



Biodiversity Implications of a Sustainability Standard for Sugarcane

Report of the IUCN-convened expert group assessing biodiversity implications of Raízen's implementation of the Bonsucro Standard in Brazil





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Description: Expert group visiting sugarcane fields (foreground) and conservation set-aside (middle of picture frame) near Raízen's Maracaí mill in Brazil.

Page 2 Executive Summary picture credit: Lee Gross, Ecoagriculture Partners.

Description: Expert group visiting Raízen's supplier sugarcane fields in Brazil.

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Executive Summary

As part of its sustainability initiatives, Raízen – a joint venture company between Shell and Cosan, and Brazil’s largest producer of sugarcane-based ethanol – has committed to implement the Bonsucro standard (a standard to improve the sustainability of sugarcane production and processing). IUCN, Shell and Raízen are interested in assessing the biodiversity-related implications and management changes that have resulted from certification to date, and identifying opportunities for improving biodiversity-related outcomes more broadly, as the Bonsucro standard is applied across the company’s entire operations. The principal focus of this assessment was Raízen’s first certified mill in Maracaí and parts of its sugarcane supply chain in the State of São Paulo. IUCN convened an independent expert group with relevant expertise on local wildlife, conservation planning, sustainability standards, and biodiversity indicators. The group was given access to company information and datasets including farming and mill operating practices, and Bonsucro standard verification data. The group reviewed this information to identify practices, management changes, issues, and opportunities relevant to the standard’s biodiversity aspects and Raízen’s operations. The review also included a four day field mission to the Maracaí mill and related sugarcane supply areas.

Raízen’s implementation of the Bonsucro standard has been associated with several important and positive changes at the field, mill, and company management levels. At the same time, the group identified some potential issues and challenges related to the implementation of the standard’s biodiversity-related principles and criteria. With respect to agrochemicals, the group noted efforts to reduce rates of agrochemical application and improve pesticide management. More broadly, the company has put in place systems for tracking conditions and compliance requirements for environmental permits and licenses. Raízen prepared a substantive Environmental Management Plan (EMP) for the Maracaí Mill and its suppliers, including a set of time-bound targets for various environmental management objectives. The group noted that the EMP is an important part of the standard compliance process, but could be strengthened by expanding its scope and specifying indicators for monitoring progress, including in key areas such as water quality monitoring. Finally, with respect to the critical issue of land use and conservation planning, the group did not receive evidence of plans for full compliance with Brazil’s Forest Code (federal legislation) from the Maracaí mill cane suppliers. However, Raízen itself is conducting detailed spatial analysis of its cane supply areas to design plans for full Forest Code compliance and to ensure compliance with the requirements of the Bonsucro standard relative to conservation of High Conservation Value areas.

Looking ahead, the expert group made several recommendations to assist Raízen in effectively achieving Bonsucro certification company-wide while enhancing the biodiversity and other environmental benefits of its sustainability efforts. First, the company should work with its farms and cane suppliers to pursue opportunities to substitute more hazardous agrochemicals with less hazardous ones. In addition to reducing health and environmental risks, such an initiative may help the company stay ahead of evolving national, international, and Bonsucro agrochemical regulations and guidelines. Second, ensure comprehensive EMPs with progress monitoring are in place company-wide. Third, the company should undertake ecologically-based conservation and restoration planning efforts at a landscape-scale to identify the most critical lands and management needs for conservation and restoration. With the prospect of having nearly one million hectares of Raízen-affiliated cane production areas Bonsucro-certified by the end of this decade, the potential benefits of ecologically based landscape planning and cost-effective restoration strategies are substantial. Finally, to help guide and assess such conservation and restoration efforts, the company should join and support long term biodiversity monitoring and research initiatives in and around its cane supply landscapes, such as those now being led by Brazilian universities and research institutes. Through these measures Raízen will demonstrate a strong commitment to embrace the “continuous improvement” philosophy embedded within the Bonsucro standard, and will continue to distinguish itself as a sustainability leader in Brazil’s sugarcane sector.

Background

Formed in 2011 as a joint venture (JV) between Shell and Cosan, Raízen is Brazil's largest producer of sugarcane-based ethanol, sold for domestic consumption as well as export. The company also produces sugar and electricity. As part of its sustainability initiatives, Raízen has committed to adopting the Bonsucro standard for all of its sugarcane processing mills and their raw material suppliers. This commitment was made in 2011 as part of the JV agreement with Shell.

IUCN has a collaborative partnership with Shell on biofuels sustainability, and contributed to sustainability analysis for this JV. Raízen is now progressing with implementation of the Bonsucro standard and has achieved certification for seven mills so far. Drawing on this initial experience, IUCN, Shell and Raízen are interested to assess the biodiversity-related implications and management changes that have resulted from certification to date, and to identify options for improving biodiversity-related outcomes more broadly, as the Bonsucro standard is applied across the company's entire operations.

Bonsucro was launched in 2009 to help improve the social and environmental sustainability of sugarcane production and processing. Through a two-year global consultation process including farmers, industry, and civil society stakeholders, the initiative resulted in the release, in 2011, of the Bonsucro sustainability standard. This standard aims "to improve the social, environmental, and economic sustainability of sugarcane by promoting the use of a global metric standard, with the aim of continuously improving sugarcane production and downstream processing in order to contribute to a more sustainable future"¹. The standard includes five core principles - related to: 1) legal compliance, 2) human rights, 3) production and processing, 4) biodiversity and ecosystem impacts, and 5) continuous improvement - and accompanying criteria with which sugarcane production and processing systems must comply to receive Bonsucro certification. Compliance is verified through annual third-party audits based on a formal process and against a set of indicators embedded in the standard.

Project Objectives

To evaluate the biodiversity implications of Raízen's implementation of the Bonsucro standard, IUCN in October 2012 convened a group of experts in sustainability standards, biodiversity indicators, conservation planning, and related fields. This assessment focused on the company's Maracaí mill, the first mill ever to become Bonsucro-certified. The project had four main objectives:

1. To compile biodiversity-related information from Raízen's implementation of the Bonsucro standard at the Maracaí mill and a portion of its sugarcane supply areas;
2. To interpret this information to identify management changes that did, or may have, resulted in impacts to biodiversity and environmental quality (i.e. water, soil and air), compared to pre-certified conditions where possible;
3. To suggest approaches that can assist Raízen with effective implementation of biodiversity-related principles and criteria of the Bonsucro standard; and
4. To suggest a biodiversity monitoring framework for assessing conservation outcomes of the Bonsucro standard for Raízen in the long term.

¹ <http://bonsucro.com/site/production-standard/>

Report Objectives

This report marks the end of the project and is a synthesis of the expert group's key findings and recommendations. While the group's primary charge was to assess Raízen's implementation of the Bonsucro standard, the timing of the group's work coincided with a public consultation period (January 15 – February 28, 2013) created by Bonsucro to invite feedback on the standard and suggestions for improvement. Thus, IUCN, on behalf of the expert group, also submitted (as a secondary and separate output) comments and recommendations as part of this public consultation process.

The specific objectives of this synthesis report are:

1. To summarise the assessment approach adopted by the expert group;
2. To highlight changes in farm, mill, or business management practices associated with Raízen's implementation of the Bonsucro standard that have or may result in impacts for biodiversity and environmental quality;
3. To present the key findings of the expert group, and make specific recommendations that can assist Raízen with effective implementation of biodiversity-related principles and criteria, as well as recommendations to build on and go beyond the Bonsucro standard to improve biodiversity outcomes and environmental management company-wide; and
4. To suggest a biodiversity monitoring framework for assessing conservation outcomes of the Bonsucro standard for Raízen in the long term.

Assessment Approach and Scope

IUCN convened an expert group with relevant and complementary specialisations (see Annex 1 for expert list, p12), who were given access to relevant information already being collected, including information on farm and mill operating practices, Bonsucro audit/verification data, and existing relevant datasets from secondary sources such as government and research. Satellite data was not made available; however the group obtained satellite imagery of the study area from Google Earth. Based on the stated project objectives, the expert group requested a list of information, and Raízen provided relevant information that could be made available, as a series of documents (see Annex 2 for provided list of information, p13).

The group independently reviewed these documents (according to group member expertise as indicated in Annex 1) to identify practices, management changes, issues, and opportunities relevant to the biodiversity-related Bonsucro principles and criteria (primarily Principles 1, 4 and 5). These observations were synthesized in a common template. The group then participated in a four-day field mission to "ground-truth" its analysis, interview key staff at the Maracaí mill and one of its chief sugarcane suppliers, and present key initial findings and recommendations to Raízen and Shell in Raízen's São Paulo head office (see Annex 3 for a copy of the field trip day's agenda, p14). The overall assessment approach was informed by IUCN Member Ecoagriculture Partners' 2012 publication entitled *Assessing the Ecological Impacts of Agricultural Eco-Certification and Standards: A Global Review of the Science and Practice*².

As noted above, the principal focus of the assessment was Raízen's first certified mill and parts of its supply chain in Maracaí and sugarcane cultivation areas in the State of São Paulo. Given that the Maracaí mill is already Bonsucro certified, the intent of this work was not to conduct an additional audit or verification of the Maracaí mill and its suppliers. Rather, it was to understand the

² http://www.ecoagriculture.org/publication_details.php?publicationID=415

biodiversity implications of Bonsucro certification in this context and to identify opportunities for effectively managing biodiversity impacts at other mill sites, particularly as the company expands the implementation of the standard across all its operations and supply chains.

Main Biodiversity and Environmental Quality Observations in the Maracaí Mill and Supply Areas

Raízen's implementation of the Bonsucro standard has been associated with several important and positive changes at the field, mill, and company management levels. Some of these changes appear to have been made in direct response to the requirements of the Bonsucro standard, and would not necessarily have occurred without the commitment to implement the Bonsucro standard, as detailed below. There were also some gaps observed between the expert group's understanding of the intent of the standard's principles and criteria and the actual implementation of them in the context of the Maracaí mill and its suppliers. The following are key observations based on the expert group's review of information and field observations related to the Maracaí mill and one of its main sugarcane suppliers, as well as additional information shared by Raízen regarding company-level environmental management systems during meetings in São Paulo.

1. **Agrochemicals:** Through the implementation of the standard, positive changes that reduce the risk of environmental and health impacts related to agrochemicals occurred in the Maracaí mill and one of its sugarcane suppliers. These changes included (comparisons based on pre-certified period of 2010-11 compared to post-certified period of 2011-12): inorganic fertilizer application as measured by phosphate-equivalent mass (kg/ha) decreased by approximately 20% and there was an approximate 4-fold reduction in acidifying gaseous emissions – primarily resulting from reductions in diesel consumption (from 6.5 million liters of diesel consumed to 5.8 million liters) and pre-harvest burning areas (from 62% to 37% of supplier sugarcane areas); workers that manage pesticides were trained according to Bonsucro specifications and the Brazilian law; procedures were implemented to deal with pesticide leakages in order to avoid contamination; and, the storage of products containing hazardous residues as well as used pesticide package disposals were improved to reduce the environmental impact and obey Brazilian law. In addition to the standard requirements, the sugarcane supplier was involved with continued and extensive pest monitoring on its farms so as to be efficient with pesticide application. However, interviews with supplier field staff and analysis of pesticide application data for 2011-12 indicate the use of the pesticide endosulfan by them – this pesticide has been listed in Stockholm Convention Annex A since 2011³ as a persistent and bio-accumulative organic pollutant. There are some exemptions for endosulfan use for specific crop-pest complexes, but none of them considers exemptions for its use in sugarcane production. As a signatory member of this convention, Brazil initiated a process of phase-out of endosulfan and its commercialization will be cancelled in July 2013. The Bonsucro Standard defines that pesticides have to be registered for use and must not contain active ingredients listed in the Stockholm and Rotterdam Conventions, and, therefore, Raízen suppliers should not apply endosulfan in their sugarcane fields for Bonsucro compliance.
2. **Environmental Regulatory Compliance:** Raízen's company-wide systems for tracking conditions and compliance requirements of environmental laws, permits and licenses (called Sigma System and Ambito) across its operations, including the Maracaí mill, are important

³ <http://chm.pops.int/Implementation/NewPOPs/TheNewPOPs/tabid/672/Default.aspx> “Technical endosulfan (CAS No: 115-29-7), its related isomers (CAS No: 959-98-8 and CAS No: 33213-65-9) and endosulfan sulfate (CAS No: 1031-07-8) were assessed and identified as persistent organic pollutants.”

systems that can ensure that all operations are in full compliance with the law at all times, as required to achieve and maintain Bonsucro certification (Principle 1). For instance, as a consequence of the implementation of the Bonsucro standard, actions were taken to improve water usage rates to receive water licenses at the Maracaí Mill. However, the group identified one instance of vinasse (cane residue following ethanol distillation) leakage into nearby water bodies at the Maracaí Mill in 2012⁴, but it should be noted that the final legal decision on whether this was insufficient compliance with environmental regulations is still pending. There is also the important issue regarding full compliance with Brazil's Forest Code (federal legislation aimed at conserving and restoring natural habitats). It is dealt with in the context of spatial conservation planning below.

3. Development of plans and systems for spatial zoning of agricultural operations and conservation set-asides: Bonsucro certification requires compliance with Brazil's Forest Code, which mandates rural landowners such as sugarcane farmers to conserve or restore a portion of their land as natural habitat. To address this requirement, Raízen is conducting high-resolution mapping and spatial analysis of its own farms to identify the requirements for land conservation and restoration according to the Forest Code. This new mapping and analysis capacity should also help the company comply with the Bonsucro prohibitions on conversion of high conservation value (HCV) areas on lands that supply certified mills (Bonsucro Criterion 4.1 prohibits the certification of any operation sourcing sugarcane from HCV lands converted or destroyed after a cut-off date of 1 January 2008). However, specifically in the case of the Maracaí mill, the expert group did not find evidence of plans for full Forest Code compliance by the sugarcane supplier visited – including plans for set aside areas and reforestation activities. Bonsucro had granted a temporary exemption to the requirement of legal compliance in the case of the Forest Code in 2011-12. It should be noted that this exemption has now expired and the supplier will need to demonstrate plans for Forest Code compliance by the next Bonsucro audit to be in compliance with Principle 1.
4. Environmental Management Plans (EMPs): Bonsucro requires certified entities to prepare and implement an Environmental Management Plan (EMP) to address endangered species, habitats, and ecosystems, as well as ecosystem services and invasive species (Bonsucro Criterion 4.1). Despite the lack of detailed guidance from the Bonsucro standard as to the requirements of the EMP (Criterion 4.1, Appendix 4), the company prepared a substantive EMP for the Maracaí Mill and its supplier, including a set of time-bound targets for implementing improved practices related to several conservation and environmental management issues. For example, the EMP for current conservation areas includes a fire brigade with consistent results as there was no sign of recent fires in the conservation areas visited by the group in spite of pre-harvest fires being used widely until recently. However, the expert group noted that information on progress towards achieving the targets set in the EMP was absent. The EMP for the Maracaí Mill and its supply areas could be further improved by: 1) including an appropriate monitoring system to assess progress towards these targets; 2) providing additional detail on water quality monitoring to comply with Criterion 4.2 and further guidance related to mitigating soil loss through conservation techniques; and, 3) further specify plans for protecting and restoring riparian areas, wetlands, and other natural habitats (as was done with fire management). With these changes, the EMP could function as a more comprehensive, operational document for environmental management of the mill and its upstream supply chain.

⁴ CETESB *Auto de inspeção* Nº 1451938 (30/10/2012), open to public access.

Key Recommendations for Raízen at the Company-Wide Level

Raízen's experience at the Maracá mill and other recently certified operations can provide valuable learning to inform the company's efforts to certify all of its operations and supply chains and meet its stated sustainability commitments. Key biodiversity-related recommendations to assist Raízen in achieving Bonsucro certification company-wide, while simultaneously improving its environmental performance, are presented below. Continuous improvement of social and environmental performance is integral to the Bonsucro standard as per Principle 5. Commitment to continuous improvement of social and environmental performance will also enable Raízen to distinguish itself as a sustainability leader, retaining a differentiated position even if and when the rest of the sugarcane sector "catches up" by seeking Bonsucro certification or a similar standard of sustainability. For each recommendation, potential benefits for Raízen are identified.

1. Substitute more hazardous agrochemicals with less hazardous ones

As evidence improves on impacts of agrochemicals on human and environmental health, best practices, laws, and international norms related to agrochemicals are continually evolving. Overall, these frameworks favour agricultural practices that reduce the quantity of agrochemical use, substitute more toxic substances with less toxic ones, and improve the targeting and precision of agrochemical use to minimize non-target impacts. To remain a sustainability leader, Raízen should aim to position itself "ahead of the curve" on best practices related to agrochemicals. This would entail, for instance, adhering to forthcoming changes in international norms and following the systematic classification of toxicological and environmental hazards (provided by the Brazilian ministries of agriculture, health, and environment) towards substitution of more hazardous compounds currently being used with less hazardous compounds. In some cases, such best practices may be more stringent than the Bonsucro agrochemical requirements, but there are important benefits to be gained.

In Brazil, one practical option would be to follow the Toxicological Classification and the Environmental Classification of commercial pesticide formulations defined by the Ministério da Saúde (Ministry of Health) and Ministério do Meio Ambiente (Ministry of Environment), respectively, and that are available in every pesticide label and leaflet, or in AGROFIT⁵, the online pesticide portal of the Ministério da Agricultura, Pecuária e Abastecimento (Ministry of Agriculture). The intent would be to replace 'Extremely Toxic' (Toxicological Class I) compounds for 'Highly Toxic' (Toxicological Class II) compounds for 'Moderately Toxic' (Toxicological Class III) compounds for 'Slightly Toxic' (Toxicological Class IV) and/or replace compounds that are 'Highly Dangerous to the Environment' (Environmental Class I) to 'Very Dangerous to the Environment' (Environmental Class II) to 'Dangerous to the environment' (Environmental Class III) to 'Slightly Dangerous to the Environment' (Environmental Class IV) and so on. An examination of pesticide commercial formulations employed in the supplier sugarcane fields in 2011-2012 indicates potential opportunities for this kind of reduction in toxicity of their agrochemicals.

As mentioned earlier, the Bonsucro Standard already defines that pesticides have to be registered for use and must not contain active ingredients listed in the Stockholm and Rotterdam Conventions. These are international conventions banning or severely restricting the use of persistent organic pollutants and as such represent the very minimum standard for pesticide restriction for those implementing the Bonsucro standard. It is therefore highly desirable that Raízen goes beyond this standard in using whenever possible and appropriate

⁵ http://extranet.agricultura.gov.br/agrofit_cons/principal_agrofit_cons

biological control, setting action thresholds to start chemical control and, when using chemical control, selecting compounds that are less hazardous to human and environmental health.

Potential business benefits:

- Reducing health risks for employees and communities
- Preparing for, and reducing transition costs from, regulatory updates
- Protecting biodiversity beneficial for crop productivity
- Demonstrating “best in class” practices related to agrochemical use and management

2. Ensure comprehensive environmental management systems are in place company-wide

Ensuring effective company-wide systems are in place for tracking environmental regulatory compliance requirements, implementing EMPs and monitoring their constant progress as well as refinement, and for collecting and analysing environmental results and data, will deliver comprehensive and streamlined environmental management systems - Raízen’s Sigma System and Ambito for tracking environmental compliance requirements and its Sustainable Development (SD) data tracking system are good examples of such systems, but improvements can be made. As mentioned before, a high standard for EMPs is essential as it is one of the central planks for the delivery of an effective company-wide environmental management system. According to Raízen, the company is currently in the process of establishing a standardized template for mill-level EMPs and is benchmarking all existing EMPs against this template to ensure a consistent and effective approach to environmental management across the company. This process should help facilitate Bonsucro compliance and improve environmental outcomes, provided that a high standard for EMPs is established – the three specific improvements suggested for the Maracaí mill EMP in the previous section (p6, EMP bullet): monitor target progress, address water and soil gaps, and specify plans for protecting natural habitat, should be considered for inclusion in Raízen’s EMP benchmarking process.

Raízen has devoted considerable efforts to the design of EMPs as part of Bonsucro compliance, but further development is needed to ensure that these EMPs are comprehensive, operational, and measurable. EMPs should provide the means to verify outcomes and should be operational in terms of providing specific steps with specific timelines to mill and farm managers. For example, Raízen can consider reporting periodically on specific areas of lands set aside for conservation to indicate progress towards conservation set-aside targets established in the EMPs). The current plans provide a framework for measures and activities to be taken, but additional clarity is needed to understand with whom the responsibility for measures lies and against what targets these individuals/measures are assessed. To ensure compliance by operators throughout the supply chain, EMPs should include indicators to measure progress towards time-bound targets, which can be assessed on a regular basis through Raízen’s Sustainable Development (SD) data tracking system by operators from the field to the corporate office, to analyze and report on the performance outcomes of EMPs.

Potential business benefits:

- Being a first-mover on compliance as environmental regulations become more stringent
- Reducing costs from environmental compliance requirements
- Identifying and sharing best practices and increased comparability of results across business units
- Marketing and communicating credible environmental results to stakeholders

3. Maintain and improve conservation value at the landscape-level

As noted earlier, Brazil's Forest Code requires the conservation and/or restoration of natural habitats on farm properties as per federal legislative requirements. Bonsucro certification provides an additional compliance mechanism beyond the Brazilian regulatory process. As Raízen seeks certification for its remaining mills over the next several years, it will therefore need to comply with this law, including through the establishment and implementation of land conservation and restoration plans on portions of the approximately one million hectares from which the company expects to source sugarcane by the latter part of this decade. Cumulatively, these actions may result in significant habitat protection and restoration. However, the overall value of this habitat for biodiversity protection and the provision of ecosystem services will depend strongly on the type, configuration, and quality of habitat conserved or restored. Well-designed conservation reserves could benefit agricultural productivity by maintaining clean water supplies and supporting biological pest control. On the other hand, habitat restoration could constitute a major cost for Raízen and its suppliers. These considerations present both a strong conservation case and a strong business case for strategically selecting and managing conservation set-asides for maximum benefit, and to focus on cost-effective restoration actions. Specific recommendations include:

- a. Define a clear methodology for assessment of High Conservation Value (HCV) areas in Raízen's own properties, supplier farms, and new conversion and acquisition of lands (as required by Bonsucro criterion 4.1). Raízen could work with Brazilian conservation organizations or other qualified groups, following and building on established guidelines and norms, to define a clear and consistent methodology for the identification and assessment of HCV areas.
- b. Conduct landscape-level analysis (i.e. spatial mapping) of Raízen's and third-party suppliers' sugarcane supply areas to identify mandatory set-aside areas (e.g., HCV areas and environmental protection areas pursuant to the Forest Code) as well as other habitats previously identified as a high priority for conservation (e.g., areas designated in government land-use plans, maps, or prior conservation inventory and planning exercises). In addition to these conservation set-aside areas, where additional large or high-quality remnant habitat patches remain in a production landscape, concentrate on protecting these areas as the foundation of a Forest Code compliance strategy. Such areas will typically provide significant conservation value and may be more self-sustaining as ecosystems, requiring less restoration work or other intervention.
- c. "Core" conservation areas should then be buffered and connected by ecological corridors to the extent possible. To improve landscape connectivity, prioritize the conservation and restoration of wide vegetated riparian zones, which typically provide multiple ecosystem services and can service as habitat patches (for smaller animals) and corridors (for larger animals) in fragmented landscapes.
- d. In landscapes where there is currently little natural vegetation, restoration will be required to comply with the Forest Code. In these instances, an important and cost-effective first step may be to incorporate in and around farmland small patches of natural or semi-natural vegetation with high potential for ecosystem service values, such as erosion control, water purification, and supporting biological pest control (natural pest enemies). These could include taking out of production marginal lands such as steep slopes, perennially wet depressions, and soil or geological anomalies that are less suitable for agriculture but may be able to support unique vegetative communities. In addition, farm managers should consider installing hedgerows or live fences along roads and in other places where they serve to reduce wind velocity and provide habitat for beneficial insects.

- e. Additional lands designated for restoration should, where possible, be configured to provide several large patches of habitat that are interconnected by riparian zones or other linear areas of natural or semi-natural habitat. Patch size should be calculated and planned to provide a substantial amount of natural habitat exclusive of edge effects (the boundary zone of a natural habitat patch that is typically degraded due to being adjacent to modified land uses such as agriculture).
- f. Land managers should consult local ecological experts when developing restoration plans. Local ecological stations and/or local universities and research institutes are good places to seek such expertise from (as confirmed at the Assis Ecological Station during the field trip). Frequently, it is appropriate and much more cost-effective to enable restoration to proceed mainly through natural colonization, with some management assistance. For example, in the area surrounding the Maracaí Mill, abandoned pastures undergo much faster secondary succession than abandoned agricultural fields due to richer seed bank, re-sprouting of underground plant vegetative parts, and greater permeability of the landscape to animal seed and fruit dispersers. Therefore when habitat restoration away from stream edges is necessary, selecting pastoral sites rather than agricultural fields may be more economically and ecologically viable. However, on some sites, importation and planting of particular species will be required, or more intensive efforts will be needed to avoid dominance of invasive species.
- g. Fire must be carefully controlled and managed to maintain or enhance the ecological integrity of conservation lands. The suspension of pre-harvest burning on mechanically harvested fields will reduce the risk of unintentional burning of natural habitats – the current fire management regime is effective and Raízen is encouraged to continue and maintain it to avoid uncontrolled fire occurrences on native vegetation areas. Raízen should also consider the need to work with its suppliers to institute burning protocols where fire is still used in hand-harvested crops. In certain instances, it may be appropriate to use fire as a restoration and habitat management tool in fire-adapted ecosystems such as those in the Cerrado biome. However, such use of fire should be designed and conducted in cooperation with ecologists possessing detailed knowledge of the focal ecosystems.

Potential business benefits:

- More targeted restoration approaches that could reduce overall costs/optimize efforts
- Maintain/enhance water quantity and quality
- Protect biodiversity beneficial for crop productivity (incl. pest reduction)
- Improve the ecological functions of the agricultural landscapes

4. Support and join long term biodiversity monitoring and research initiatives

The Bonsucro standard requires certified entities to manage biodiversity as part of an Environmental Management Plan. This should include biodiversity monitoring to understand and adaptively manage the negative and positive impacts of land management (i.e., sugarcane production areas and natural and semi-natural lands) on biodiversity. Instead of conducting its biodiversity monitoring in isolation, Raízen and its suppliers will benefit from collaborating with researchers, research centres, and established long-term monitoring programs to develop and apply consistent monitoring approaches that track the most meaningful biodiversity indicators in the most cost-effective manner. In addition, such collaboration could facilitate linkages between biodiversity monitoring in sugarcane production areas to monitoring in nearby natural reserves and at larger scales, to understand the contribution of Bonsucro-certified production areas to landscape- and regional-scale biodiversity conservation. Such monitoring will help support the

quest of conservationists and sustainably managed businesses to make agricultural landscapes more “multi-functional” by providing high levels of commodity production as well as significant conservation value for native species and ecosystem services. The inclusion of agricultural landscapes composed of sugarcane fields and natural, semi-natural and restored habitats, within a long-term biodiversity monitoring program could serve as the basis for the documentation of how much wildlife habitat is being supported and restored in such landscapes by Raízen. One example of a relevant emerging research initiative is the long-term biodiversity monitoring program currently being planned by the Biota Program⁶, of the São Paulo Science Foundation (FAPESP). This initiative will facilitate collaboration between scientists and also other stakeholders. Raízen could position itself as a pioneer in scientifically-based ecological management within the ethanol sector by participating in a program such as this.

The biodiversity monitoring program has to be carefully designed so as to combine cost-effectiveness with resulting strong biodiversity datasets. This includes defining a network of sampling sites and/or stations to be surveyed over time, defining sufficient sample sizes and sampling effort for sound statistical analyses, and choosing a set of indicator taxa (groups of organisms) or assemblages that are known to be responsive to environmental change. Otherwise the monitoring program may become unfocused and changes in species composition and/or species densities over time and space will not be interpretable in terms of improved environmental changes deriving from Raízen’s commitment to better land management practices. For the same reason, biodiversity monitoring should be coupled with relevant habitat, landscape and abiotic characterization for improved interpretation of biodiversity trends over time and space.

Potential business benefits:

- Reducing costs from standardized and periodic species surveys
- Partnerships with research institutions, NGOs provide access to additional expertise
- Marketing, communication and relationships: demonstrating that business can be part of the solution for conservation with robust scientific evidence.

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⁶ <http://biota.org.br>

Annex 1: Experts List

Experts	Main Expertise	IUCN Affiliation	Report Types Reviewed
<p>Dr. Luciano Verdade: Associate Professor, University of São Paulo</p> <p>Dr. Jeffrey Milder: Conservation Scientist, Rainforest Alliance, USA</p>	<p>Terrestrial wildlife, agricultural impacts</p> <p>Standard impact analysis (biodiversity), spatial analysis/GIS, landscape ecology</p>	<p>Member of IUCN's Species Survival Commission (SSC)</p> <p>NGO Member</p>	<ul style="list-style-type: none"> - Environmental licenses for mill operations - Habitat quality, baseline information from secondary sources - Audit reports - Bonsucro calculator - Spatial analysis
<p>Dr. Luis Schiesari: Associate Professor, University of São Paulo</p> <p>Mr. Edegar de Oliveira Rosa, Project Manager, WWF Brasil, Brasilia</p>	<p>Freshwater wildlife, agrochemical impacts</p> <p>Bonsucro standard, Biodiversity Management Plans for agriculture & forest code regulations in Brazil</p>	<p>Affiliated with an SSC Member</p> <p>NGO Member</p>	<ul style="list-style-type: none"> - Water quality information - Bonsucro preliminary environmental report - Bonsucro audit report - Environmental Impact Assessments - Bonsucro calculator - Agrochemical data - Environmental Management Plans/Environmental Action Plans
<p>Mr. Leandro Baumgarten: Science Manager, The Nature Conservancy, Brasilia</p> <p>Mr. Lee Gross: Project Manager, Agricultural Markets & Biodiversity Specialist, Ecoagriculture Partners, USA</p>	<p>Conservation planning, High Conservation Value Area assessments, Brazilian forest code regulations</p> <p>Standard impact analysis (biodiversity and livelihoods), High Conservation Value Area assessments, Monitoring & Evaluation systems</p>	<p>Member of IUCN's Commission for Ecosystem Management (CEM) + NGO Member</p> <p>NGO Member</p>	<ul style="list-style-type: none"> - HCVA information - Environmental Management Plans/Environmental Action Plans - Environmental Impact Assessments - Secondary sources - Environmental compliance, landscape-level

Annex 2: Provided List of Information

For the Maracaí Mill, including its supply chain:

1. Bonsucro audit report
2. Preliminary environmental report
3. Industrial mill location map with natural vegetation and surface water information and sugarcane plantation maps with regional land use and surface water information
4. Environmental Management Plans
5. Environmental Action Plans
6. Bonsucro Calculator data and supporting standard compliance evidence from sugarcane supplier
7. Quantitative and qualitative information of land and mill management practices including types of pesticides and their doses of application (mass per unit area); types of fertilizers and their doses of application; chemical composition of vinasse employed (as chemical composition of vinasse is highly variable); volume and chemical composition of mill effluents; water use; measures to control erosion.
8. Environmental Impact Assessments
9. Copy of Environmental Licences (with conditions)

Landscapes/regions including and around the Maracaí Mill and its supply chains:

10. Secondary sources available for the study area (i.e., the mill's supply shed and its surroundings), such as studies by government, universities or NGOs on land cover change, flora & faunal inventories and assessments, watershed assessments, maps of legal land designations: main source was information from the Assis Ecological Station.

Note: Some additional information was requested but not available. For example, High Conservation Value (HCV) area information and GIS information about the sugarcane farms and landscape context was requested by the expert group but was not available from the sugarcane supplier. No HCV area information was prepared for Bonsucro certification at the Maracaí Mill as there has been no conversion of land to sugarcane after 2008 for the Maracaí Mill supply base; and no GIS information about the sugarcane farms and landscape context was available from the sugarcane supplier.

Annex 3: Agenda of Field Day Visit

Part 1: Estação Ecológica de Assis Visit		
08:00 – 10:00	<ul style="list-style-type: none">• Target of visit: HCV and Preserved areas within region of Maracaí Mill	Lead: Guide from ecological station
Part 2: Sugarcane Supplier Visit		
10:00 – 14:00	<ul style="list-style-type: none">• Target of visit: Sugarcane fields focused on natural fragments, Preserved areas, restored riparian zones ongoing or consolidated.	Lead: Sugarcane Supplier Managers
Part 3: Raízen Maracaí Mill Visit		
14:00 – 18:00	<ul style="list-style-type: none">• Target of visit: Industrial site, focused on vegetal fragments, Preserved areas, restored riparian zones ongoing or consolidated.• Visit to the factory	Lead: Raízen staff
End at 18:00		



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