvest season)												X		

Certification Criteria	Certification / Survey										
Key High Frequency (7+) Medium Frequency (4-6) Low Frequency (1-3)	Field to Market Supplement for FSA Equivalency										
	Bonsucro	ProTerra	Kellogg Grower Survey	Field to Market Fieldprint Calculator	SAI/FSA	SASB	Unilever SAC	Sedex SAQ	Ceres	Federal Regulation	
Size of site			X					X			
Yield of production	X	X	X								
Theoretical recoverable sugar content of cane	X										
Fermentable total sugars content of cane, expressed as invert	X										
Written procedure to evaluate and select suppliers based on ability to meet defined standards								X			
Payment for cane deliveries are made according to agreed contract	X										
Mill overall time efficiency	X										
Factory Performance Index	X										
Industrial Efficiency	X		X		X						
Total raw materials used per kg product	X										
Number of recalls issued, total amount of food product recalled						X					
Long-term Investments											
Highest level of education obtained by grower			X								
Plans for long-term economic viability of farm farm work			X	X	X						
Research and extension costs as a percent of sales	X						X				
Other											
Food Safety											
Global Food Safety Initiative audit conformance: (1) major non-conformance rate and associated corrective action rate, and (2) minor non-conformance rate and associated corrective action rate						X					
Documented training for ensuring food safety and quality of products	X										
Business Ethics											
Code of conduct signed relating to ethic business practices			X					X			
Site is certified by other standards, such as Ethical Trading Initiative								X			
Written policy on prohibiting bribery, corruption and fraud within business								X			
Records of social/ethical audits								X			
Records of criteria are kept for 5 years		X									
Senior manager and procedure for responding to business ethics non-compliances								X			
Percentage of suppliers that are audited								X			
Political/Lobbying Spending											
Amount of political campaign spending, lobbying expenditures, and contributions to tax-exempt groups including trade associations						X					
Five largest political, lobbying, or tax-exempt group expenditures						X					
Supply Chain Transparency											
Sufficient records and documentation are kept to demonstrate traceability		X	X					X			
Percentage of agricultural raw materials that are certified to a third-party environmental and/or social standard						X					
Percentage of greenfield expansion or new sugarcane project covered by ESIA	X	X									
Inventory control documentation		X									
Visitations and monitoring of suppliers								X			
Data on sustainability of consignments are maintained and verifiable	X							X			
Mixed consignments receive new ID # and retain data of each mixture component	X	X									
Final products can be traced to each owner in supply chain	X	X	X			X		X			
Each consignment has a unique identification #	X	X	X								

Appendix D: Federal and Louisiana State Regulations

Pesticides

Regulation	Federal Agency	Louisiana Agency
Agricultural employers must follow specific guidelines to train, inform, protect and mitigate workers' contact and use of pesticides (does NOT require Spanish language materials)	EPA: Agricultural Worker Protection Standard (WPS)	(LDAF verifies WPS compliance with scheduled inspections)
All pesticides distributed or sold in the US must be registered under FIFRA and applied according to the pesticide label	EPA: Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	LDAF: Louisiana Pesticide Law and Rules & Regulations (All pesticides distributed, sold or applied in Louisiana must be registered with the LDAF)
Any person who applies or supervises the use restricted use pesticides (RUPs) must be certified in accordance with EPA regulations and state, territorial and tribal laws.	EPA: Certification of Pesticide Applicators	LDAF: Requires farmers to be retrained and re-certified as private applicators every 3 years
All private applicators are required to keep records of RUP applications for two years	USDA: Federal Pesticide Recordkeeping Program	
Pollutants are prohibited from being discharged into waterways without a NPDES permit	EPA: Clean Water Act	
Pesticides that “may affect” an endangered species or its habitat must be applied according to labels and Endangered Species Protection Bulletins	EPA: Endangered Species Protection Program (ESPP)	

Prescribed Burns

Regulation	Federal Agency	Louisiana Agency
Concentration of PM _{2.5} (smoke) cannot exceed 12.0 micrograms per cubic meter of air (µg/m ³) by annual mean, averaged over three years	EPA: National Ambient Air Quality Standards for Particulate Matter (NAAQS)	
Concentration of PM ₁₀ (smoke) cannot exceed 150 µg/m ³ in a 24-hour period more than once per year on average over three years	EPA: National Ambient Air Quality Standards for Particulate Matter (NAAQS)	
<p><u>VOLUNTARY</u> -- certified prescribed burn managers will:</p> <ul style="list-style-type: none"> ● Provide education and training to employees conducting burn operations ● Be on site for all burns ● Provide proper equipment for controlling and confining fires for all burns ● Follow the 7-step best practices protocol 		LDAF/LSU AgCenter: Certified Prescribed Burn Manager program (CPBM) and Louisiana Smoke Management Guidelines

Farms, Facilities, Fuel & Equipment

Regulation	Federal Agency	Louisiana Agency
Stationary engines or reciprocating internal combustion engines must comply with EPA air quality requirements as designated per type of engine	EPA: Compliance for Stationary Internal Combustion Engines	

Farms storing more than 2,500 gallons of oil in aboveground containers must have plan to maintain and implement oil spill prevention plan (SPCC Plan)	EPA: SPCC Program	
Farms with storing capacity of more than 1 million gallons must maintain Facility Response Plan	EPA: Facility Response Plan (FRP)	
Farms with underground storage tanks with capacities more than 1,100 gallons of motor fuel must meet federal regulations for design, construction, installation, monitoring, operating, release detection, reporting, cleanup	EPA: Underground Storage Tanks (USTs) Laws and Regulations	
Farms storing more than 25 gallons of used oil must meet technical requirements from EPA	EPA: Resource Conservation and Recovery Act (RCRA) Training Module about Used Oil	
Farms must report oil spills that could reach waterways	EPA: Oil Spills Prevention and Preparedness Regulations	

Waste

Regulation	Federal Agency	Louisiana Agency
Farms that operate an underground injection well must report waste disposal practices	EPA: Underground Injection Control (UIC)	
Farms with hazardous waste must establish basic hazardous waste management standards and comply with federal safety standards to protect human health	EPA: The Resource Conservation and Recovery Act (RCRA)	

and the environment		
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Chemical Handling

Regulation	Federal Agency	Louisiana Agency
<p>Owners/operators of facilities with regulated hazardous materials must:</p> <ul style="list-style-type: none"> • Know hazards posed by the chemicals and assess the impacts of possible releases • Design and maintain a safe facility to prevent accidental releases • Minimize the consequences of accidental releases that do occur 	EPA: The General Duty Clause , Clean Air Act	
<p>Farms with more than threshold levels of hazardous substances must report inventory and Risk Management Plan (RMP) with appropriate state and local agency (plan must be revised every 5 years)</p>	EPA: Emergency Planning & Community Right to Know Act (EPCRA)	Louisiana State Police / Right-to-Know Unit

Worker Health and Safety

Regulation	Federal Agency	Louisiana Agency
Workers must have access to first aid kits and CPR training	OSHA: 1910.266 App A	State OSHA extension office
Protection of migrant and seasonal workers	United States Department of Labor: Migrant and Seasonal Agricultural Worker Protection Act (MSPA)	Louisiana Workforce Commission (LWC): Migrant and Seasonal Farmworker Services (MSFW)
Inspecting workplaces that create or handle combustible dusts	OSHA: Combustible Dust National Emphasis Program	State plan participation in this national emphasis effort is strongly encouraged but is not required
Worker protection against pesticide poisoning and injury	EPA: Agricultural Worker Protection Standards	LA Department of Agriculture and Forestry: Pesticide and Environmental Programs
Labor laws <ul style="list-style-type: none"> ● Child labor ● No discrimination ● Minimum age 	United States Department of Labor- Wages and Fair Labor Standards Act (FLSA)	Louisiana Department of Labor
Wages <ul style="list-style-type: none"> ● Minimum wage ● Overtime ● Recordkeeping 	United States Department of Labor- Wages and Fair Labor Standards Act (FLSA)	Louisiana Department of Labor

Appendix E: Louisiana State Voluntary Agriculture Programs

Voluntary Program	Program Details	State Agency
Resource Management System (RMS) Conservation Plan	<p>Landowner contacts the local conservation district or NRCS (or vice versa) to develop a non-legally binding course of action that includes:</p> <ul style="list-style-type: none"> ● A conservation district cooperater agreement ● A soil map with appropriate interpretations ● Appropriate worksheets developed with the client ● Appropriate available job sheets and other prepared material ● Operation and maintenance agreements and procedures ● A conservation plan map ● A record of clients' decisions ● Available maps, sketches, and designs resulting from the planning process that will be useful to the client in implementing the plan ● Information reflecting site-specific effects and impacts based on on-site visits 	<ul style="list-style-type: none"> ● Natural Resource Conservation Service (NRCS) ● Soil & Water Conservation Districts (SWCD)
Louisiana Master Farmer Program	<p>Addresses environmental concerns and enhance production and resource management skills through a voluntary certification process that includes:</p> <ul style="list-style-type: none"> ● Classroom instruction on environmental stewardship issues ● Conservation-based field day where specific best management practices are demonstrated and discussed ● Producer must develop and implement RMS Conservation Plan 	
Certified Prescribed Burn Manager program (CPBM) and Louisiana Smoke Management Guidelines	<p>Certified prescribed burn managers will:</p> <ul style="list-style-type: none"> ● Provide education and training to employees conducting burn operations ● Be on site for all burns ● Provide proper equipment for controlling and confining fires for all burns ● Follow the 7-step best practices protocol 	<ul style="list-style-type: none"> ● Louisiana Department of Agriculture & Forestry (LDAF) ● LSU AgCenter

Appendix F: Farm Survey

Introduction: Thank you for taking the time to complete this survey! Your responses will help highlight the great work of sugarcane growers in Louisiana and aid in communicating with end-users (such as food companies).

Background: This survey is a collaboration between graduate students at the University of Michigan and the LSU AgCenter. Three students have worked with LSU AgCenter since January 2017 to help develop a way to measure environmental impact of the sugarcane industry in Louisiana. Over the coming years, this survey aims to profile growers' efforts to sugar end-users and customers.

Survey Composition: The survey contains 38 questions is composed around three main topics: environment, society, and economy. Questions are focused on the following areas: land, water, air, people, community, and livelihoods.

Frequently Asked Questions:

Q: Will my responses be shared with other growers or customers of the industry?

A: No. Your responses will remain anonymous. Findings from across the state may be reported as aggregate statistics, but your identifying information will never be shared.

Q: What happens after I fill out the survey?

A: Students at the University of Michigan will convey survey findings of the Louisiana sugarcane industry's overall environmental impact. This information will help the industry maintain a strong relationship with end-users and customers.

Q: How frequently will the survey be completed?

A: The goal is to complete this survey on an annual basis, expanding the number of growers who participate each year. Thank you for being a part of the inaugural survey!

Land

The following questions cover land management practices for sugarcane growers. Please answer to the best of your knowledge.

Q1 How many acres is your farm? (numbers only)

Q2 What crops other than sugarcane, if any, are grown on your farm?

Q3 On how many acres of your farm is sugarcane grown?

Q4 Do you currently use any of the following conservation practices in your sugarcane production? (check all that apply)

- Field borders (grassy roads, uncultivated areas at the edges of production fields)
- Nutrient management (basic soil testing program)
- Enhanced nutrient management (precision fertilizer application via mapping, or enhanced nitrogen products to prevent unwanted movement)
- Reduced tillage (limited tillage outside of seedbed prep. activities)
- Cover crops (winter)
- Cover crops (spring)
- Crop rotation (other cash crops in rotation)
- Land forming/precision grading
- Grade stabilization drainage structures
- Irrigation pumping plant efficiency improvement
- Other irrigation efficiency improvements
- Pesticide management (Low-drift Nozzles, Drift Control Agents, Mode of Action Rotation, Precision Application Systems)

- Other _____

Q5 Have you ever developed a nutrient management plan consistent with best management practices from a credible institution, such as the LSU AgCenter, certified crop consultant, or South Florida Water Management District?

- Yes
- No
- I Don't Know

Q6 What was the average nitrogen rate (lbs/acre) applied on your farm in 2017? (number only)

Q7 Which of the following practices did you typically perform before disposing of used pesticide containers last year? (check all that apply)

- No rinse
- Rinse 1-2 times
- Rinse 3+ times
- Pressure wash
- Other _____

Q8 Have you ever used Integrated Pest Management (IPM), which emphasizes the control of insect pests based on scouting, resistant varieties, appropriate cultural practices, and the use of insecticides if necessary?

- Yes, I currently use IPM
- Yes, I have used IPM in the past
- No, I have never used IPM

Q9 Did you use any of the following practices for your pesticides last year? (check all that apply)

- I did not use any of the following practices for pesticides
- Select pesticides based on recommendations by qualified consultants, crop advisers, or academic institutions
- Keep pesticide application limited to target areas
- Select application equipment with care and maintain it carefully
- Carefully calibrate application equipment at the beginning of the spray season and periodically thereafter
- Assess environmental risks/concerns around target area before applying pesticides
- Rotate pesticides to create variation in the active ingredients
- Triple rinse all application equipment
- Triple rinse all empty pesticide containers, render unusable, and do not keep past 90 days after the spraying season
- Other _____

Water

The following questions cover water management practices for sugarcane growers. Please answer to the best of your knowledge.

Q10 Approximately how many acres were irrigated last year? (numbers only) *If you don't use irrigation, please enter "0"*

Q11 How many times was irrigation used last year? (numbers only)

Q12 Did you quality test your irrigation water last year?

- Yes
- No

Q13 Do you feel your water sources are under threat from any of the following?

- I do not feel my water sources are under threat
- Contamination
- Extreme weather events
- Competing uses from other farms or businesses

- Competing uses from municipalities or local governments
- Other _____

Q14 Which of the following are included in your water management plan? (check all that apply)

- None
- Conservation
- Drainage
- Water use efficiency
- Prevention of runoff
- Other _____

Q15 Did you suffer yield loss last year from any of the following weather events? (check all that apply)

- I did not suffer yield loss last year
- Drought
- Flooding
- Severe wind
- Hurricane
- Ground freeze
- Other _____

Q16 Do you consider yourself at risk from volatile weather events, such as floods, droughts, etc.?

- Yes
- No
- I don't know

Q17 If you answered yes, do you feel prepared to address those risks?

- Yes
- No

Q18 How many times did you evaluate in-field drainage systems in the last year?

- Never
- 1-2 times
- 3-5 times
- 6-10 times
- More than 10 times

Air

The following questions cover air pollution mitigation practices for sugarcane growers. Please answer to the best of your knowledge.

Q19 Did you conduct controlled agricultural burns on harvested sugarcane fields last year?

- Yes
- No

Q20 If yes, did you conduct controlled burns before harvest, after harvest, or both?

- Before harvest
- After harvest
- Before and after harvest
- N/A

Q21 Are you certified as a prescribed burn manager by a local and/or state agency?

- Yes
- No

Q22 Did you practice any alternative methods, such as row sweeping, to manage post-harvest residue last year?

- Yes
- No

Q23 Have you ever notified the surrounding community in advance of prescribed burns?

- Yes
- No

Q24 Has your farm received a complaint from prescribed burns in the last year?

- Yes
- No
- I don't know

People

The following questions cover community engagement and health issues for sugarcane growers. Please answer to the best of your knowledge.

Q25 The majority owner of the farm is:

- Male
- Female
- Jointly-owned

Q26 Do you employ people on your farm who are not part of ownership?

- Yes
- No

Q27 How many people are employed on the farm? (numbers only)

Q28a Of the farm's total workforce, how many are permanent workers? (numbers only)

Q28b How many are seasonal workers? (numbers only)

Q29 Is there a process for providing feedback that is communicated clearly to employees?

- Yes
- No

Q30 Is Personal Protective Equipment (PPE) necessary for pesticide applications provided to employees?

- Yes
- No

Q31 In the last year, have you conducted a health and safety training for employees?

- Yes
- No

Q32 Is machinery equipment properly maintained and repaired to minimize risk to workers?

- Yes
- No
- I Don't Know

Q33 What is one specific action you do to promote safe working practices in sugarcane cultivation among your employees?

Q34 What is one specific challenge you believe faces future generations of sugarcane growers (e.g., weather events, economic viability, etc.)? What is something you have done to help address this challenge?

Livelihoods

The following questions cover livelihood considerations for sugarcane growers. Please answer to the best of your knowledge.

Q35 Are you satisfied with your current system for financial bookkeeping?

- Yes
- No
- I Don't Know

Q36 Do you have crop insurance?

- Yes
- No

Q37 If you have needed financing resources in the last year for your farm's operations or improvements, were you able to acquire it?

- N/A
- Yes
- No

Q38 Do you attend grower meetings to learn about emerging trends in sugarcane?

- Yes
- No

Regulatory Compliance

To the best of my knowledge, I comply with all state and federal regulations as they relate to worker health & safety; pesticide use; chemical handling and disposal; and hazardous waste.

- Yes
- No

Appendix G: Mill and Refinery Survey (Not Implemented)

Regulatory

1- I comply with the following OSHA regulations surrounding worker health and safety:

CHECK ALL THAT APPLY (check boxes)

- Anti-discrimination
- Fair pay
- Protection against pesticide poisoning and injury

Land

2- Does your facility require suppliers (other than sugarcane growers: for example, chemicals suppliers) to meet any environmental impact standards?

(Options: Yes, No, I Don't Know)

3- What type of waste do you dispose of from your mill/ refinery?

RANK FROM MOST TO LEAST BY VOLUME (check boxes)

- Organic waste (cane debris)

- Water
- Chemicals
- Fuel
- Other: _____

3A- Do you have a waste management plan in place to minimize and reduce waste?

(Options: Yes, No, Not Sure)

3B- Do you have a waste recovery plan that utilizes waste materials for secondary use, such as bagasse?

(Options: Yes, No, I Don't Know)

Water

4- Do you have a wastewater management plan?

(Options: Yes, No, Not Sure)

5- What percent of wastewater do you estimate is reused in your mill/ refinery? ____ %

6- How many gallons of wastewater do you estimate is reused in your mill/ refinery? _____ gallons

Air

7- Do you report to CDP (formerly the Carbon Disclosure Project) supply chain? If yes, please skip questions

8-12.

(Options: Yes, No)

8- Have you implemented an energy management plan with established targets for reducing energy consumption and improving energy efficiency?

(Options: Yes, No)

9- Have you identified all sources of GHG emissions?

(Options: Yes, No)

9A- If yes, have you set measurable goals to reduce GHG emissions?

(Options: Yes, No)

10- Approximately how much fuel is used to transport cane to the mill? _____ gallons per ton of sugarcane

11- Approximately how much fuel is used to transport cane away from the mill/refinery? _____ gallons per ton

12- What percent of energy usage comes from renewable energy sources? ____ % OR I don't know

12A- Which of the following renewable energy sources do you use? CHECK ALL THAT APPLY (Check boxes)

- Water
- Wind
- Solar
- Biofuel
- I Don't Know

13- How much energy is used to process cane per ton? _____ kWh per ton

People

14- Have you ever participated in a Sedex Members Ethical Trade Audit (SMETA) audit?
(Options: Yes, No)

15- What percent of the mill/ refinery's workforce is permanent workers? What percent is seasonal workers?
_____ % permanent workers and _____ % seasonal workers

15A- Do permanent workers receive employment benefits (healthcare, paid time off)?

15B- Do seasonal workers receive employment benefits (healthcare, paid time off)?

16- Is there a communicated grievance mechanism for employees to provide feedback?
(Options: Yes, No)

17- Have you undergone a Combustible Dust Training Program?
(Options: Yes, No, Not Sure)

18- How often is equipment inspected for safety?

- Once per year
- Every 6-12 months
- More than every 6 months

Community

19- Does your company participate in or organize opportunities for local community development (for example, volunteering at or fundraising for a local school)? (Options: Yes, No) If yes, please describe.

20- Do you support youth education around farming? (Options: Yes, No) If yes, please describe.

Livelihoods

21- Do you have financial safeguards to protect against losses?
(Options: Yes, No, I Don't Know)

22- Are you satisfied with your system to track production costs?
(Options: Yes, No, I Don't Know)