2014

Guidance for the Production Standard

including Guidance for the Bonsucro EU Production Standard

Version 4.0 September 2014

Acknowledgement

The Bonsucro Secretariat would like to express their gratitude to the participants of the Standard Revision Committee (SRC)* who have dedicated time, knowledge and passion to this two-year project. Without their guidance, advice and decisions, the Production Standard and Guidance would not have achieved the expected improvement and relevance to the sustainability hotspots within the sector. The Secretariat also thanks their companies who have allowed their employees to share their resources with Bonsucro.

The Secretariat also thanks the industrial members** who have accepted to receive the Bonsucro team and their chosen certification bodies to carry out the pilot audits. Their collaboration has ensured the revised Standard and Guidance are practical tools that can be implemented in the field.

The Secretariat would like to thank all the Bonsucro members and licensed certification bodies who have shared their experience and knowledge with the SRC and ensure the resulting Standard and Guidance are in line with the reality of the industry.

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London 21st July 2014

Nicolas Viart

Bonsucro Head of Sustainability

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Previous SRC members: Beatriz Secaf (UNICA), Luiz Amaral (UNICA), Allan Rankin (BP), David Howson (Bacardi).

***Mills and their supplying farms who participated to the pilot audits: DC Bioenergia S.A., EID Parry India Ltd, Bunge- Usina Moema Açúcar e Álcool Ltda, New South Wales Sugar Milling Cooperative Ltd, Bundaberg Sugar Ltd, Azucarera del Norte S. A..*

This document is written in English. Bonsucro will base all of its interpretation and decisions upon the English version. Bonsucro does not assume any liability for errors or misunderstandings introduced when this document is translated into other languages.

Bonsucro (trading name of Better Sugarcane Initiative Ltd.) is responsible for this document. The Guidance for the Bonsucro Production Standard is a living document and will be reviewed on an on-going basis for continued relevance and effectiveness.

Bonsucro Standards are reviewed at least every five years. The next review of the Bonsucro Production Standard is scheduled for September 2019.

The current standard was approved by the Bonsucro membership on 1st August 2014. It becomes effective from 21st September 2014.

From 26th September 2014 onward, non-certified mills who wish to become Bonsucro certified must be found in compliance with the revised Bonsucro Production Standard version 4.

Certified mills which audit is planned between 26th September and 1st January 2015, will have the possibility to choose to be audited against version 3 or version 4 of the Bonsucro Production Standard

Bonsucro certified mills must be in compliance with the revised Bonsucro Production Standard from 21nd September 2015 onward.

Bonsucro encourages its stakeholders to share their views regarding the Standards. Any comments on this document can be submitted to info@bonsucro.com and via the Bonsucro website: www.bonsucro.com.

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1. Introduction

Bonsucro

Bonsucro is a global multi-stakeholder non-for-profit initiative dedicated to reducing the environmental and social impacts of sugarcane production while recognising the need for economic viability. The mission of Bonsucro is to achieve a sugarcane sector that is continuously improving and verified as by acting collaboratively within the sector and working to continuously improve the three pillars of sustainability: economic, social and environmental viability. Bonsucro aims to achieve this mission through providing the definition for sustainable sugarcane and all sugarcane derived products through a multi-stakeholder approach. Bonsucro also aims at ensuring the integrity of the implementation of the Bonsucro Production Standard, through the implementation of the Certification Protocol.

Objective of The Guidance for the Production Standard

The primary purpose of this document is to provide farmers and millers with guidance and clarification on the indicators of the Bonsucro Production Standard. It also provides additional requirements, the implementation of which will support conformity with the Bonsucro Production Standard. It serves as guidance on how to implement the Standard at the mill and farm level. This Guidance document provides guidance through:

1. Description of the reason why the indicator was introduced in the Bonsucro Standard
2. Objective targeted when indicator is found compliant
3. Implementation information to become in compliance with the indicator
4. Information relating to exceptional situations
5. Details of the methodology of compliance of the metric indicators (although for full details, the reader shall refer to the Bonsucro Calculator).

The guidance also provides auditors with detailed information on what is expected from the operators.

History of the Document

Version 4.0

In June 2012, upon the recommendation of the Bonsucro Secretariat, the Board of Directors agreed to start the revision process of the Bonsucro Production Standard and Guidance. The Board instructed the Secretariat to follow the Standard Revision Procedure set up in line with the ISEAL Code of Best Practice for Standard Setting. The Secretariat called for the participation of Members,and one representative of each class of membership formed the Standard Revision Committee (SRC). The SRC first met in London in November 2012. The committee subsequently met remotely, and once in person in New Orleans in November 2013. The SRC was given the task to draft the new version of the Bonsucro Production Standard and Guidance. They based their work on six public and online consultations, six pilot audits and the involvement of several external consultants and technical experts. Each meeting was minuted and minutes were made public on the Bonsucro website.

A total of 6 public consultations to which 402 people participated were carried out during the project.

Nov 2012:	1st consultation (London)
Jan 2013 – March 2013:	2nd public consultation (online)
Nov 2013:	3rd consultation (New Orleans)
Dec 2013 – Jan 2014:	4th consultation (online)
Feb 2014:	5th consultation (India)
June 2014:	6th consultation (online)

A total of six pilot audits involving six Bonsucro Member mills and their supplying farms have taken place:

February 2014: Brazil

March 2014: India

April 2014: Brazil

April 2014: Australia (2)

May 2014: Honduras

On **1st August 2014**, the Bonsucro membership adopted the present standard.

Revision round	Date	Description of amendment
A	June 2010	Draft version sent to Bonsucro EU Sub Committee
B	July 2010	Final version approved by Bonsucro Management Committee
C	December 2010	Revision made based on compliance with EU RED
D	February 2011	Revision made based on compliance with EU RED
Draft version 2.0	November 2013	First draft open for public consultation
Draft version 2.5	June 2014	Second Draft open for public consultation
Draft version 2.9	July 2014	Final draft published for vote by members

Version 4	July 2014	Revised Bonsucro Production Standard and Guidance with inclusion of new indicators and clarification added to the guidance document which became a guidance for implementation. 16 core indicators over 8 criteria 12 new indicators (added or replacing other indicators) 2 indicators which value were modified 2 indicators removed Removal of Principle 7 – Chain of Custody

2. Scope

The Bonsucro Production Standard applies worldwide to any sugarcane mill and their supplying area wishing to sell sugarcane derived products as Bonsucro certified and make related claims. The Standard evaluates the outcome of practices implemented at mill and farm levels.

The Bonsucro Certification System makes a distinction between 2 certification options:

1. "Bonsucro": compliant with Bonsucro requirements
2. "Bonsucro EU": compliant with Bonsucro requirements PLUS additional requirements that are needed for EU RED compliance (in line with the EU Renewable Energy Directive (RED) 28/2009/EC – its similar provisions in the EU Fuel Quality Directive (FQD) 30/2009/EC)

Within the Bonsucro Certification System documents (i.e. Standards, Guidance, and Certification Protocol) the extra Bonsucro EU requirements are clearly marked.

For certification against Bonsucro EU, the Bonsucro requirements PLUS all additional EU RED requirements must be met. Achieving Bonsucro EU certification is equivalent to achieving Bonsucro certification. Whereas the contrary does not apply; achieving Bonsucro certification is not equivalent to achieving Bonsucro EU certification.

3. Referenced Publications

Bonsucro Production Standard

Bonsucro Chain of Custody Standard

Bonsucro Certification Protocol

Bonsucro calculator

ISEAL Code of Good Practice for Setting Social and Environmental Standards

ISO/IEC 17065:2012 – conformity assessment – Requirements for bodies certifying products, processes and services

ISO/IEC 17021:2011 – Conformity Assessment – Requirements for bodies providing audit and certification of management systems

PAS2050:2008 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources

4. Definitions and Abbreviations

NOTE – Consensus should be the result of a process seeking to take into account the views of interested stakeholders, particularly those directly affected, and to reconcile any conflicting arguments. It need not imply unanimity. (Adapted from ISO/IEC Guide 2:2004)

Consensus: General agreement, characterized by the absence of sustained opposition to substantial issues by any important stakeholder group.

Farm: Operator producing the sugarcane which is delivered to the mill.

Mill: Operator that applies for certification. The mill has the ultimate responsibility for compliance with the Bonsucro Standard.

Operator: Farm or mill. Entities that are responsible for the undertaking and contracting activities related to the sugarcane growing and processing, including transportation.

Stakeholder: Individual or group that has an interest in any decision or activity of an organisation (from ISO 26000)

Standard: Document that provides, for common and repeated use, rules, guidelines or characteristics for products or related

processes and production methods, with which compliance is not mandatory. (Adapted from Annex 1 of the WTO TBT Agreement)

Abbreviations:

EIMP: environmental impact and management plan

ESIA: environmental and social impact assessment

FPIC: Free Prior Informed Consent

GHG: greenhouse gas

HCV: high conservation value

LUC: land use change

PPE: personal protective equipment

For further definitions, see Annex 1.

5. Framework for auditing

The Bonsucro Certification System

The Bonsucro Certification System consists of 3 main elements:

1. Standards: Bonsucro has developed 2 standards:
   - The "Bonsucro Production Standard" contains principles and criteria for achieving sustainable production of sugarcane and all sugarcane derived products in respect of economic, social and environmental dimensions..
   - The "Bonsucro Mass Balance Chain of Custody Standard" contains a set of technical and administrative requirements for enabling the tracking of claims on the sustainable production of Bonsucro sugarcane and all sugarcane derived products along the entire supply chain from fields to mill including transportation; through to production (e.g. conversion, processing, manufacturing, transformation), to warehousing, transportation and trade, to the use of sugarcane and all sugarcane derived products.
2. Guidance for implementation:
   - Bonsucro has developed guidance documents for members that provide further information on how to become compliant with the Bonsucro Production Standard and/or Chain of Custody Standard.
3. Certification Protocol: Bonsucro has developed a Certification Protocol for auditors that lists the process and procedures for certification against the Bonsucro Standards. This includes: 1.) rules and requirements for independent Certification Bodies to audit against the Bonsucro standards, and 2.) audit procedures for independent Certification Bodies to verify compliance with the Bonsucro Standards.

Together, these 3 elements form the Bonsucro Certification System. As such, these individual documents must always be used in relation to each other.

Unit of certification

✓ The certificate holder is the mill.

✓ The unit of certification is the mill and its cane supplying area and includes all relevant activities on the farms, mill site, including by-product production and power export.

✓ The mill has the ultimate responsibility for compliance with the Bonsucro Standard.

✓ The cane supply area included in the unit of certification comprises of the farms/estates supplying cane in conformity with the Bonsucro Standard. This may be 100 % of the farms/estates supplying cane to the mill, or a lesser number. In the latter case only a respective percentage of the mill's production would be considered as Bonsucro certified.

✓ The total area included in the unit of certification and used for cane production, not just the area harvested in the reporting period, is used in assessing the cane supply area.

✓ To guarantee that the sugarcane included in the unit of certification is actually processed by the mill, the mill must have a management system in place to ensure that the sugarcane processed at the mill is coming from a given field included in the unit of certification.

✓ If the mill is purchasing sugarcane, sugar or biofuel not produced within the unit of certification, it shall demonstrate that the sources of production fulfil the requirements of the Bonsucro Production Standard.

Certification process

✓ Audits are conducted on the mill and on a sample of individual farms/estates in the cane supply area supplying cane to the mill as per the sampling methodology outlined in the Bonsucro Certification Protocol.

✓ In order to achieve certification with the Bonsucro Production Standard:

- Full compliance with the 16 core indicators (plus Principle 6 for certification against Bonsucro EU) is required, plus
- A minimum of 80 % of all the indicators must be satisfied. To be considered satisfied, an indicator which applies to mill and farm must be met by both entities.

✓ A mill that applies for certification against the Bonsucro Standard must also apply for certification against the Bonsucro Chain of Custody Standard. A certificate can only be issued when the mill is found compliant with both Standards. A mill can't be issued a Bonsucro Production Standard certificate without being in compliance with the Chain of Custody Standard.

✓ The result of the audit will be a volume of the Bonsucro certified sugarcane products based on a proportion of sugarcane supplied to the mill.

✓ The certification decision will be based on the result provided by the Bonsucro Calculator (see tab "output summary"). Data must be collected by growers and millers and verified during the audit process.

✓ The audit will be performed according to the frequency defined by Bonsucro in the Certification Protocol

✓ The audit must be performed by Bonsucro Licensed Certification Bodies.

For more certification requirements see the Bonsucro Certification Protocol

6. Guidance to the Bonsucro Production Standard

Principle 1 – Obey the Law

Criterion 1.1 To comply with applicable laws

1.1.1 National laws complied with

CORE INDICATOR

Comment: *National laws include State, Provincial and Municipal laws as well as licensing and permit to operate.*

Note that in some cases, the Standard can go beyond the national laws and in such cases, the Standard shall prevail. In some cases the Standard contradicts or contravenes national laws, in which case, national laws shall prevail. Therefore the strictest requirement shall prevail. The scope of the legal assessment shall match in the scope of application of the Bonsucro standard:

- ✓ Waste, Pollution & Environmental Protection;
- ✓ Nature Conservation & HCV Area Protection;
- ✓ Water Quality & Extraction;
- ✓ Energy & GHG emission;
- ✓ Labour Conditions;
- ✓ Operational Health & Safety;
- ✓ Social Wellbeing;
- ✓ Land and water Title and Land and water Use Rights;
- ✓ Soil Protection;
- ✓ Agricultural and processing practices (including storage, handling and application of fertilizers and agro-chemicals);
- ✓ Transportation.

Objective: To ensure that relevant statutory requirements are met and complied with.

Guidance for implementation:

Mills and farmers must demonstrate awareness of, and compliance with, national legal obligations with respect to the criterions in this Standard. They must have knowledge of the content of the legislation (what is it about, and the key requirements or proscriptions of the specific laws). The operators shall use a system to identify and access applicable laws and get updates from national and local agencies and Government. The system can be maintained internally or managed externally, be paper-based or computer-based.

If national exemptions apply, the operator shall record them.

The operator shall report to the auditor cases where requirements of the Standard come into conflict with national legislation.

The operator shall keep record of any court convictions and any non-compliance fines incurred during the year preceding the

assessment as well as the corrective actions resulting from them.

Criterion 1.2 To demonstrate clear title to land and water in accordance with national practice and law

1.2.1 The right to use land and water shall be demonstrated

CORE INDICATOR

Comment: *Land use includes farming, building storage and production facilities.*

Right to water refers to the right to extract and use water from the environment (either surface or underground water).

ILO Convention No. 169 addresses issues related to indigenous and tribal peoples: the rights of ownership and possession over the lands they traditionally occupy, or have had access to (Article 14); land alienation (Article 17); unauthorized intrusions (Article 18); agrarian programs (Article 19).

ILO Convention No. 117 (Article 4) requires the enforcement of the ownership and use of land resources with due regard to customary rights.

In some countries, right to land use, management and ownership are governed by customary law (set of usually unwritten rules recognised or not under national law). Customary land tenure systems vary significantly across communities (e.g. collective ownership, traditional land distribution by tribal chieftain).

Objective: Demonstrate operator's right to own and/or use land and water and prevent conflict on land use right.

Guidance for implementation:

The operator shall identify the local communities and their use of lands and water to identify relevant customary and statutory land users and their rights. This can be achieved by mean of stakeholder consultation, historical data or legal ownership or lease data (land use). This would help the operator to prevent the occurrence of conflict on land or water use.

The operator shall demonstrate its statutory or customary land and water rights.

Evidence of ownership and/or use rights to the land and water includes land title, legal evidence of ownership or lease of land which shall be the official land title in the country or equivalent (e.g. notary, government agency, tax invoices or other), lease contract. The evidence should primarily be written evidence but where customary rights are involved, it is recognised that rights can be evidenced in other forms by a local statutory or customary body.

Evidence of right to the use of water includes possession and compliance with relevant water permits, including compliance with any cap on quantity of extracted water.

When statutory, customary or user right of land has been relinquished (for example if the land has been sold or rented out) by a third party to the benefit of the operator, the operator shall demonstrate that the decision was:

taken by Free Prior Informed Consent taking special care of collecting the views of affected parties and vulnerable groups, including, but not limited to, women

negotiated (potentially including provision for fair compensation).

Relinquishing right of land use can be of the form of selling land or delegating control to other parties. In the process of relinquishing title to the land, the operator shall exercise no pressure or eviction using extra-judicial and illegal forces.
In cases where the operator is involved in a conflict on right to use land or water with local communities, the operator shall carry out actions which aim to resolve such a conflict. The operator shall involve an independent third party authority such as government or local agencies, in the process. The operator shall use stakeholder consultation to achieve a negotiated resolution of the conflict (potentially including provision of fair compensation) based on Free Prior Informed and documented Consent as stated in indicator 5.8.1. The operator shall have a clear and communicated objective of definitively settling the dispute and preventing its repetition.

1.2.2 Land that is legitimately contested by other users

Comment: *The indicator applies to the operator using the land.*

Based on ILO Convention No. 169 which addresses issues related to indigenous and tribal peoples (the rights of ownership and possession over the lands they traditionally occupy, or have had access to (Article 14); land alienation (Article 17); unauthorized intrusions (Article 18); agrarian programs (Article 19)).

ILO Convention No. 117 (Article 4) requires the enforcement of the ownership and use of land resources with due regard to customary rights.

Objective: Conflict on land use right shall be solved before a case is filled in the recognised justice system.

Guide for implementation:

The operator which is involved in legal action, either as claimant or defendant, shall make appropriate actions to resolve the conflict. The operator shall resolve and conform to any justice court case, court rulings, or appeals.

A recognised justice system can be national or international court of law.

The operator shall act toward the definitive settling of the dispute. A court decision shall demonstrate the settlement of the dispute has been reached.

1.2.3 Water that is legitimately contested by other users

Comment: *The indicator applies to the operator using the water*

Based on ILO Convention No. 169 which addresses issues related to indigenous and tribal peoples (the rights of ownership and possession over the lands they traditionally occupy, or have had access to (Article 14); land alienation (Article 17); unauthorized intrusions (Article 18); agrarian programs (Article 19)).

ILO Convention No. 117, art 4 requires the enforcement of the ownership and use of land resources with due regard to customary rights.

Objective: Conflict on water use shall be solved before a case is filed in the recognised justice system.

Guide for implementation:

The operator which is involved in legal action, either as claimant or defendant, shall make appropriate actions to resolve the conflict. The operator shall resolve and conform to any justice court case, court rulings, or appeals.

A recognised justice system can be national or international court of law.

The operator shall act toward the definitive settling of the dispute. A court decision shall demonstrate the settlement of the dispute has been reached.

Principle 2: Respect Human Rights and Labour Standards

Criterion 2.1 To comply with ILO Labour conventions governing child labour, forced labour, discrimination and freedom of association and the right to collective bargaining

2.1.1 Minimum age of workers

CORE INDICATOR

Comment:

This indicator applies to all workers undertaking activities on the operator premises (including transportation of the cane) as well as on all farms included in the unit of certification, irrespective of their contractual status.
Table based on ages included in ILO C138 (minimum age) and ILO C182 (worst forms of child labour)

General Minimum age requirements	Non-hazardous work	Light work in family and small-scale holding	Hazardous work
Most countries	15[1]	13	18
Developing countries which have ratified ILO C138, Para 4 art.2	14	12	18

(1) Not less than the minimum age of completion of compulsory education. If national law stipulates a higher age, the higher age will apply.

Definitions are given in Annex 1 of Bonsucro Standards:

Child: Any person less than 15 years of age, unless local minimum age law stipulates a higher age for work or mandatory schooling, in which case the higher age applies. However, local minimum age law can be set at 14 years of age in accordance with developing country exceptions under ILO convention C138.

Child labour: Any work by a child younger than the age(s) specified in the above definition of a child, except as provided by ILO Recommendation No. 146.

Hazardous child labour is defined by Article 3 (d) of the ILO Convention No. 182 (1999) concerning the Prohibition and Immediate Action for the elimination of the worst forms of child labour, as "work which, by its nature or its circumstances in which it is carried out is likely to harm the health, safety or morals of children".

Family and small-scale farms: entities where only direct family members work and which do not regularly hire workers.

The following work is considered as hazardous by ILO Convention C182

- Slavery, sale and trafficking of children, debt bondage, serfdom, force or compulsory labour;
- Work at dangerous heights (for example in warehouses) or in confined spaces;
- Work with dangerous machinery, equipment and tools (cane crushers, harvesters, machetes), or
- Work which involves the manual handling, lifting or transport of heavy loads (for example carrying sugarcane or sugar bags);
- Work in an unhealthy environment which may, for example, expose children to hazardous substances (agro-chemicals such as herbicides, pesticides, fertilizers), agents or processes (such as crushing, storage of bags), or to temperatures (boilers, long exposure to the sun), noise levels, or vibrations damaging to their health;
- Work under particularly difficult conditions such as work for long hours or during the night or work where the child is unreasonably confined to the premises of the employer.

Objective: The aim is to ensure that no child is employed /working in the facility, in accordance with ILO Conventions ILO C182, C138 and C184.

Guidance for implementation:

The operator shall ensure that the age limit for each category of work as summarized in the table above is respected: see www.ilo.org for countries that have ratified ILO C138 with potential special allowances.

- This is applicable to all children including contracted workers, migrant labour and family farms.

In the case of family and small-scale farms where children work, the operator shall ensure that:

- Only children above the age set by the conventions work;
- The children are under adult supervision;

- The children do not perform any hazardous work;
- The work does not interfere with child's schooling;
- The work does not put the children's health at risk.

In every case, the operator shall:

- Define the applicable references as per the law of the country/region or in absence of it, the adequate ILO convention;
  - The operator shall follow the more strict regulation or convention ratified by the country.
- Define, disclose and enforce age limit per job category.

The operator shall:

- Implement a system for checking and recording workers' ages;
- Ensure that persons responsible for hiring are aware of how to detect fraudulent documents. Documentary evidence for compliance may include one or more of the following:
  - Any copies such as birth certificates, religious or other local record or passport or ID. Note that in no instance this should authorise the producer to retain workers' identity papers;
- Keep record of hours of work;
- Ensure that contracts are signed by a parent or guardian where workers are under age,.

If the mill operates in area where child labour is an issue, the operator shall have a system in place to report any case of child labour in the area not included in its unit of certification. The operator shall also have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

2.1.2 Absence of forced or compulsory labour

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises (including transportation of cane) as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

ILO Convention C29 defines forced labour as: all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself/herself voluntarily. No forced labour shall occur, neither for men nor women irrespective of their employment status (permanent, temporary or contractual) and irrespective of their age. Forced labour may take different forms: prison labour, coercion, slavery, bonded labour and human trafficking. Menace of penalty can take different form: threats, violence, retention of identity documents, physical confinement (such as imprisonment), denunciation to authorities, non-payment of wage or loss of rights or privilege.

Objective: In accordance with ILO Convention C29 and C105, the aim of this indicator is to ensure that:

- There is no forced, bonded or involuntary labour;
- There is no reliance on human trafficking
- There are no menace of penalty (for example deposits of money or ID on commencement of employment);
- Employees are free to leave at any time with reasonable notice;
- Employees are free to leave at the end of their shift.

Guidance for implementation:

The operator should carry out a review of existing practices to be complemented by interviews .

The operator shall:

- Verify the law of the country/region in respect of this issue.
- Ensure that:
  - The employment is entirely voluntary;
  - The employees are free to leave
  - The workers are "free to move";
  - There is no retention of identification documents and;
  - There is no lodging of deposits;
  - Prison labour is not used;
  - The purpose of any security guards posted is for normal security reasons but not to control the workforce.
  -

The operator should refer to the ILO Handbook for Employers & Business[1] which defines the various assessment methods to be used

(1). A Handbook for Employers and business, combating forced labour (http://www.ilo.org/sapfl/Informationresources/ILOPublications/lang-en/docName-WCMS_101171/index.htm)

to identify forced or compulsory labour:

- A review of relevant company and employee documentation;
- An inspection of the workplace and related facilities (e.g. dormitories);
- On- and off-site interviews with workers and their representatives;
- Interviews with different management representatives.

The list of examples below is non-exhaustive, nor is every item obligatory.

- Is the mill or its supply chain on any existing governmental black list registry (e.g. black list of companies using the ILO definition and clear methodology)?;
- Review any practices employed by the operator or by agencies contracted by the operator that may demonstrate absence of coercion of employees:
  - The worker can enter employment without threat of a penalty;
  - The employment can be terminated freely:
    - Employee original identity documents are not retained
    - Financial penalties on workers are not imposed for termination
    - Wages are paid on time and not halted.
  - The workers are not threatened with violence, harassment or intimidation;
  - The security personnel are not armed at any of the workers' accommodation;
  - There is no financial coercion of employees such as:
    - Deposits paid by workers upon hire;
    - Recruitment fees, unless allowed by national law;
    - Unfair employment loan, or credit, for which workers pledge his/her work to repay;
    - Unfair purchasing schemes (e.g. in the case of accommodation's store, no unreasonable pricing, or way to pay for the products, etc.) which is managed directly or indirectly by the employer and which might deprive workers of their financial freedom;

- ◊ Delays in wage payment such that wage arrears accumulate;
- ◊ Deception in the calculation and payment of wages, including unfair wage deductions;
- ◊ Wage payment in the form of vouchers, coupons or promissory notes;
- ◊ Payment "in-kind" in the form of goods or services that create a dependency on the employer, including absence of total payment of wage "in kind" without cash and only if authorised by national law, regulation or collective agreement;

- Evaluate potential vulnerable group of workers that might be subjected to forced or compulsory labour;
- Review of any documentation of grievances or complaints against management, co-workers and security personnel;
- Design policy and procedures for disciplinary action and ensure that policies exist for appeals and grievances to be heard;
- Implement training programme for workers on human right issues and on how to use such appeals and grievances procedures if necessary;
- Design company documentation regarding disciplinary measures and sanctions to ensure the company does not impose work as a means of disciplining workers;
- Ensure that overtime practices are in accordance to national law and collective agreement, and not done as a threat to dismissal or economic sanction;
- Ensure that workers are free to move and that the role of security guards is limited to security;
- Verify that migrant workers are treated fairly, irrespective of their legal status.

If the mill operates in area where forced labour is an issue, the operator shall have a system in place to report any case of forced labour in the area not included its unit of certification. The operator shall also have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

Verification shall use a mix of these methods. When interviews are used, they shall include men and women, younger and aged workers, workers with different functions and contract types (e.g. permanent, seasonal and migrants), and relevant stakeholders e.g. churches, NGOs, etc. Any information from interviews needs to remain anonymous. Guidance on interviews is provided in the ILO Combating Forced Labour Handbook for Employers & Business, Chapter 4[(1)].

(1) Combating forced labour: a Handbook for employers and business:

http://www.ilo.org/sapfl/Informationresources/ILOPublications/WCMS_101171/lang-en/index.htm

2.1.3 Absence of discrimination

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

In ILO C111, the term discrimination includes:

(a) any distinction, exclusion or preference made on the basis of race, colour, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation;

(b) such other distinction, exclusion or preference which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation as may be determined after consultation with representative employers' and workers' organisations, where such exist, and with other appropriate bodies.

Discrimination may take the form of dismissal, transfer, relocation, demotion, denial of remuneration, social benefits and/or vocational training, amongst others.

Objective: The aim of the indicator is to ensure that:

◊ Workers are treated equally in all matters;

◊ All workers have equal opportunity in employment, including access to vocational training, and to particular occupations and terms and conditions of employment;

◊ There are adequate systems in place to ensure that no form of discrimination occurs either during recruitment or employment.

Guidance for implementation:

Special care shall be taken on the treatment of vulnerable groups subject to discrimination (such as female workers, migrant workers or contracted workers, underrepresented ethnic or social groups), union representatives, union members or non-unionised workers. The operator should:

✓ Have a non-discrimination policy and it is communicated to workers and implemented;

- ✓ Ensure equal pay for work of equal value;
- ✓ Advertise and hire staff not discriminatorily (e.g. medical testing for pregnancy or HIV);
- ✓ Not make discrimination in promoting, compensating and providing training;
- ✓ Respect religious holidays;
- ✓ Treat complaints equally and does not use complaints raised as a mean of discrimination;
- ✓ Guarantee that any segregation of workers is due to accepted cultural norms and that equal opportunities still apply across all groups
- ✓ Encourage the formation of workers group aimed at representing and collecting views of under-represented groups (such as women's committee).

If the mill operates in area where discrimination is an issue, the operator shall have a system in place to report any case of discrimination in the area not included its unit of certification. The operator shall also have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

2.1.4 Respect the right of all workers to form and join trade unions and/or to bargain collectively.

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

ILO Conventions C 98 and C87 form the basis for this indicator. Workers shall be able to choose how they want to organise; to express their issues and to collectively negotiate solutions.

Objective: The aim of this indicator is to ensure:

- ✓ That the workers' rights to freely join a worker association are recognised;
- ✓ That there is no anti-union discrimination
- ✓ That the union officials/ worker's representatives are fairly selected and perform their duties to the benefit of the workers

without the undue influence of the employer or employer's organisation.

Guidance for implementation:

The operator shall:

✓ Make clear its position on trade unions or worker association in line with national law. Details on the legal standing of Trade Unions can be found on the International Confederation of Free Trade Unions website (http://survey.ituc-csi.org);

✓ Have an open approach to Freedom of Association, including a policy for supporting the implementation of an active Trade Union or an effective workers' committee;

✓ Ensure that workers are free to form a union (subject to national law);

✓ Ensure workers are free to join or not (in accordance with national law) as they wish, especially if the operator has selected certain trade unions;

✓ Guarantee that workers who choose not to join a union, can provide their feedback to the management in as many ways as possible e.g. a workers' committee, suggestion box, worker survey, focus groups, confidential hotline;

✓ Guarantee that if workers decide not to join a union in accordance with national law, there is no discrimination against them;

✓ Ensure that workers are free to leave a union (in accordance with nation law);

✓ Ensure workers are informed at the start of their employment of how to join a union;

✓ Not restrict the scope of activity of trade unions unless specified by law;

✓ Respect the right of collective bargaining if permitted by law;

✓ Implement an effective mechanism to make the workers' views known to management in places where the right to freedom of association and collective bargaining is restricted under law. For example, the operator can support the existence of workers' councils, suggestion boxes, worker surveys, focus groups or confidential hotlines;

✓ Ensure that workers representatives are volunteers and fairly selected, minutes of meetings are made available in an appropriate language and there is evidence of management action being taken following the raising of issues;

✓ Guarantee that trade unions or workers' committees' officials are freely and democratically elected without undue influence (including financial) of the employer or employer's organisation, that they represent the whole workforce and that they are allowed the required time to perform their functions without financial penalty or being discriminated.

In the case where the site of employment is very small (<30 people) and there may not be a committee, the operator shall ensure access to management and the effectiveness of the system implemented. The operator shall also allow workers (workers in the mills, farms, outsourcing companies) to join external trade unions.

If the mill operates in area where union rights are an issue, the operator shall have a system in place to report any case of union rights in the area not included its unit of certification. The operator shall also have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

Criterion 2.2 To provide a safe and healthy working environment in work place operations

2.2.1 Lost time accident frequency

Comments: This indicator concerns all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.

(October 1998) (http://www.ilo.org/public/english/bureau/stat/download/occinj.pdf):

A lost time accident is defined as an injury involving a worker which causes him/ her to miss his/her next shift due to injury. Definition of accident is provided by the ILO "Resolution concerning statistics of occupational injuries (resulting from occupational accidents)", adopted by the Sixteenth International Conference of Labour Statisticians

An occupational accident is an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death. Included in occupational accidents are travel, transport or road traffic accidents in which workers are injured and which arise out of, or in the course of work, i.e. while engaged in an economic activity, or at work, or carrying on the business of the employer.

Occupational injury: any personal injury, disease or death resulting from an occupational accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity. Only injuries which cause the worker to be unable to carry on with his/her normal duties on the next day or next shift are considered.

Objective: To measure the effectiveness of safety and operational procedures in preventing accident and injury on duty.

Guidance for implementation:

The Lost time accident frequency is the number of cases of occupational injury during the one year period x 1,000,000 divided by the total number of hours worked by workers during the reference period. Ideally, the denominator should be the number of hours actually worked by workers. If this is not possible, it may be calculated by multiplying the number of workers by the numbers of normal hours of work, taking into account entitlements to periods of paid absence from work, such as paid vacations, paid sick leave and public holidays.

The operator shall note the number of fatal injuries and any actions taken following each of them.

2.2.2 Assessment of the main health and safety risks and measures implemented for mitigation of risk

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as to all the farms included in the unit of certification, irrespective of their contractual status.*

Use national legislation in the definition of risks and measures or, in its absence, recommendation 192 of ILO Convention C184, which provides guidance for identifying the key potential hazards for assessment:

1. hazardous chemicals and waste;
2. toxic, infectious or allergenic biological agents and waste;
3. irritant or toxic vapours;
4. hazardous dusts;
5. carcinogenic substances or agents;
6. noise and vibration;
7. extreme temperatures;
8. solar ultraviolet radiation;

9. transmissible animal diseases;
10. contact with wild or poisonous animals;
11. the use of machinery and equipment;
12. the manual handling or transport of loads;
13. intense or sustained physical and mental efforts, work-related stress and inadequate working postures;
14. risks from new technologies; and
15. fire source.

Objective: The aim of the indicator is to ensure that health and safety of workers is preserved.

Guidance for implementation:

The operator shall:

Identify the hazards and analyse or evaluate the risks associated in terms of health and safety. This is applicable to all types of work on the operator's premises.

A risk is defined as the probability that a worker will be harmed or experience adverse health effects if exposed to a hazard.

Risk = probability of exposure x gravity when exposed

The factors influencing the risk are: the level of exposition to the hazard, how the workers are exposed (breathing vapour, skin contact), and how severe the effects under the conditions of exposure are.

Design and implement measures to ensure that risks are eliminated, prevented or adequately mitigated.

The plan shall be documented, implemented, maintained and reviewed when necessary but at least every year.
In order to impact upon identified risks, the operator shall consider the following measures in the priority order:

1. Elimination of the risk;
2. Control of the risk at the source to prevent the occurrence of risk;

3. Minimization of the risk by designing safe working environment and implementing training; and
4. If the risk can't be eliminated, implementation of preventive measures (provision and use of personal protective equipment, access to first aid...).

The operator shall take specific measures for young workers, pregnant and nursing women and aged workers, where appropriate. The operator shall ensure equal treatment for workers facing similar risks.

The scope of assessment shall include all activities carrying out

- in the farms and field, including but not limited to risks associated with:
  - handling and storage of agrochemical and fertilizers,
  - intense sustained effort,
  - handling of dangerous equipment
- during transportation of cane, including but not limited to risks associated with :
  - length of journey
- in the mill including but not limited to risks associated with
  - handling of chemicals,
  - intense sustained efforts,
  - handling of heavy machines.

The scope of assessment shall also include, if applicable:

- accommodation (safety of room/dormitory including people per $m^{2)}$
- sanitary facilities including shower and toilets (e.g. electricity equipment)
- living area (electricity equipment; safety of kitchen area and/or food storage area)
- transportation of workers when provided by the farm or the mill.

2.2.3 Appropriate personal protective equipment supplied to and used by all workers

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

The aim of this indicator is to ensure that:

- ✓ Personal Protective Equipment (PPE) is supplied, made available for free for each worker when use is necessary and is in good condition;
- ✓ Workers are trained in the use of PPE to protect themselves; and
- ✓ A system is in place that monitors effective use of PPE.

Objective: Avoidance of injury through effective use of PPE

Guidance for implementation:

The operator shall ensure that:

- ✓ Clear responsibility has been defined for issuing PPE with the ultimate obligation that required, approved and appropriate PPE is issued for free to workers.
- ✓ If workers bring their own PPE, the operator shall allow them if only they have been found to be adequate.
- ✓ PPE is appropriate by providing effective protection against the hazard it intends to protect, and by being adequate given the working environment (e.g. if work is performed in hot conditions), and in terms of comfort of the workers, size of the equipment (e.g. ear plugs, goggles, security shoes, gloves, masks, leg protection, etc.)
- ✓ PPE is available (for example by verifying the storage of PPE) and that PPE are in good conditions.
- ✓ PPE is effectively used by workers (for example operator should carry out visual inspection).
- ✓ Label instructions in respect of protective equipment for agrochemicals is followed.

✓ Records of purchase of PPE by producer are kept.

✓ Records of training on PPE of workers and on specific hazard handling (e.g. chemical spraying) are kept

✓ Records of monitoring of use of PPE are kept.

2.2.4 Percentage of staff trained for health and safety at start and at least every 5 years

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

To guarantee adequate level of knowledge and to mitigate the risk of injuries, each new worker shall be trained upon initial employment, and updated at least within 5 years.

Objective: The aim is to ensure:

✓ That workers are regularly trained on how to perform their tasks safely and with minimum risks to their health.

Guidance for implementation:

✓ The operator shall keep records (including training material, name of trainers, duration of training, presence list) related to the training of:

* new employees at start of employment;
* every employee at least every 5 years.

✓ The operator shall ensure that all new employees receive basic health and safety instruction prior to formal training before commencing their tasks.

✓ The operator shall ensure that:

* Trainers are competent;
* Training is tailored to the level of the audience (including language), the tasks performed and the potential hazards of the workplace and activities performed;
    ◊ For example, workers dealing with agrochemicals shall be trained on the proper use of agrochemical (follow label instructions and internal instructions), safe application, use of protective personnel equipment, procedures for storage and disposal, and record keeping).
* Training includes training on emergency response.

2.2.5 All workers present in the field and/or mill have access to drinking water in sufficient quantity

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

A source of drinking water should be accessible to all workers at any time during work time. The water shall be supplied in sufficient quantity during work time. This is to reduce the risk of dehydration and possible consequent health risk.

Objective: Ensure access to drinking water in sufficient quantity, particularly in conditions of high temperature and humidity.

Guidance for implementation:

The operator shall ensure that a source of drinking water is directly accessible at no cost, at any time and without limitation during work time. If the source is not directly accessible by workers, due to practical organisation, drinking water shall be still provided at no cost to each worker in sufficient quantity, especially when working under high temperature conditions.

The operator shall assess what sufficient quantity means in the local conditions. If legislation provides a value, it can be used as a starting point but recognising that local conditions might require larger quantities.

The operator shall ensure that the sources of drinking water are protected from chemicals/micro-biological spillage.

The drinking water provided shall comply with the microbiological, physical and chemical parameters and other characteristics established in applicable country legislation or in their absence, the following critical parameters defined by the World Health Organization are a guideline:

Parameter	Value
Faecal coliforms	Zero
Chlorine residue or residue from other treatment disinfectants	0.2 to 0.5 mg/L
Nitrates	10 mg/L as nitrates
pH	6.5 to 8.5
Sodium	20 mg/L
Sulphates	250 mg/L
Turbidity	Less than or equal to 5 NTU (nephelometric turbidity unit)

The operator shall implement a control plan to monitor the quality of drinking water which should also include control at the point of consumption.

If the mill operates in area where access to drinking water is an issue, the operator shall have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

2.2.6 All workers present on the field and/or mill have access to first aid and provision for emergency response.

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

Objective: The aim is to ensure:

✓ that first aid supplies are available and dedicated personnel are trained to use them (in line with national legislation if existing);

- ✓ that emergency response is available to take in charge injured or ill persons until professional health services take actions.

Guidance for implementation:

The operator shall follow national legislation in terms of first aid for emergency response (if existing).

The operator shall ensure that workers are trained to the emergency response procedures and comply with them.

The operator shall ensure that first aid supplies and number of trained personnel are

- ✓ Adequate to local health and safety requirements;
- ✓ Adequate for the size of the facility and the location of operations; and
- ✓ Accessible to all workers.

The operator shall make provision for emergency response which includes

- ✓ Means to get ill or injured persons to health professional quickly and safely;
- ✓ Transport to the first aid and medical facilities;
- ✓ The availability of a first aid trained person on every shift at adequate location; and
- ✓ First aid kit is accessible and kept up to date. The content of first aid supplies shall refer to national legislation. In the absence of such legislation, the kit should at least include blood stoppers, antiseptic wound cleanser, bandages, CPR mouth piece, tweezers, scissors, adhesive tape, eye wash, latex gloves, hand sanitizer, snake bite serum.

2.2.7 Working hours lost as percentage of total hours worked

Comment: *Applies to the mill only. Total hours mean total hours worked by mill employees. Contractor hours are excluded from this indicator.*

Objective: This indicator measures employee satisfaction with working conditions.

Guidance for implementation:

The operator shall keep track of the working hours lost through absence, also referred to as "no-show". It includes all unplanned causes of unjustified absence (according to company policies) which could be but are not limited to:

- Strikes;
- Non-justified sickness absence; and
- Absenteeism etc.

It does not include planned absence such as holiday, legal time off such as maternity leave, or training.

Even if the operator replaces an absent employee, the mill operator still counts this absence. Depending on operator policies, no shows due to meteorological conditions (e.g. rain) could be included in this indicator.

The operator shall record number of hours worked during the reference period. Ideally, the denominator should be the number of hours actually worked by workers in the reference group. If this is not possible, it may be calculated by multiplying the number of workers by the numbers of normal hours of work, taking into account entitlements to periods of paid absence from work, such as paid vacations, paid sick leave and public holidays.

This indicator is not affected by any down time in the mills; it only refers to personnel working hours.

Criterion 2.3 To provide employees (including migrant, seasonal and other contract labour) with at least the national minimum wage

2.3.1 Ratio of lowest entry level wage including benefits to minimum wage and benefits required by law.

CORE INDICATOR

Comment: *This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the*

unit of certification, irrespective of their contractual status.

The minimum wage as fixed by legal requirement, and in the absence of by using ILO C131 as a reference, serves as a basis for the definition. In some cases, the minimum wage is defined by region, states or by worker organisations, and can be specific for some work positions.

The base of reference shall be the minimum wage based on normal hours of work.

Objective: The aim is to ensure:

Wages and benefits paid to workers meet minimum national legal standards.

- ✓ Deductions from wages as disciplinary measures shall not be permitted;
- ✓ Deductions from wages not provided by national law are permitted only with the express permission of the worker concerned.

Guidance for implementation:

As specified in ILO Convention C95 and Article 24 to 35 of ILO C110:

- ✓ The operator shall pay to the workers all mandated benefits and allowances;
- ✓ The operator shall not include essential services for employees to perform their work as benefits (e.g. protective equipment, tools, or special medical exams) nor deduct their cost to the wages paid to the workers;
- ✓ The operator shall ensure that workers paid at piece-rate would receive the required minimum wage if only working the number of normal legal hours of work;
- ✓ The operator shall provide workers including those paid by piece rates with pay slips for each payment;
    - The slip shall provide adequate information as to how the wage was calculated and shall identify the amount and reason for any deductions of pay.
- ✓ The operator shall ensure workers understand the composition of their wage, including calculation of overtime and possible deductions;

✓ The operator shall pay wages on time (at least every month) and not halt them in such a way that arrears accumulate and has an effect of binding the workers to employment;

✓ The operator shall not make any unfair or non-agreed deductions;

✓ If the operator makes payments "in-kind" in the form of goods or services or clothing, this must be authorised by national law, regulation or collective agreement and does not create a dependency on the employer;

* The operator shall not pay wage fully "in kind" and the operator shall not pay wage in the form of promissory notes, vouchers or coupon;
* No payroll deductions for disciplinary measures or employment broker's fees.
* If housing is provided and rent deducted from wages, the deduction shall not be above the market rate;
* If food is provided and deduction allowed by law, prices used for the food deduction shall not be above prices of food available in the market;

✓ On the base of ILO C100, the operator shall ensure equal treatment and equal remuneration to all workers including migrant workers, contracted labour and piece rate workers irrespective of gender and ethnic/social origin.

In absence of national minimum wage, the operator shall determine a minimum wage using ILO C 131 article 3 taking into consideration sector/industry agreements and/or customary practices:

"The elements to be taken into consideration in determining the level of minimum wages shall, so far as possible and appropriate in relation to national practice and conditions, include--

- (a) the needs of workers and their families, taking into account the general level of wages in the country, the cost of living, social security benefits, and the relative living standards of other social groups;
- (b) economic factors, including the requirements of economic development, levels of productivity and the desirability of attaining and maintaining a high level of employment."

If the mill operates in area where minimum wage payment is an issue, the operator shall have in place a corporate social responsibility programme which acts toward ensuring compliance of the whole cane supply area with this indicator.

2.3.2 Maximum number of hours worked

Comment: *The indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.*

Normal hour means the time during which the persons employed are at the disposal of the employer; it does not include rest periods during which the persons employed are not at the disposal of the employer.

Overtime means the time worked above the normal hours, as defined by national legislation. Overtime must be voluntary.

If there is no legal requirement framing the maximum numbers of hours worked, the total number of working hours shall not exceed 60 hours per week.

Objective: to preserve the health of workers by limiting the total amount of hours worked

Guidance for implementation:

For each worker, the operator shall ensure that the total number of hours worked does not exceed the level set by the legislation or regulation.
The operator shall keep record of and control the number of hours worked by all workers.

If legal legislation does not include a maximum hours which can be worked or does not specify conditions framing the number of hours worked (for example by requiring the implementation of a fatigue management plan or other mitigation measures), the operator shall ensure workers do not exceed 60 hours of work.

The operator shall ensure that overtime is voluntary.

2.3.3 Overtime is paid at a premium rate or equally compensated

Comment: *The indicator is based on ILO convention C30.*

The indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.

Objective: To protect wage and reward workers

Guidance for implementation:

Overtime work (either defined internally if in line with national law or by national legislation) shall be voluntary. The total overtime hours shall not exceed the level set by national legislation.
The operator shall pay any overtime hours at a premium rate which shall be more or equal to 25% of the normal hour rate.
Alternatively the operator can compensate overtime work by other means (e.g. extra hours of rest) with the condition that it complies with local legislation and respects the 25% premium rate.

2.3.4: Payment for cane deliveries are made according to agreed contract

Comment: *Applies to mill only.*

Objective: It is to ensure that farmers receive expected payment for the cane delivered to the mill

Guidance for implementation:

The operator shall ensure farmers agree and understand their contract, especially the calculation method used to determine the price of cane delivered (even if negotiated and agreed by professional bodies).

The operator shall make payment for cane deliveries on time and according to agreed contract and not halt them in such a way that arrears accumulate.

The operator should provide farmers with a summary of deliveries and payments made.

CRITERION 2.4: TO PROVIDE CLEAR, EQUITABLE AND COMPREHENSIVE CONTRACTS

2.4.1 Existence of a contract or equivalent document

CORE INDICATOR

Comments: This indicator applies to all workers undertaking activities on the operator premises as well as on all the farms included in the unit of certification, irrespective of their contractual status.

All workers shall to be provided with a contract or equivalent document (e.g. national working card), to be aware of their rights, and to be paid in a form and at a frequency of payments agreed in contracts and in workers union's agreements.

Objective: this indicator aims at ensuring workers fully understand the term of employment and at avoiding any deception.

Guidance for implementation:

If not specified by the law the contract shall include at least the following elements: hours of work, overtime payment, notice, holidays, wages, and mode of payment. Payment of wages shall be in conformity with ILO Convention no. 95 and ILO C110 as indicated in 2.3.1.

- ✓ The operator shall provide to employees contracts or equivalent documents prior to work commencing;
  - Where written contracts are not required by law, the operator shall ensure employees understand and agree with the terms of the verbal contracts.
- ✓ The operator shall provide workers with a copy of their contracts;
- ✓ If necessary, the operator shall explain the clauses in the contract to workers in an appropriate manner (especially if workers are illiterate or if they speak another language) to ensure they understand the clauses, rights and obligations included in their contract;
- ✓ The number of contracts provided shall be cross-referenced with the number of employees on the registry;

The operator shall ensure that the following is included in each contract (in addition any other legal requirements):

- ✓ The wage, the frequency of payment and form of payment;
- ✓ The frequency of payment;

- ✓ Working hours and rest periods;
- ✓ The condition of payment of overtime and stipulate that working overtime must be on a voluntary basis and in accordance with national law or collective agreement;
- ✓ Weekly rest and maternity leave (if applicable);
- ✓ If any, all legal deductions (which must all be agreed by the worker).

Principle 3: Manage input, production and processing efficiencies to enhance sustainability

(4) Brauman K.A. & Viart N. (in prep) The Development of a regionally-sensitive water-usage indicator to identify sustainable practices for sugarcane growers, London

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

3.1.1 Total raw materials used per kg product

Comment: *Applies to milling only. It includes all raw materials including cane, but only such raw materials which comprise a mass used > 1 % of the cane mass. This will normally include lime, caustic soda, some other chemicals (e.g. sulphur).*

Objective: This indicator measures the effectiveness of use of raw materials

Guidance for implementation:

(5) Brauman K.A., Siebert S. & Foley J.A. (2013) Improvements in crop water productivity increase water sustainability and food security - a global analysis. Environmental Research Letters 8, 024030

The major raw material is of course sugarcane. It may also include imported sugar, molasses and bagasse, and supplementary fuels such as coal and fuel oil. Further input materials for by-product manufacturing activities (if any) should be included.

Products include any products that are sold by the mill such as sugar, ethanol and value-added co-products and by-products such as molasses, animal feeds, yeast, lysine, other fermentation products, fusel oil, CMS, particle board and paper from bagasse and bagasse if sold. A limitation of 1% of the total mass of sugar and ethanol shall be used to identify the products.

Different values of the indicator are necessary if sugar only is being produced (<11) and if no sugar and only ethanol is being produced (<20). If sugar and ethanol are being produced simultaneously, then the required standard is between these 2 values on a mass pro rata

basis: .

$$\frac{(\text{mass Sugar} \times 20) + (\text{mass Ethanol} \times 11)}{\text{mass Sugar} + \text{mass Ethanol}}$$

3.1.2 Yield of production

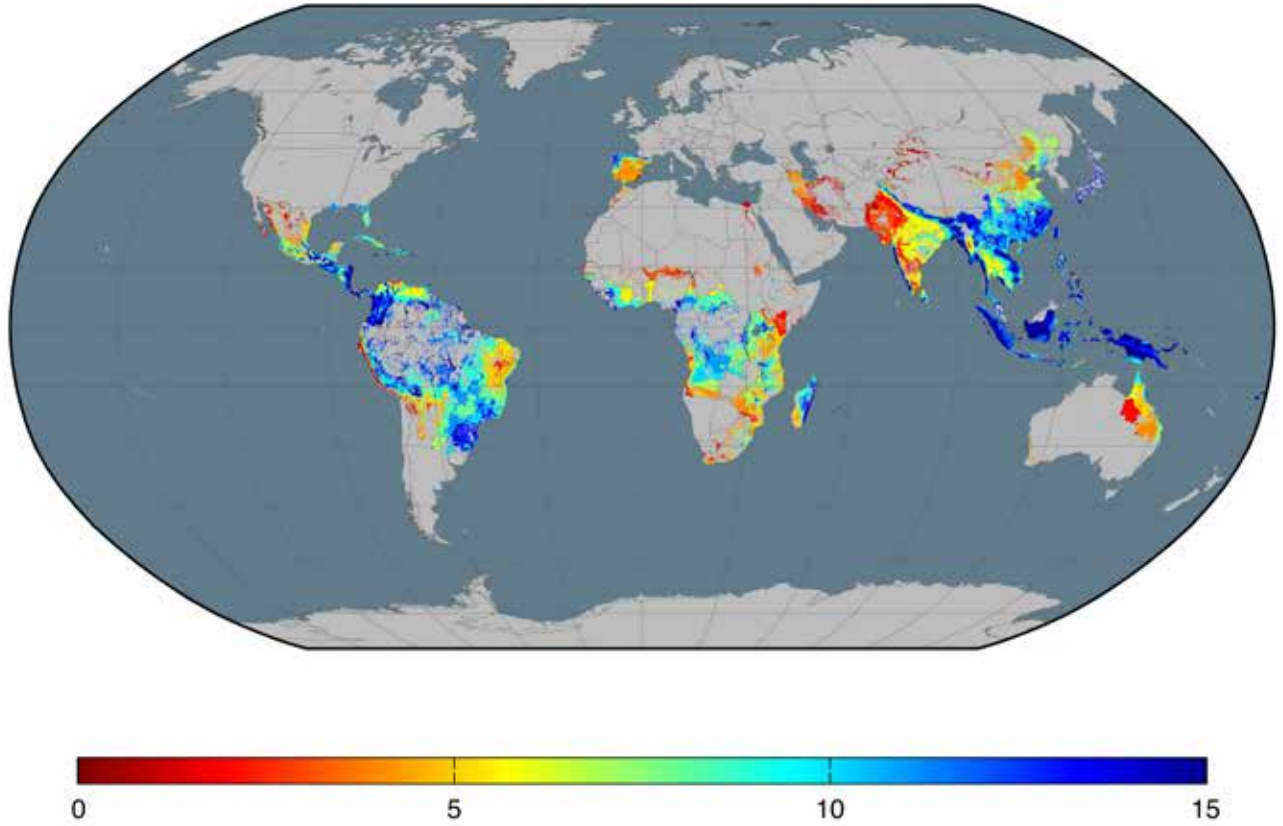
Comment: *Applies to the farm only. The indicator, also called Water Use Productivity4, is based on the principle of "Crop per Drop"*[5]..

The indicator provides growers with a target yield adapted to the climate under which cane is grown. The indicator was developed by observing the ratios of sugarcane production to water consumption achieved by the 50% best performers within each climatic zone for rainfed and irrigated cane separately.

Objective: to maximise yield taking into account the climatic conditions where cane is grown.

Guidance for verification:

the operator shall determine the climatic zone in which its operations take place (using the GPS coordinates of the mill). For this, the operator shall visit http://bonsucro.com/site/production-standard/climatic-zones/ , localise where the gathering mill is located and note the yield for rainfed cane and irrigated rain. The operator shall record the total production as well as the total area harvested by water regime: rainfed, supplementary irrigation and full irrigation.



Map Produced by the Global Water Initiative at the University of Minnesota Institute on the Environment

The yields to achieve are as follows.

	Rainfed	Irrigated
Climate Zone	Yield (tons/ha)	Yield (tons/ha)
1	8	117
2	11	62
3	4	55
4	39	87
5	33	62
6	37	62
7	60	87
8	66	88
9	38	62
10	80	79
11	71	88
12	57	72
13	63	79
14	61	79
15	49	73

(6) "Good Management Practices for the Cane Sugar Industry" by J Meyer et al.,p. 439.

Value for reporting period or 5 year rolling average can be used. This allows for the effect of a catastrophic flood or drought to be accommodated.

3.1.3 Mill overall time efficiency

Comment: *Applies to the mill only. This represents the time that a mill is processing cane, as a percentage of the total time from start to end of season.*

Objective: The aim is to measure the operational time efficiency of the processing operation.

5 Good Management Practices for the Cane Sugar Industry" by J Meyer et al.,p. 439.

Guidance for verification:

The length of a season is calculated from the time the first cane is processed by the mill at the start of a season to the point at which the last cane is processed. Mill shall keep data which show the times that the mill was and was not

processing cane for whatever reason. Any stops, including maintenance activities (corrective or preventive), or power supply failure must be counted, with only one exception being due to rainfall.

In the case of a mill having two extraction lines, the length of stoppage of one should represent a pro rata number of hours related to the capacity of that line. It is calculated using the formula .

$$\text{time lost line 1} = \frac{\text{capacity line 1} \times \text{stoppage line 1}}{\text{capacity line 1} + \text{capacity line 2} + \ldots + \text{capacity line } n}$$

For example for a mill with two line crushing at 400 and 200 $t_{C/h,}$ if the smaller line stops for 10 h and the other keeps running, the time lost will not be 10 h but 200/600 x 10 hours = 3.33 hours. The total stoppage will be calculated by adding all pro-rata stoppage.

Value for reporting period or 5 year rolling average can be used. This allows for the effect of a catastrophic flood or drought to be accommodated.

3.1.4 Factory Performance Index

Comment: *Applies to the mill only and when sugar only is produced by the mill and when mill produces ethanol from final molasses only. If sugar and ethanol are produced, the mill shall comply with 3.1.6 Industrial Efficiency.*

Objective: This aims to measure the efficiency of recovery of sugar from cane. It is not an indicator of the quality of the cane.

Guidance for implementation:

The Factory Performance Index (expressed as %) is a measure of mill performance independent of cane quality and represents the ratio of actual sugar recovered to the theoretical recoverable sugar in cane, expressed as a percentage. A value of 100 % is what would be expected of an average-to-good mill.

$$\text{FPI} = 100 \times \frac{\text{OR}}{\text{OR}^*}$$

Where OR is the Overall Recovery and OR* the Theoretical Overall Recovery

The calculation takes into account the fibre content and the raw juice (mixed juice (from mills) or draft juice (from diffusers)) purity of the cane, both of which are cane quality factors that affect recovery of sugar.

The Theoretical Overall Recovery OR*, used if sugar only is being produced and normalized for juice purity and cane fibre content, is calculated as:

$$OR^* = E^* \times BHR^* = 0.98 \times [100 - \frac{20 \times W_{F,C}}{100 - W_{F,C}}] \times [1.5 - \frac{50}{P_J}]$$

Where E* is the Standard Extraction, BHR* is the Standard Boiling House Recovery, is the fibre content of the cane in g/100 g and the purity of the raw juice[6].

In addition, refining all white sugar in a white end refinery is expected to increase the undetermined loss by 0.4 % of the sugar in raw juice. Then the factor 0.98 becomes 0.976.

3.1.5 Industrial efficiency

Comment: *Applies to the mill only. This is an alternative to Factory Performance Index in the case where mills produce ethanol from anything other than final molasses (juice, syrup, A or B molasses).*

Objective: This aims to measure the efficiency of production of ethanol from cane. It is not an indicator of the quality of the cane.

Guidance for implementation:

The industrial efficiency (expressed as %) is calculated as follows:

$$IE = \frac{TSAI_{(\text{sugar, ethanol, yeast, molasses})}}{TSAI_{(\text{cane, imported molasses})}} \times 100$$

Where TSAI, total sugar as inverted, is reducing sugars and sucrose converted to reducing sugars. Note that TSAI in yeast acquired is omitted from denominator. It is assumed 681.63 L of ethanol per tonne of sucrose and 2 kg TSAI/kg yeast

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

3.2.1 GHG emissions per tonne of cane;

3.2.2 GHG emissions per tonne of sugar produced;

3.2.3 GHG emissions per MJ of ethanol

Comments: This is a field-to-mill gate calculation, based on a Life Cycle Assessment of the processes. Global warming burden is expressed as the net equivalent carbon dioxide emission, related to the amount of cane produced, or the amount of sugar produced, or energy content of ethanol.

Objective: To estimate the GHG emissions associated with the processes of growing and processing sugar cane

Guidance for implementation:

Implementation consists of collecting the input data required for the calculation as listed in the Bonsucro Calculator. A detailed description of what is involved in the calculation is given in the Bonsucro Calculator.

There are three indicators for this criterion, one to estimate the GHG emission for the sugarcane production, one for the sugar production and one if ethanol is also produced instead of some or all of the sugar. If a mill produces sugar and ethanol both indicators apply.

The GHG emissions are allocated to either product according to their energy values as calculated in the Bonsucro calculator.

Note that the emissions coming from the production of exported molasses are included in the calculation of the GHG emissions for the sugar production.

To calculate GHG emissions, the Bonsucro calculator uses a series of default conversion factors used to convert energy use into GHG emissions expresses in CO2eq.
Default values used as secondary data when primary data is not available are those shown in Annex 3. Some data shall be adapted to local circumstances (e.g. GHG emissions from electricity generation will depend of the energy mix of a country). They have to be

justified by supporting evidence.

In order to calculate the agricultural contribution all agricultural inputs including fertiliser and application rates, insecticide, herbicide, pesticide and their application rates, lime application and fuel used in agricultural operations are required.

Note that transport of workers and aerial spraying are excluded.

The records of crop chemical applications and other contributing farm operations would need to be kept and available.

The operator should therefore give full attention to this input data and rely on production records. It is not necessary to include in the calculation inputs which have little or no effect on the result, such as chemicals used in low amounts in processing (less than 1% of the total mass of input). The GHG savings are normally rounded to the nearest percentage.

Average values for all supplying farms are required for the estimate of GHG emissions per unit of final product – where practically not feasible, it may be possible to use estimated values for all farms included in the unit of certification, pending the estimate can be justified.

In order to calculate the mill's contribution, all industrial inputs including data on the transportation of the cane from the field, data on additional energy sources used or chemical products used are required as well as information on the water treatment practices. The quality of the cane will affects the level of emissions coming from the burning of the bagasse in the boilers.

The data which has the most substantial influence on GHG emissions calculation is as follows:

- ✓ Export and import of power;
- ✓ Sugarcane yield and factory recovery;
- ✓ Amount of fertiliser and chemical inputs, particularly N fertiliser;
- ✓ The extent of cane burning;
- ✓ The quantities of any supplementary fuels purchased;
- ✓ Irrigation power input; and
- ✓ Cane transport distances.

A credit is achieved by exporting bagasse and power generated in cogeneration. The calculation assumes that additional export power generated in condensing turbines also attracts a credit.

If any of the sugarcane is produced on land which was new cane land after 1st January 2008, then emissions from direct Land Use Change (LUC) have to be taken into account in the calculation. Change from one annual crop to another is not regarded as land use change. For the purpose of LUC emissions, sugarcane is considered as an annual crop. The effect of LUC is to affect the carbon stock per hectare, above and below ground, of the land in question. The method of estimating the change in carbon stock is that proposed in the PAS 2050, developed by the Carbon trust and DEFRA and published by the British Standards. This uses the table of IPCC default land use change values for selected countries, and assumes emissions are released in equal quantities per year over 20 years (see annex 4). The table provides emissions in t CO2eq/ha/year. Principle 4: Actively manage biodiversity and ecosystem services.

Principle 4: Actively Manage Biodiversity and ecosystem services

Criterion 4.1 To assess impacts of sugarcane enterprises on biodiversity and ecosystem services

4.1.1: Dissolved Oxygen in receiving streams

Comment: *Applies to mill only. Dissolved Oxygen provides an indication as to whether or not freshwater species can thrive, survive or just limp along the receiving stream. The concentration of dissolved oxygen in surface water is controlled by temperature and has both a seasonal and a daily cycle. Cold water can hold more dissolved oxygen than warm water.*

Objective: The indicator evaluates the dissolved oxygen in receiving streams. This is to ensure that the mill is not polluting the environment through releasing untreated or inadequately treated effluents.

Guidance for implementation:

It should be noted that effluent flows from a mill vary considerably during the week and along the season.

DO samples should represent average conditions in the stream being monitored. A sample should be collected in the middle of the

stream, between 0.15 to 0.40 m below the water surface. If the sample must be collected from the shore, the sample should be collected in a site which represents conditions in the stream, also a few cm below the surface. Sampling must take place downstream of the discharging point where flows mix.

DO analysis should be made using iodometric (Winkler – reference method), luminescence-based (optical sensor), amperometric (probe) or spectrophotometric methods of analysis, in line with local legislation if applicable. The protocol of measurement will depend on the methodology used.

It is recommended that operators follow the "Common guidance for the identification of High Conservation Values" published by the HCV Resource Network to identify which HCVs are present in the area of interest (http://www.hcvnetwork.org/resources/resources/

lder.2006-09-29.6584228415). It provides practical guidance on the identification of HCVs.

4.1.2 Percentage of areas defined internationally or nationally as legally protected or classified as High Conservation Value planted to sugarcane after the cut-off date of 1 January 2008.

CORE INDICATOR

Comment: *The High Conservation Value (HCV) approach is one of the most important tools for responsible resource management and responsible sourcing. High Conservation Values (HCVs) are biological, ecological, social or cultural values which are considered outstandingly significant or critically important, at the national, regional or global level.*

Objective: To prevent the use of areas legally protected or of critical biodiversity (including HCV categories 1-6) for the cultivation of sugarcane.

Guidance for implementation:

The operator shall provide a map showing areas not acceptable for development (based on national interpretation of HCV categories 1-6 or research identifying HCV and based on local legislation) and a map showing new areas developed after 1 January 2008 (or equivalent documentary evidence, for example satellite imagery, research surveys, stakeholder consultation) to demonstrate that expansions or new developments do not involve areas internationally or nationally legally protected or HCV categories 1-6.

In the absence of HCV maps or database, the operator shall provide credible documentary evidence to demonstrate that no HCV was converted into sugarcane after 1 January 2008.

The identification of HCV can take into account internationally and nationally legally protected areas as well as Ramsar sites (www.ramsar.org), Important Bird Areas (www.birdlife.org) and IUCN Red data species lists (www.iucn.org) or published by organisations such as IBAT for business (http://www.ibatforbusiness.org).

The six HCVs are:

- HCV1. Species diversity: Concentrations of biological diversity including endemic species, and rare, threatened

or endangered species, that are significant at global, regional or national levels;

- HCV2. - Landscape-level ecosystems and mosaics: Large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance;
- HCV3. Ecosystems and habitats: Rare, threatened, or endangered ecosystems, habitats or refugia;
- HCV4. Ecosystem services: Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes;
- HCV5. Community needs: Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or indigenous peoples;
- HCV6. Cultural values: Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.
-

International definitions of HCVs are to take precedence over national where both exist (for more information visit www.hcvnetwork.org).

4.1.3 The key environmental issues are covered by an appropriate and implemented environmental impact and management plan (EIMP)

CORE INDICATOR

Comment: *An EIMP aimed at identifying the impact of activities on the environment and to propose and manage a set of actions aimed at mitigating the negative impacts and managing the natural resources.*

Objective: To implement an effective EIMP that covers 90% of key environmental issues

Guidance for implementation:

The key environmental issues to be covered by the EIMP are:

1. Biodiversity

    * For example: loss or reduction of biodiversity, conservation of natural fauna and flora, including rare, threatened or endangered species, habitats, provision of habitat corridors, constitution of set-aside area to enhance biodiversity, management of HCVs, conservation of wetlands and other natural areas in a satisfactory state;

2. Ecosystem Services

    * For example: protection or restoration of riparian areas, constitution of natural wind screen or vegetative buffer zones, flood control, filtration, management of HCVs;

3. Soil

    * For example: loss of nutrient, erosion, alkalinisation, acidification, loss of carbon, erosion, microbiological fauna, trash blanket, fallow cropping, compaction;

4. Water

    * For example: availability of water resources, pollution of water basin, impact of intake of water on water availability, consumption of water, quality of effluents, management of irrigation systems, quality of irrigation water;

5. Air

    * For example: level of micro particles emitted, ashes from boilers, volatilisation of chemicals;

6. Climate Change

    * For example GHG emissions, energy consumption;

7. Use of agro-chemicals

    * for example: implementation of a weed management plan, implementation of integrated pest management plan, avoiding most harmful chemicals, use of biologic control;

8. Use of artificial fertilisers

    * For example: implementation of a fertiliser management plan, impact on surface and groundwater bodies, use of vinasses, type of fertilisers used, leaching, use of organic fertilisers;

9. Cane Burning

* For example fallout from fire, dust;

10. Waste and Noise.

The operator shall:

- Identify the natural resources on which its operation relies and the impacts of its activities on them;
- Propose actions (preventive and corrective) to mitigate the identified impacts and to manage or enhance the natural resources;
- Set measurable objectives;
- Implement the actions;
- Monitor progress against the objectives; and
- Act accordingly.

The assessment should involve the potentially affected stakeholders (local communities, other growers) in the form of a consultation which will include:

* Identification of the stakeholders to be involved;
* Description of the consultation process followed (Free, Prior and Informed Consent shall be used for the process and consensus shall be sought when decision shall be taken or conclusions agreed);
* Records taken from the consultation process and actions decided.

The operator shall make the summary of the EIMP publicly available in a way that is accessible to affected communities and does not disclose any confidential information.

4.1.4 Ratio of fertilizer N and P applied (expressed in equivalent phosphate) to fertilizer N and P recommended by soil or leaf analysis (expressed in equivalent phosphate)

Comment: *Since phosphorus and nitrogen differ in their effects on eutrophication, a phosphate equivalent conversion is used based on potency factor of 3.06 for phosphorus and 0.42 for nitrogen (ref: IChemE (2002) Sustainable development progress metrics).*

Objective: To optimise usage of fertiliser N and P for economic and environmental sustainability.

Guidance for implementation:

Sample procedure and analytical procedures for the determination of recommendation shall be according to local industry recognised best practices, ideally supported by scientific publication.

The operator shall:

- Create a soil map showing field boundaries or list the fields classified by soil type.
- Carry out soil and /or leaf analysis by soil type
- Record total quantity of fertilizer recommended for each element, expressed in total N and P
  - For example: Total N = (area soil type 1 x recommendation in N for soil type 1) + (area soil type 2 x recommendation in N for soil type 2 in kg/Ha)+....
- Apply fertilisers according to recommendations
- Record the total quantity of fertiliser applied for each element, expressed in total N and P
  - For example by recording the application in N and P for each field or using stock assessment methodology.

The operator shall carry out soil sample or leaf sample analysis for each dominant soil type. Fields should be sampled at least at (re) planting. If no laboratories are available there should at least be an estimate of soil clay content and evidence that fertiliser rates vary with soil.

4.1.5 Agro-chemicals applied per hectare per year

CORE INDICATOR

Comment: *Quantities of active ingredients of agro-chemical (including pesticides, herbicides, insecticides, fungicides, nematicides, ripeners) applied calculated as a measure of potential toxic effects on aquatic life.*

Objective: To minimise air, soil and water contamination

Guidance for implementation:

The operators shall ensure chemicals are applied according to national legislation and only for the registered use and at the registered rate.

The operator shall calculate the quantities of active ingredients applied on areas harvested and planted in the year of assessment only.

Chemical listed in WHO II, Annex B and C of the Stockholm convention should be avoided.

4.1.6 Banned agro-chemicals applied per hectare per year

CORE INDICATOR

Comment: *Bonsucro supports the implementation of International Conventions which aims at banning the use of the most highly hazardous chemicals due to their effect on human health, soil, air and the environment.*

Objective: no banned pesticides is used on farms.

Guidance for implementation:

The operator shall not use any agrochemicals listed below (see Annex 5):

- List Ia and list Ib of the WHO Recommended Classification of Pesticides by Hazard;
- Annex A of the Stockholm Convention on Persistent Organic Pollutants;
- Annex 3 of the Rotterdam Conventions;
- Annex A, Annex B, Annex C, and Annex E of the Montreal Protocol.

Note that when national legislation goes against one of the international conventions, protocol or WHO lists, by allowing only banned agrochemicals and therefore when no non-banned alternative is allowed by legislation, the national legislation shall be complied with.

Principle 5: Continuously improve key areas of the business

Criterion 5.1 To train employees and other workers in all areas of their work and develop their general skills

5.1.1 Percentage of payroll spent for or time spent by direct employees in vocational training sessions

Comment: *This applies to employees of the mill and or the farm. The training includes all direct vocational and professional training, including the ones required by law, requalification, literacy training. Note that Health and Safety training are not included as they are covered in criteria 2. The training can be of the form of class-room training but as well field training.*

Objective: To ensure all employees are adequately trained for their jobs, and to empower employees to reach their potential.

Guidance for implementation:

Requirements - Farm records and mill data.

Agriculture: training carried out by extension officers, by suppliers of agro-chemicals or machine manufacturers shall also be included.

The operator shall keep records (including training material, name of trainers, duration of training, presence list) related to the training.

The operator shall ensure that:

- Trainers are competent;
- Training is tailored to the level of the audience;
- All employees are given the same opportunity to access training.

The mill shall verify the efficiency of the training provided. This can be achieved by various means (questionnaire, exam or follow-up) to ensure the training reached the expected goal.

The operator shall record the total number of days spend by all employees on training or the total payroll of employees whilst on training.

Criterion 5.2 To continuously improve the status of soil and water resources

5.2.1 Net water consumed per unit mass of product

Comment: *In the mill:*

✓ water consumed = water captured (surface and/or underground) – all effluent discharged into the environmental (rivers or on land).

In the farm:

✓ water consumed = water captured (surface and/or underground) for irrigation.

This amount is then related to the mass of sugarcane, sugar and/or ethanol produced.

Objective: To ensure that water resources are used efficiently.

Guidance for implementation

In the farm:

To acknowledge the recycling of wastes, vinasse and effluents water applied to the fields are not accounted. However, in the case where vinasse or any effluent waters are diluted before their application on the field, the farm shall report the amount of extracted water used for dilution.

In the mill:

In case where vinasse or effluent water is applied to the field, the mill shall account for these effluents returned to the environment.

This indicator will require the adequate water permits are held by the operator and that on-site flow-meter devices are available.

If flow meters are not easily accessible in the area of production, the auditor shall assess if the methodology used by the operator to

estimate the volume of water is adequate and confidence can be given to the total amount of water consumed.

5.2.2 Water use efficiency

Comment: *In the farm,*

✓ water consumed = all waters applied for irrigation, including extracted waters, recycled waters, diluted vinasse, diluted effluents.

The indicator only applies to full irrigation.

Objective: It is to determine if operators make efficient use of irrigation systems and waters.

Guidance for implementation:

The indicator relies on a direct measure of all waters applied to the fields.

1mm of water applied on 1 ha = 10 m^{3} of water.

The operator shall have the necessary water permits and use on-site devices that show m^{3} per hour flow. If flow meters are not easily accessible in the area of production, the auditor shall assess if the methodology used by the producer to estimate the volume of water is adequate and confidence can be given to the total amount of water consumed.

If water meters are not easily accessible in the area of production, the auditor shall assess if the methodology used by the producer to estimate the volume of water is adequate and confidence can be given to the total amount of water consumed.

5.2.3 Percentage ground cover of tops or leaves after harvest

Comments: Residue of cane leaves and tops on the fields after harvesting helps to maintain the organic carbon content of the soil, prevent soil erosion and help nutrient recycling.

Objective: To ensure the maintenance of soil organic carbon.

Guidance for implementation:

The operator shall keep records of the measured or estimated percentage of ground cover for all harvested fields after harvest.

5.2.4 Soil surface tilled per year (% of area under cane)

Comment: *It is important to adapt the tillage practices to the nature and geography of the soil where cane is grown so erosion is minimised.*

Objective: To minimise the opportunity for erosion and prevent soil and water losses.

Guidance for implementation:

This is calculated by number of hectares mechanically tilled divided by the total area in the unit of certification.

If any portion of the field had tillage, 100% of the field area would be considered as being tilled.

The fields would be considered as not tilled only if fields or portions of a field (for example in the case of minimum tillage) had no or minimal mechanical disturbance,

Only tillage wider than 20 cm shall be taken into consideration.

5.2.5 Percentage fields with samples showing analyses within acceptable limits for pH

Comment: *The level of acidity of the soil is an indicator of the health of the soil and its ability to sustain the growth of sugarcane. Increased acidity of soil has a negative effect on sugarcane as it increases levels of exchangeable Al which is toxic to the plant, reduces the cation exchange capacity (ability to hold nutrients) and other exchangeable elements (Ca, Mg and K). The acidification is often due to the oxidation of ammoniacal fertilizers to nitric acid, mineralization of organic matter and leaching of basic cations from the soil.*

Objective: To ensure the maintenance of an optimum soil pH for sugarcane cultivation.

Guidance for verification:

The operator shall identify the optimum pH for each soil types where cane is grown and provide pH analysis from soil samples. It is recognised that pH level changes slowly over the time. The acceptable pH range is 5.0 to 8.0. The operator shall carry out soil samples for each dominant soil type. Fields should be sampled at least once per crop cycle ideally at plough-out or (re)planting.

5.3.1 Theoretical recoverable sugar content of cane

Comment: *Theoretical recoverable sugar content of cane (TRS) is a measure of how much sugar present in the cane can be extracted. It is a measure of the quality of the cane, not of the efficiency of recovery of the sugar at the mill (which is covered in criteria 3). The fibre content of cane and the purity of the raw juice have an effect on recoverability of sugar and are included in this parameter. This indicator applies only where no ethanol is produced from crystallisable sugar.*

Objective: This is a measure of the quality of cane delivered to the mill

Guidance for implementation:

The operator shall collect the data used for calculation, as required by the Bonsucro Calculator.

$$\mathrm{TRS} = W_{S,C} \times \mathrm{OR}^*$$

where is the sucrose content of cane in g/100 g.

The Theoretical Overall Recovery OR*, used if sugar only is being produced and normalized for juice purity and cane fibre content, is calculated as:

$$\mathrm{OR}^* = \mathrm{E}^* \times \mathrm{BHR}^* = 0.98 \times [100 - \frac{20 \times W_{F,C}}{100 - W_{F,C}}] \times [1.5 \times \frac{50}{P_J}]$$

Where E* is the Standard Extraction, BHR* is the Standard Boiling House Recovery, is the fibre content of the cane in g/100 g and the purity of the raw juice.

Values for fibre content, raw juice purity and sucrose content shall be the ones for the reporting period or a 5 year rolling average can be used. This allows for the effect of a flood or drought to be accommodated.

5.3.2 Fermentable total sugars content of cane, expressed as invert (TSAI).

Comment: *An additional indicator is required in the case where ethanol is produced. In that case, the content of Total Sugars As Invert (TSAI) in cane and not just recoverable sucrose is important. This is a measure of the quality of the cane, not of the industrial efficiency of converting sugars into ethanol at the mill (which is covered by criteria 3). TSAI is the sum of reducing sugars and sucrose, where the sucrose is converted to equivalent reducing sugars by dividing by 0.95.*

This indicator applies only when ethanol is produced.

Objective: This is a measure of the quality of cane delivered to the mill, in the particular instance that fermentation of sugars is part of processing.

Guidance for implementation:

The operator shall collect the data used for calculation as required by the Bonsucro Calculator.

To determine the fermentable total sugars we assume a standard utilisation of 90.5 % of the TSAI to be converted to ethanol.

Value for total sugars content expressed as reducing and for reducing sugar/sucrose ratio shall be the one for the reporting period or a 5 year rolling average can be used. This allows for the effect of a flood or drought to be accommodated.

Criterion 5.4 To promote energy efficiency

5.4.1 Total net primary energy usage per kg product

5.4.2 Energy used in cane transport per tonne of cane transported

5.4.3 Primary energy use per tonne of sugarcane

Comment: *Primary energy does not represent the measurable energy coming from a source of energy (e.g. measured kWh from an electricity production unit) but takes into account the efficiency of generation and supply of that energy. For example, a conversion factor is applied to the energy in the fuel used to generate electricity to establish the primary energy content in the electricity produced. The primary energy of the power produced therefore differs from the energy measured. This applies to power, fuel, steam and any other energy input.*

Objective: To promote efficient use of energy by monitoring energy usage in field and factory operations.

Guidance for implementation:

The operator shall collect the data used for calculation as required by the Bonsucro Calculator.

The Bonsucro Calculator sets the scope of assessment which includes both direct and indirect energy usage from field to mill gate. It includes also energy inputs in producing the fertilizers and chemicals.

The result is a net energy usage which takes into consideration potential energy exports. Therefore a negative value can be achieved if substantial export of power is undertaken. There are two ways to calculate the energy usage in transportation depending on the available data:

- Calculated from average distances, payload weights and fuel usage in spreadsheet calculations. The average consumption of a vehicle shall take into consideration the real usage of the machine (with and without payload). Therefore it must be assessed if manufacturer data are relevant;
- Calculated from total fuel usage.

Note that energy used in transporting workers and aerial spraying is excluded.

Criterion 5.5 To reduce emissions and effluents. To promote recycling of waste streams where practical.

5.5.1 Atmospheric acidification burden per unit mass of product

Comment: *Measures the potential of certain released gases to form acid rains by using a sulphur dioxide equivalent measurement.*

Objective: This evaluates the potential of the activities to result in atmospheric acidification and consequent acid rain.

Guidance for implementation:

There are two indicators, one for agriculture and one for the mill.

The unit of Environmental Burden is kg sulphur dioxide equivalent/tonne of product .

It is calculated from estimated emissions of $SO_{2..}$

Major sources will be boiler emissions, sulfitation vents, nitrogenous fertilizer, burning of cane and diesel emissions. Coal or fuel oil burnt in boilers will add to emissions.

The calculation relies on a series of default emission factors and a potency factory of $NO_{2\ of\ 0.7.}$

The operator shall collect the data used for calculation as required by the Bonsucro Calculator.

5.5.2 Non-hazardous solid residues per tonne of cane

Comment: *This is a direct measure of what the agriculture and mill activities generate as residue. Some residue can constitute a saving in fertiliser when re-applied to the fields.*

Objective: to evaluate the level of waste and residues generated by the production processes.

Guidance for implementation:

The indicator takes into consideration wastes disposed of and/or reapplied to the fields. This excludes wastes that are directly generated by the production processes (for example quantity of empty container of chemical products).

Residues include filter cake, surplus bagasse, cane washing residues, boiler ash, mud/soil, cane waste in fields after harvest, in transport or at the mill. When direct measurements are not possible, the operator shall estimate the quantities and justify them.

Although the evaluation takes into consideration the waste coming from the agriculture and mill activity, the indicator only applies to the mill.

The operator shall collect the data used for calculation as required by the Bonsucro Calculator.

5.5.3 Percentage of categories of non-production waste categories that are recycled

Comment: *This is a direct measure of recycling practices of waste at the mill and farm level. Recycling also include safely disposing of toxic waste.*

Objective: to reduce the impact of the enterprise on the environment.

Guidance for implementation:

The operator shall have an active recycling programme for at least 50 % of the following categories:

- Fibre (including paper)
- Metal (including steel)

- Plastic (including agro-chemical containers)
- Oil and lubricants
- Batteries
- Chemical products

This indicator considers all non-production residues which are generated by the production activities. The operator shall demonstrate existence and usage of a recycling channel or when unavailable, safe disposal of waste through dedicated and specialised channels.

The recycling channels can be done individually managed by each actor or through centralised collecting points.

Criterion 5.6 To foster effective and focused research, development and extension expertise

5.6.1 Research and extension costs as a % of sales.

Comment: *Includes levies paid to industry for extension and research. Additional R&D expenditure made by mills and growers shall be included.*

Objective: This indicator is a measure of the investment by the industry in innovation and future sustainability

Guidance for implementation:

The operator shall calculate the revenue from cane sold to mill or the proceeds from the sale of sugar, ethanol, bagasse, molasses, yeast, power and any other co-products, depending on whether it applies to the mill or the farm.

Research and extension cost will include levies to research institutes as well as any direct expenditure by the operator. All growers, including small scale growers, shall include any extension costs incurred.

Direct expenditure on R&D will be the cost of running tests which includes cost of personnel, material, and products. This includes trials on new machines but does not include the investment in new machines or equipment.

Criterion 5.7 For greenfield expansion or new sugarcane projects, to ensure transparent, consultative and participatory processes that address cumulative and induced effects via an

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

5.7.1 Percentage of greenfield expansion or new sugarcane project covered by ESIA

CORE INDICATOR

Comment: *Greenfield expansion refers to conversions of land to sugarcane fields including change of use from other crops and cattle farming that lead to an increase of more than 10% of the rolling average of the total cane area over the previous 5 years. Areas that are being renewed with new sugarcane plantations should not be considered in this indicator.*

New sugarcane project relates to significant changes in the operations (e.g. mechanisation, doubling crushing capacity).

ESIA is a tool to provide environmental and social information for decision-makers who authorise/manage the project. It enables social and environmental issues to be taken into account during all phases of project design and implementation.

An ESIA is used to assess the effect of a proposed development on the environmental and socio-economic conditions of local communities and other groups. It is focused on the mitigation of negative impacts and the enhancement of positive impacts. The following issues should be evaluated on ESIA reports:

ENVIRONMENTAL

- ✓ Soil;
- ✓ Water;
- ✓ Biodiversity;
- ✓ Ecosystem Services;
- ✓ Air;
- ✓ Climate;
- ✓ Waste and Noise;

SOCIAL

- ✓ Structure (health, transportation, education and others);
- ✓ Areas or resources of customary use;
- ✓ Land conflicts;
- ✓ Areas of high cultural, archaeological and historical values;
- ✓ Food security.

Objective: To ensure any industry expansion is undertaken with due regard to environmental and social issues.

Guidance for implementation:

When carrying out an ESIA, the operator shall follow relevant national legislation or in its absence use the recommendations from IFC (www.ifc.org) or IFAD (www.ifad.org).

The operator shall ensure that the ESIA:

I. starts early in project development and is completed prior to end of formulation phase;
II. focuses on the significant environmental and social issues;
III. involves key stakeholders (operators, workers, local communities) and affected people, taking special care of involving under-represented groups;
IV. provides information for decision-making in a clear and usable manner, taking into account the views and concerns of affected parties, local communities, and relevant agencies;
V. Free Prior Informed Consent shall form the basis for the process of decision making
VI. recommends feasible changes in design and implementation which are both sustainable and cost-effective, while enhancing the livelihoods of the rural poor and reducing rural poverty and are based on the result of negotiation with affected parties.

The ESIA shall at least include the following stages:

- screening and scoping to identify areas and community potentially affected by the potential impacts;
- identify the potential impacts;
- consider alternatives;
- identify appropriate mitigation measures (to avoid, minimise or compensate the risk);
- monitor and evaluate the measures and their actions.

The operator shall make the summary of the ESIA publicly available in a way that is accessible to affected communities and does not disclose any confidential information.

The ESIA shall be adapted to the nature and scale of operations. The operator shall ensure that local customs, languages, practices and indigenous knowledge are respected and considered during the ESIA process.

The operator shall ensure any actions resulting from an ESIA are implemented.

Before the project enters in its formulation stage, the operator shall involve independent third party ESIA experts who will either realise the assessment or peer-review the findings.

Where an impact assessment is required by national, regional, and/or local laws, the operator may integrate the process to avoid duplication. The operator shall follow the higher and more comprehensive standard.

When allowed by legislation, small-scale operators that are working together and/or selling to the same processor or producer (such as those working in a cooperative or an outgrower scheme) shall be permitted to combine operations under one ESIA.

Criterion 5.8 To ensure active engagement and transparent, consultative and participatory processes with all relevant stakeholders.

5.8.1 Existence of a usage of a recognized grievance and dispute resolution mechanism for all stakeholders.

Comment: *Conflicts can emerge from unresolved grievances or complaints. They can involve either the operators, workers or contracted workers (for example resulting in strikes) or between operators and their local communities (for example in case of environmental concerns such as pollution, conservation priorities or right to land use). Conflicts are detrimental to all parties involved either due to the very cause of the conflict or due to the increased cost and loses endured.*

Objective: Conflicts involving stakeholders (including workers and contracted workers) shall be prevented by a clear grievance and dispute resolution mechanism and if conflicts happen they must be identified and resolved in a transparent and consultative manner.

The operator may refer to AA 1000 standards Stakeholder Engagement Standard (www.accountability.org) as useful source of information.

Guidance for implementation:

The operator shall make commitments to addressing grievances and disputes constructively and proactively through dialogue and by having grievances and dispute resolution mechanisms that allow affected parties to raise problems with the operator with a clear process for discussion and resolution.

The operator shall implement a resolution mechanism and communicate it internally and externally so that it is locally recognised as a legitimate procedure to refer to in the event of problems. The mechanism shall:

- Be easily accessible to all parties and adapted to the local use (for example if internet access is limited in the area; implementing an online form shall not be considered as "easily accessible");
- Allow for anyone (including workers, contracted workers, local communities, indigenous and tribal people) to freely, and without fear of prejudice, express their grievance;
- Ensure that the operator acts appropriately when grievance and complaints are submitted.
  - The grievance and complaints must be acknowledged, recorded and acted on.
  - The operator shall keep record of all grievance, complaints and conflicts and following actions;
- Ensure that dispute, grievances and conflicts aimed to be resolved through negotiated agreement between parties based on Free, Prior and Informed Consent (FPIC).

When conflict occurs, the mechanism shall aim at its complete resolution and the prevention of its repetition. The mechanism shall allow for the use independent, legitimate and recognised third party mediation.

5.8.2 Percentage of projects involving multi stakeholders where agreement has been reached by consensus driven process based on Free Prior Informed Consent.

Comment: *Stakeholders can be involved in various moments of the company's activities. They can be consulted to evaluate and address environmental and social impacts and management plans or current or future activities, land use issues, to help to the identification of HCV areas or to resolve conflicts.*

Free Prior Informed Consent can be defined as follows:

✓ Free: implied no coercion, intimidation or manipulation;

✓ Prior: implies consent has been sought sufficiently in advance of any commencement of activities and respect of time requirements of consultation processes;

✓ Informed: implies that information is provided that covers the following:

- Nature, size, duration, reversibility and scope of any projects;
- Reason or purpose of the project;
- Location of areas that will be affected;
- A preliminary assessment of the possible economic, social, cultural and environmental impacts (positive and

negative), including potential risk and benefits;

- Personnel likely to be involved in the implementation of the project.

✓ Consent: parties must establish a dialogue allowing them to identify appropriate and workable solutions in an atmosphere of mutual respect and full and equitable participation with ample time to reach decisions. This process may include the option of withholding consent. Potentially affected people must be able to participate through their own freely chosen representatives and customary and other institutions. The participation of women, youth and children are preferable where appropriate.

Objective: To ensure that stakeholders are actively and effectively involved in the business to ensure their support.

Guidance for implementation:

The operator shall develop and implement a stakeholder engagement process which:

- Includes a stakeholder mapping stage which shall be relevant for each project.
  * The mapping allows the identification of potentially affected stakeholders.
  * The operator shall give special attention to ensure that women, youth, indigenous and vulnerable people can participate meaningfully in meetings and negotiations.
  * This can be achieved by including women's groups, youth groups and issue- based groups in the stakeholder meetings, and holding separate meetings with such groups if necessary;
- Allows participation of all stakeholders including affected stakeholders;
- Sets the methodology to invite stakeholders to engage and to make information available to them:
  * in an open, transparent and timely way;
  * prior to meetings; and
  * in a format (e.g. including adapted language, style, presentation, etc.) that is appropriate for stakeholders and/ or stakeholder groups involved in decision-making;
- Set the methods used to engage, consult with, and if required reach consensus with affected stakeholders;
- Set the methodology to share the results of consultation publicly.

The operator shall keep record of agreement taken by consensus driven process as well as dissenting views of individual stakeholders

and/or single-issue groups.

Criterion 5.9 To promote economic sustainability

5.9.1 Value added / tonne of cane

Comment: *Value added is not the same as profit. Value added by the operation is the value of sales less the cost of goods, raw materials (including energy) and services purchased. It does not include depreciation. It is easier to calculate than profit, because it is unaffected by different accounting approaches or standards. An organization creating value distributes that value to employees, the government (tax), capital providers and shareholders and retains some for further investment.*

Objective: The aim is to evaluate economic sustainability.

Guidance for verification:

For the mill the added value is calculated from the sale of sugar, ethanol, molasses, bagasse and power. In the case of growers, value added represents cane sales less the cost of inputs.
Other raw materials and services includes agro-chemicals, fertilisers, chemical products used in processes, energy supplies (including diesel for machines), consultancy, expert services, harvesting or soil management activities if subcontracted, maintenance.

The calculation shall exclude all subsidies, salaries, taxes and benefit repartition.

The auditor shall verify the data provided by farm and mill.

Principle 6: Additional mandatory requirement for biofuels under the EU Renewable Energy Directive (2009/29/EC) and revised Fuel Quality Directive (2009/30/EC)

Criterion 6.1 To monitor global warming emissions with a view to minimizing climate change impacts.

6.1.1 Global warming burden per unit of energy.

Guidance for verification:

To calculate the greenhouse gas emissions from the production and use of sugarcane ethanol, the following default values provided in point D of the annex V of the EU Directive must be used (see annex 6).
The default value is the sum of the default value for cultivation: 14 g CO2eq/MJ + the default value for processing (including excess electricity): 1 g CO2eq/MJ + the default value for transport and distribution: 9 g CO2eq/MJ. Emissions from the manufacture of machinery and equipment shall not be taken into account.

The default value of 24 g CO_2eq/MJ shall be used if there was no land use change after January 2008. Note that planting cane to former crop land is not regarded as land use change.

If there has been direct land use change after January 2008, then an amount el needs to be added to the default value of 24 g CO_2eq/MJ. This estimates the change in carbon stock as a consequence of direct land use change. Details for the calculation of carbon stocks are provided in Annex V, part C point 7. Of the EU legislation and the EU guidelines for land use change emissions (OJ L151, 17/06/2010).

Note that although sugarcane is a multi-annual crop, its stem is harvested annually. For this reason it is classified as an annual crop in the EU Directive 2009/28/EC. Therefore any conversion of land from perennial crop to sugarcane results in the emissions of GHG that must be evaluated according to the methodology laid in Annex V of the EU directive.

The greenhouse gas emission saving from the use of biofuels and bioliquids shall be at least 35 % (therefore less than 54.4 g CO_2eq/MJ). With effect from 1 January 2017, the greenhouse gas emission saving from the use of biofuels and bioliquids shall be at least 50 % (therefore less than 41.9 g CO_2eq/MJ) . From 1 January 2018 that greenhouse gas emission saving shall be at least 60 % (therefore less than 33.5 g CO_2eq/MJ) for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.

The calculation of actual values is not permitted.

Criterion 6.2 To protect land with high biodiversity value, land with high carbon stock and peatlands.

6.1.2 Percentage of land with high biodiversity value, high carbon stock or peatlands planted to sugarcane after the cut off date of 1 January 2008.

Comment: *Are considered land with high biodiversity value, land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status:*

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

(b) areas designated by law or by the relevant competent authority for nature protection purposes; or for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition by the European Commission; unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes;

(c) highly biodiverse grassland that is:

I. natural grassland that would remain grassland in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes; or

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

(d) new nature protection areas derived from a published European Commission decision. Bonsucro will communicate to economic operators any details of lists on protected areas as soon as they are available from the EC.

Are considered land with high carbon stock, land that had one of the following statuses in January 2008 and no longer has that status:

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

(b) continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds in situ (It does not include land that is predominantly under urban or agricultural use, understood as tree stands in agricultural systems, such as fruit tree plantations and agroforestry systems when crops are grown under tree cover);

(c) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds in situ, unless evidence is provided that the carbon stock of the area before and after conversion is such that when GHG emissions savings is calculated, it complies with the

minimum threshold established in criterion 6.1.1 of the Bonsucro standard.

Biofuels shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil

Guidance for verification:

Compliance with the land related criteria could take many forms, including aerial photographs, satellite images, maps, land register entries/databases and site surveys. Evidence can be positive (e.g. an area photograph of the land showing it is planted with sugarcane) or negative (e.g. a map of the primary forests in the region, showing that the producing land falls outside them).

Regarding areas designated by law or by the relevant competent authority for nature protection purposes; or for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition by the European Commission, proofs of compliance may include, but are not limited to, official maps and GPS coordinates, and existing environmental impact assessment studies that take into account this variable.

Annexes

Annex 1 Definitions

			Reference
Company	The entirety of any organization or business entity responsible for implementing the standard.		SA 8000
Supplier/ contractor	A business entity which provides the company with goods and/or services integral to, and utilized in/for, the production of the company's goods and/or services.		SA 8000
Subcontractor/ sub-supplier	A business entity in the supply chain which, directly or indirectly, provides the suppliers with goods and/or services integral to, and utilized in/for, the production of the suppliers's and/or company's goods and/or services.		SA 8000
Agricultural Worker Categories	There is a lack of clear-cut distinctions between different categories of workers. Consequently, there are numerous types of labour relations and different forms of labour force participation. The different categories of workers also vary within each country and, in certain cases, a single farmer may be grouped in more than one category. Many smallholders supplement their income with wages earned by working in large commercial farms during harvesting periods.		ILO
	Summary of broad categories of agricultural workers:		
Agricultural Worker Categories	NON WAGED Large and Middle Scale Farmers Small Scale Farmers Subsistence farmers Unpaid Family workers Collective farmers Tenants and Share croppers	WAGED Permanent Workers Temporary and Seasonal Workers Migrant Workers Subcontracted Workers Squatters Land-less workers	ILO. Safety and health in Agriculture document

Child	Any person less than 15 years of age, unless local minimum age law stipulates a higher age for work or mandatory schooling, in which case the higher age would apply. If however, local minimum age law is set at 14 years of age in accordance with developing country exceptions under ILO convention 138, the lower age will apply.	ILO
	The ILO Minimum Age Convention, No. 138 (1973) states that the minimum age of employment should not be less than the age of completion of compulsory schooling and, in any case, shall not be less than 15 years. However a Member country whose economy and educational facilities are insufficiently developed, may under certain conditions initially specify a minimum age of 14 years.	ILO
Child labour	Any work by a child younger than the age (s) specified in the above definition of a child, except as provided by ILO recommendation 146	ILO
Young worker	Any worker over the age of a child as defined above and under the age of 18.	ILO
Worst forms of child labour	Whilst child labour takes many different forms, a priority is to eliminate without delay the worst forms of child labour as defined by Article 3 of ILO Convention 182.	ILO
Hazardous child labour	Hazardous child labour is defined by Article 3 (d) of the ILO Convention concerning the Prohibition and Immediate Action for the elimination of the worst forms of child labour, 1999 (182) 3D work which, by its nature or its circumstances in which it is carried out is likely to harm the health, safety or morals of children.	ILO
Occupational accident	An Occupational accident is an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death. Included in occupational accidents are travel, transport or road traffic accidents in which workers are injured and which arise out of or in the course of work, i.e. while engaged in an economic activity, or at work, or carrying on the business of the employer. Occupational injury: any personal injury, disease or death resulting from an occupational accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity.	ILO Resolution/ Convention 155 on statistics of occupational injuries (resulting from occupational accidents), adopted by the Sixteenth International Conference of Labour Statisticians, (Oct.1998)
Occupational disease	A disease contracted as a result of an exposure to risk factors arising from work activity	ILO
Reporting period	This will be one year unless otherwise agreed. The period should include a single complete milling season.	

Theoretical recovery of sugar	The theoretical OR (Overall Recovery) normalized for juice purity and cane fibre content is calculated as:	"Good Management Practices for the Cane Sugar Industry" by J Meyer et al.,p. 439.
	$$\mathrm{OR}^* = \mathrm{E}^* \times \mathrm{BHR}^* = 0.98 \times [100 - \frac{20 \times W_{F,C}}{100 - W_{F,C}}] \times [1.5 \times \frac{50}{P_J}]$$	
	where wF,C is the fibre content of the cane in g/100 g and PJ the purity of the raw juice. In addition, refining all white sugar in a white end refinery is expected to increase the undetermined loss by 0.4 % of the sugar in raw juice. Then the factor 0.98 becomes 0.976.	
Phosphate equivalent as a measure of eutrophication	Since phosphorus and nitrogen differ in their eutrophication effects, a phosphate equivalent conversion is used based on potency factors of 3.06 for phosphorus and 0.42 for nitrogen. Using 120 kg N /ha/y and 20 kg P /ha/y, the figure would be (120 x 0.42) + (20 x 3.06) = 112 kg phosphate/ha/y.	IChemE (2002). Sustainable development progress metrics. Inst. Chem. Engrs. London.
High Conservation Value	High Conservation Values (HCVs) are biological, ecological, social or cultural values which are considered outstandingly significant or critically important, at the national, regional or global level. All natural habitats possess some inherent conservation values, including the presence of rare or endemic species, provision of ecosystem services, sacred sites, or resources harvested by local residents. However, some values are more significant or critical than others, and it is the HCV approach which offers an objective way of identifying those values to be maintained or enhanced. (see www.hcvnetwork.org). A cut-off date of 1 January 2008 will apply.	
	The six High Conservation Values (HCVs):	
	HCV 1 - Species diversity: Concentrations of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels.	
	HCV 2 - Landscape-level ecosystems and mosaics: Large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.	

High Conservation Value	HCV 3 - Ecosystems and habitats: Rare, threatened, or endangered ecosystems, habitats or refugia.	
	HCV 4 - Ecosystem services: Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.	
	HCV 5 - Community needs: Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or indigenous peoples.	
	HCV 6 - Cultural values: Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.	
	Also includes soils with a large risk of significant soil stored carbon such as peat lands, mangroves, wetlands and certain 100% native and natural grassland (that were never modified by human activities).	
Significantly affected	A significant impact would be apparent if the operations of sugarcane farms or mills resulted in changes to the environment that resulted in (1) the quality and / or quantity of habitat supporting an endangered or threatened species being affected to the extent that the numbers and viability of the species (the classification from the IUCN red list) was adversely affected; (2) conversion, diminution or degradation of the integrity of an endangered habitat such that there was a measurable adverse impact on its ecological status in the opinion of a competent ecologist (3) ecosystem service (such as water supply) being sufficiently changed as to cause material adverse impacts to local communities or ecosystems (for example, flows contain additional nutrients that change downstream ecology or affect the availability of drinking water for downstream communities).	
Conducting business with integrity	Businesses should work against corruption in all its forms, including extortion and bribery.	Principle 10 UN Gobal Compact

Forced or compulsory labour	This shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily	ILO Convention C29
	Most common forms of forced or compulsory labour: Forced labour can take many forms – some imposed by the State, but the majority in the private economy…..Forced labour can be an outcome of trafficking in persons and irregular migration… Mechanisms of force applied include debt bondage, slavery, misuse of customary practices and deceptive recruitment systems. Some of the most common forms of forced labour include (for a full list see ILO Handbook):	Combating forced labour: A handbook for employers and business, booklet 2
	· Debt-induced forced labour: Commonly referred to as "bonded labour" in south Asia, where the practice in most common, but also known as "debt bondage". .. Debt bondage arises when a person mortgages his or her services or those of his family members to someone providing credit in order to repay the loan or advance.	
	· Forced labour as an outcome of human trafficking: Trafficking in persons, or human trafficking, is often linked to forced labour. It is fuelled by organised criminal networks or individuals and can involve deceptive recruitment, racketeering and blackmailing for the purpose of labour exploitation.	
	Forced labour linked to exploitation in labour contract systems: This can be found almost everywhere in the world today. For example, migrant workers can find themselves "bonded" to a labour contractor because excessive fees have been charged and with limited if any possibility to change the employer once they arrive in the destination country.	
Discrimination	1 The term discrimination includes—(Art 1 C111)	ILO Convention C111
	(a) any distinction, exclusion or preference made on the basis of race, colour, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation;	
	(b) such other distinction, exclusion or preference which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation as may be determined by the Member concerned after consultation with representative employers' and workers' organisations, where such exist, and with other appropriate bodies.	
	2. Any distinction, exclusion or preference in respect of a particular job based on the inherent requirements thereof shall not be deemed to be discrimination.	
	3. For the purpose of this Convention the terms employment and occupation include access to vocational training, access to employment and to particular occupations, and terms and conditions of employment.	

Symbols and Abbreviations	BOD	biological oxygen demand
	COD	chemical oxygen demand
	EMP	environmental management plan
	ESIA	environmental and social impact assessment
	G	grams
	GHG	greenhouse gas
	HA	hectares
	HCV	high conservation value
	KG	kilograms
	KJ	kilojoules
	KWH	kilowatt hours
	L	litres
	MJ	megajoules
	PPE	personal protective equipment
	RS	reducing (invert) sugars
	T	metric tonnes
	TC	tonnes cane
	TSAI	total sugars expressed as invert
	Y	year

Annex 2 List of International Conventions

http://www.ilo.org/ilolex/english/subjectE.htm	ILO Core Conventions cover the following issues: Abolition of Child labour (C 138 and C 182), Elimination of forced or compulsory Labour (C 29 and 105), Equal remuneration (C100) and elimination of discrimination in occupation and employment (C111), Freedom of Association (C87) and right to collective bargaining (C98),

Principles	International Standards	Key provisions	Summary of protections
No forced labour	ILO Convention 29 (1930) Forced Labour	Article 5	No concession to companies shall involve any form of forced or compulsory labour
	ILO Convention 105 (1957) Abolition of forced Labour	Article 1	Not make use of any form of forced or compulsory labour.
Protection of children	ILO Convention 138 (1973) Minimum Age	Article 1-3	Abolition of child labour and definition of national minimum age for labour not less than 15-18 years (depending on occupation).
	ILO Convention 182 (1999) Worst Forms of Child Labour	Articles 1-7	Abolition of child slavery, debt bondage, trafficking and procurement for prostitution; suitable methods to monitor and enforce compliance
	UN declaration on Rights of the Indigenous Peoples (2007)	Articles 17 (2), 21, 22 (2)	No exploitation or exposure to hazard or discrimination against indigenous women and children
Freedom of Association and Collective Bargaining	ILO Convention 87 (1948)Freedom of Association and Protection of Right to Organise	Articles 2-11	Freedom to join organisations, federations and confederations of their own choosing, with freely chosen constitutions and rules; measures to protect the right to organise

Freedom of Association and Collective Bargaining	ILO Convention 98 (1949) Right to organise and collective bargaining	Articles 1-4	Protection against anti-union acts and measures to dominate unions, established means of voluntary negotiation of terms and conditions of employment through collective agreements.
	UN Declaration of the Rights of Indigenous Peoples (2007)	Article 3	Indigenous peoples have the right to self-determination and to freely pursue their economic, social and cultural development.
Non discrimination and equal remuneration	ILO Convention 100(1951) Equal Remuneration	Articles 1-3	Equal remuneration for men and women for work of equal value
	ILO Convention 111 (1958)	Articles 1-2	Equality of opportunity and treatment in respect to employment and occupation; no discrimination on the basis of race, colour, sex, religion, political opinion, national extraction or social origin.
	Discrimination (Employment and Occupation)		
	UN Declaration on Rights of Indigenous Peoples (2007)	Articles 2, 8 (2e), 9, 15 (2), 16 (1), 21 (2), 22, 24 (1), 29 (1), 46 (3)	No discrimination based on origin or identity; free to express identity based on custom; special attention to full protection of rights of indigenous women.
Just employment of migrants	ILO Convention 97 (1949) Migration for Employment		Provision of Information; no obstacles to travel; provision of health care; non discrimination in employment; accommodation, social security and remuneration; no forced repatriation of legal workers, repatriation of savings.
Protection of small holders	ILO Convention 117 (1962) Social Policy (Basic Aims and Standards)	Article 4	Alienation with due regard to customary rights, assistance to form cooperatives, tenancy arrangements to secure highest possible living standards.

Just land acquisition	ILO Convention 169 (1989) on Indigenous and Tribal Peoples	Article 13-19	Respect and safeguard rights to lands and natural resources traditionally occupied and used; respect for customs of inheritance; no forced removals; compensation for loss and injury
	UN Declaration on the Rights of Indigenous Peoples (2007)	Articles 25, 26	Right to distinctive relationship with land; right to own, use, develop and control their lands, territorities and other resources
	UN Convention on Biological Diversity (1992)	Article 10 (c)	Protect and encourage customary use of biological resources in accordance with traditional practices
Fair Representation and Participation of Indigenous and tribal peoples	ILO Convention 169 (1989) on Indigenous and Tribal Peoples	Articles 6-9	Represent themselves through their own representative institutions; consultations with objective of achieving agreement or consent; rights to decide their own priorities, retain their own customs and resolve offences according t customary law (compatible with international human rights)
	UN Declaration on the Rights of Indigenous Peoples (2007)	Articles 10, 11 (2), 19, 28 (1), 29 (2) and 32.(2).	Right to free, prior and informed consent to any project affecting their lands as expressed through their own representative institutions.
	Convention on the Elimination of All Forms of Racial Discrimination, International Covenant on Economic, Social and Cultural Rights, InterAmerican Human Rights System	UN CERD Committee, UN Committee on Social Cultural and Economic Rights, InterAmerican Commission on Human Rights	Free, prior and Informed consent for decisions that may affect indigenous peoples.
Health & Safety	ILO Convention 184 (2001) Safety and Health in Agriculture	Articles 7-21	Carry out risk assessments and adopt preventive and protective measures to ensure health and safety with workplaces, machinery, equipment, chemicals, tools and processes; ensure dissemination of information; appropriate training, supervision and compliance; special protections for youth and women workers; coverage against occupational injuries and disease.

Control or Eliminate Use of Dangerous Chemicals and Pesticides	Stockholm Convention on Persistent Organic Pollutants (2001)	Article 1-5	Prohibit and/or eliminate production and use of chemicals listed in Annex A of the Convention (eg Aldrin, Chlordane, PCB); restrict production and use of chemicals in Annex B (eg DDT); reduce or eliminate releases of chemicals listed in Annex C (eg Hexachlorobenzene).
	FAO International Code of Conduct on the Distribution and use of Pesticides (1985, Revised 2002)	Article 5	Curtail use of dangerous pesticides where control is difficult; ensure use of protective equipment and techniques; provide guidance for workers on safety measures; provide extension service to small holders and farmers; protect workers and bystanders; make available full information on risks and protections; protect biodiversity and minimize impacts on environment; ensure safe disposal of waste and equipment; make provisions for emergency treatment for poisoning.
Control or Eliminate Use of Dangerous Chemicals and Pesticides	Rotterdam Conventions on Prior and Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade (1998)	Article 1, 5, and 6	Curb trade in banned and hazardous chemicals and pesticides; develop national procedures for control of their use and trade; the Convention lists banned and hazardous chemicals and pesticides.
	UN Declaration on Rights of Indigenous Peoples (2007)	Articles 21 (1), 23, 24, 29 (3)	Improvement of livelihood in sanitation, health and housing; participate in health delivery; maintain traditional health systems; effective monitoring of health.
Preserve wetlands	Ramsar convention on wetlands of International Importance	www.ramsar.org	
Cultural and natural heritage protection	World Heritage Convention concerning the Protection of the World cultural and Natural heritage	whc.unesco.org/	
Conservation of biological diversity	Convention on Biological Diversity	www.cbd.int	

Annex 3 GHG emissions Calculation

1. System Boundary

"The operational boundary includes growing and processing of sugarcane. It considers the boundary to include each individual mill and its growers as a unit, rather than a company owning and operating more than one mill. In the case of IPPs (Independent Power Producers) providing steam and power to a mill from bagasse that has been provided by the mill, the IPP is considered together with the mill concerned. The system boundary includes in addition the energy embedded in the manufacture and supply of all fertilizers and chemicals, but excludes the energy embedded in agricultural and milling capital equipment. All the activities of a plant on one site are considered, to reflect the sustainability of the total system producing food, fuel, energy and chemicals.

This analysis represents a B2B analysis, considering the operation of a cane sugar processing facility, producing raw sugar and/or ethanol at the factory gate. Stand-alone refineries are not considered to be within the boundary. It accounts for the provision of products to a third party that is not the end user (cradle-to-gate). "

2. Direct and indirect effects

"The energy and GHG calculations are associated with direct energy inputs and at a second level by indirect inputs. Direct inputs are mainly fuel and power inputs, expressed in terms of their primary energy value. Indirect inputs include, in addition, the energy required for the production of chemicals, fertilizers and other materials used. The indirect inputs do not include the additional energy necessary for the manufacture and construction of farm, transport and industrial equipment and buildings.

3. Land Use Change

Land use change can be separated into direct and indirect components:

- Direct land change refers to a change from the original state of the land to use for sugarcane production. Depending on the previous use of the land in question, it is surmised that the land use change can unlock some of the carbon in the exist ing soil and vegetation.

- Indirect land use change concerns secondary effects induced by large scale expansion. This displaces existing crops, leading to expansion of crop land elsewhere, either in the same country or in other parts of the world. The effects of these changes are very difficult to estimate.

If the product's supply chain directly caused non-agricultural land to be converted to agricultural use on or after 1 January 2008, then GHG emissions associated with the direct land use change are included in the carbon footprint calculation. The table of IPCC default land use change valuesfor selected countries published in the

PAS 2050 are used in the calculation.

4. Handling of co-products and multiple products

Two approaches are possible:

- The "substitution" or "displacement" method attempts to model reality by tracking the likely fate of by-products. Each co-product generates an energy and emission credit equal to the energy and emissions saved by not producing the material that the co-product is most likely to displace.

- The "allocation" method allocates energy and emissions from a process to the various products according to mass or energy contents or monetary values.

"In the case of sugarcane processing, a factory exporting power or bagasse achieves a credit in terms of energy and emissions saved, according to the displacement of energy in that country. Some standards recommend the use the grid average GHG intensity to calculate the GHG credit for the exported power, although it may be more realistic to use the marginal energy mix. Since the marginal energy provision is likely to be from fossil fuels, the saving estimate is conservative when using the average generation mix. In this case, the approach aligned with the EU RED is adopted, which states that for calculating exported power credits, the average factor should be used. The country specific table of values used is given below.

Where a factory produces only sugar and molasses, the allocation in proportion to market value is adopted; in most cases the allocation to molasses is less than 10 % of the total. Although the prices will change over time, the relative values will be far more stable. It is possible to use a displacement calculation, assuming that molasses displaces certain ingredients in an animal feed. However this is likely to vary significantly in different countries.

In the case of a factory producing more or less equivalent quantities of sugar and ethanol, the split of energy input and GHG emissions between the two products becomes a more difficult issue. The calculation assumes that allocation should be by energy content of the products. Sugar has a calorific value of 16500 MJ/t and ethanol 21 MJ/L; on the basis that 600 L of ethanol are produced from one tonne of sucrose, this implies a sugar equivalent value of 27.5 MJ/L for sucrose. On this basis, 57 % of the emissions should be allocated to sugar and 43 % to ethanol. As an alternative, the calculation procedure also allocates the energy use and emissions on a mass basis on equivalent sugar, on the basis that 1 tonne sugar is equivalent to 600 L ethanol.

In the case of an autonomous distillery, where the only product is ethanol, energy use and emissions are related to litres of ethanol produced or to MJ in ethanol."

5. Components contributing to emissions

"CO2 from sugarcane emitted in combustion and in ethanol fermentation is considered zero CO2 emission to the air, because this is the carbon taken in from the air during sugarcane growth. CO and VOCs emitted in combustion are assumed to be converted to CO2 fairly rapidly, but methane and nitrous oxides from burning bagasse are accounted for in GHG emissions. CO2 emissions arising from biogenic carbon sources are excluded from the calculation of GHG emissions from the life

cycle of products, except where the CO2 arises from direct land use change.

The greenhouse gases covered are CO2, N2O and CH4. Methane and N2O have global warming potentials 23 and 296 times that of CO2 respectively (IPCC 2007). Greenhouse gas emissions are aggregated on a carbon dioxide equivalent (CO2eq) basis.

Non-CO2 emissions arising from both fossil and biogenic carbon sources are included in the calculation of GHG emissions. In the case of burning bagasse in sugar mill boilers, it is assumed that 30 g CH4 and 4 g N2O are produced per 1000 MJ of energy in the bagasse burnt, based on IPCC data for burning of biomass. Changes in the carbon content of soils, either emissions or sequestration, other than those arising from direct land use change, are excluded from the assessment of GHG emissions. Any GHG emissions arising from transport required during the product and raw materials life cycle are included in the carbon footprint assessment. Emission factors for transport include emissions associated with creating and transporting the fuels required.

6. Calculation method

"A materiality threshold of 1 % has been suggested to ensure that very minor sources of life cycle GHG emissions do not require the same treatment as more significant sources.

Both the energy usage and emissions are calculated in the same spreadsheet, since the latter are largely determined by the former. The calculation includes the effects of the manufacture of fertilizer. Farming operations include chemicals application, irrigation, tillage and harvesting (and preparation of cane setts for planting). Cane transport covers getting the cane to the mill. The cane is processed to sugar and molasses or ethanol, and may include export of electric power or bagasse. The energy embedded in the manufacture of milling and other equipment is excluded. Inclusion of energy embedded in capital goods and equipment generally has an effect of less than 10 % on calculated emissions and is excluded. No allowance for transport of products from the factory is allowed for. Transport of workers is not included.

The primary energy is calculated. It differs from the direct energy input in that it takes into account the efficiency of generation and supply of the secondary energy source e.g. using a conversion factor from energy in the fuel used to generate electricity to the energy in the power produced. This applies to power, fuel, steam and any other energy input.

The GHG balance is particularly uncertain because of fertilizer nitrous oxide emissions and error margins can be enormous. The use of nitrogen fertilizers results in GHG emissions in two stages: fertilizer manufacture (primarily CO2 emissions from energy used) and fertilizer application (primarily N2O emissions from nitrification and denitrification processes in the soil). The assumption is made that 1.325 % of N in nitrogen fertilizer is converted to N in N2O through nitrification and denitrification, following the IPCC recommendations.

In addition, agricultural lime application results in GHG emissions from both production energy use and in-soil reactions that release

CO2. These latter emissions are a further source of uncertainty. The model uses the IPCC factor of 0.44 kg CO2eq/kg lime, which assumes that all C in lime becomes CO2. This is the upper limit; it is possible in weakly acidic soils that limestone results in a net sink of CO2.

The calculation approach adopted in this study is similar to that used in the EBAMM model (Farrell et al. 2006), which itself is similar to the GREET model (Wang et al. 2008). These models have been used in the past mainly to model the production of biofuels from corn, and they have had to be modified for sugarcane to incorporate additional issues as follows:

1. Modifications to incorporate sugar manufacture as the major activity. This includes power, fuels and lubricants.

2. Emissions due to cane burning. This is based on IPCC emission factors for burning biomass of 0.07 kg N2O/t dry matter and 2.7 kg CH4/t dry matter.

3. Allowance for N2O emissions from filter cake, vinasse and cane residue left in the field. This assumes 1.225 % of N in the residue is converted to N in N2O (Macedo et al. 2008).

4. Emissions of CH4 and N2O in burning bagasse in sugar mill boilers; values of 30 and 4 g /1000 MJ energy in bagasse respectively are used (Wang et al. 2008)

5. Energy value of process chemicals.

6. A credit for molasses (where produced) based on its economic value relative to that of sugar.

7. Emissions from anaerobic treatment of effluent in the case that methane is not captured and used as a fuel. IPCC guidelines suggest 0.21 t CH4 produced per t COD removed.

8. Allowance for any imports of molasses, bagasse and/or other biomass.

7. Default and secondary data

Secondary data (obtained from sources other than direct measurement) are used to calculate emissions where primary data are not available or inappropriate, to enable consistency and, where possible, comparability:

"• Global warming potential of greenhouse gases

- Electricity emissions (in kg CO2eq/kWh) from various energy sources
- Energy content of fertilizers per kg
- Energy use of pesticides and herbicides per kg
- Fuel emissions per litre
- Waste emissions per kg
- N2O and CH4 emissions from burning bagasse
- N2O and CH4 emissions from burning cane
- Energy embedded and emissions for process chemicals
- Direct land use change
- Agriculture emissions from soils

Default values used are given below

8. Presentation of results

The agricultural and processing phases are dealt with separately. Thus outputs are available as:

Net energy use in agriculture	MJ/ha or MJ/t cane
Energy used in cane transport	MJ/t cane
Net energy use in processing	MJ/t cane of MJ/t sugar
Total net energy use	MJ/t sugar or MJ/L ethanol
Agricultural GHG emissions	kg CO2eq/t cane
Processing GHG emissions	kg CO2eq/t cane or kg CO2eq/t sugar
Total net GHG emissions	g CO2eq/g sugar
	g CO2eq/L ethanol and/or g CO2eq/MJ fuel

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Default values used

it is expected that some of these default values will change as more accurate or realistic values are published. Further fine tuning may also be incorporated in future e.g. in allowing for different emissions from different types of nitrogenous fertilizer. It may also be necessary to introduce country specific default values where they are seen to make a material difference to the calculations.

Most of the default values are obtained from the EBAMM model (Farrell et al. 2006), often based on the GREET model using data from Shapouri et al. (2004) and

Graboski (2002), or from Macedo et al. (2008).

Fertilizer and agricultural chemicals, in MJ/kg:

	Energy Demand (MJ/kg)	Emissions Factor (kg CO2eq/kg)	Emissions on Application (kg CO2eq/kg)
Nitrogen (elemental)	56.9	4	6.2
Potash (K2O)	7	1.6	
Phosphate (P2O5)	9.3	0.71	
Lime (CaCO3)	0.12	0.07	0.44
Herbicide	355.6	25	
Insecticide	358	29	

Data from EBAMM

Primary energy inputs and emissions:

	Energy Demand (MJ/MJ fuel)	Total emissions (g CO2eq/MJ)
Gasoline	1.14	85
Diesel	1.16	91
Fuel Oil	1.24	96
Natural Gas	1.12	66
Coal	1	107
Electricity	2.5	150*

Energy demand data from Macedo et al. (2008), emissions from EBAMM

***Average value; country specific values should be used.**

The energy value is multiplied by the Energy Demand factor to give the primary energy value.

Embedded energy and emissions for process chemicals:

	Energy Demand (MJ/kg)	Emissions Factor (g CO2eq/MJ)
Lime (CaO)	0.11	951
Biocide	3.02	951
Nitrogen	56.33	951
Caustic	75	951
Sulfuric acid	2.4	951
Anti-foam	10	951
Miscellaneous	50	95

1 Macedo et al. (2008); 2 Mortimer et al. (2004); 3 EBAMM

Emissions factor for electricity, in kg CO2/MJ:

Country/Region	Grid average
Argentina	0.0763
Australia	0.241
Brazil	0.022
Canada	0.062
China	0.214
Finland	0.0826

Emissions factor for electricity, in kg CO2/MJ:	
Country/Region	**Grid average**
France	0.0228
Emissions factor for electricity, in kg CO2/MJ:	
Germany	0.139
India	0.253
Indonesia	0.216
Ireland	0.165
Malaysia	0.137
Mozambique	0.0009
Netherlands	0.13
Pakistan	0.103
Philippines	0.128
Poland	0.184
Portugal	0.115
South Africa	0.237
Spain	0.106
Sweden	0.016
Russia	0.091
Ukraine	0.095
United Kingdom	0.131
United States	0.16
Source: RFA, UK	

Annex 4 Default land use change values for selected countries (from PAS 2050:2008) (in t CO2eq/(ha.yr))

Argentina	Annual cropland	Forest land 17 Grassland 2.2
	Perennial cropland	Forest land 15 Grassland 1.9
Australia	Annual cropland	Forest land 23 Grassland 2.2
	Perennial cropland	Forest land 21 Grassland 1.9
Brazil	Annual cropland	Forest land 37 Grassland 10.3
	Perennial cropland	Forest land 26 Grassland 8.5
Canada	Annual cropland	Forest land 17 Grassland 2.2
	Perennial cropland	Forest land 16 Grassland 1.9

Finland	Annual cropland	Forest land 15 Grassland 7.3
	Perennial cropland	Forest land 14 Grassland 6.9
France	Annual cropland	Forest land 18 Grassland 4.5
	Perennial cropland	Forest land 14 Grassland 4.2
Germany	Annual cropland	Forest land 21 Grassland 7.0
	Perennial cropland	Forest land 14 Grassland 6.7
Indonesia	Annual cropland	Forest land 33 Grassland 19.5
	Perennial cropland	Forest land 31 Grassland 17.7
Malaysia	Annual cropland	Forest land 37 Grassland 10.3
	Perennial cropland	Forest land 26 Grassland 8.5
Mozambique	Annual cropland	Forest land 24 Grassland 3.6
	Perennial cropland	Forest land 22 Grassland 3.2

Pakistan	Annual cropland	Forest land 16 Grassland 3.6
	Perennial cropland	Forest land 15 Grassland 3.2
Poland	Annual cropland	Forest land 21 Grassland 7.0
	Perennial cropland	Forest land 14 Grassland 6.7
South Africa	Annual cropland	Forest land 26 Grassland 1.6
	Perennial cropland	Forest land 25 Grassland 1.2
Ukraine	Annual cropland	Forest land 18 Grassland 6.2
	Perennial cropland	Forest land 18 Grassland 5.8
United Kingdom	Annual cropland	Forest land 27 Grassland 7.0
	Perennial cropland	Forest land 20 Grassland 6.7
United States	Annual cropland	Forest land 17 Grassland 1.9
	Perennial cropland	Forest land 16 Grassland 1.5

Annex 5 – Banned agrochemicals

Ingredient	International Regulation
CFCs	Montreal Protocol
Halons	Montreal Protocol
Other fully halogenated CFCs	Montreal Protocol
Carbon tetrachloride	Montreal Protocol
1,1,1-Trichloroethane (Methyl chloroform)	Montreal Protocol
Hydrochlorofluorocarbons	Montreal Protocol
Hydrobromofluorocarbons	Montreal Protocol
Methyl bromide	Montreal Protocol
Bromochloromethane	Montreal Protocol
2,4,5-T and its salts and esters	Rotterdam Convention
Aldrin	Rotterdam Convention
Binapacryl	Rotterdam Convention
Captafol	Rotterdam Convention
Chlordane	Rotterdam Convention
Chlordimeform	Rotterdam Convention
Chlorobenzilate	Rotterdam Convention
DDT	Rotterdam Convention
Dieldrin	Rotterdam Convention
Dinitro-ortho-cresol (DNOC) and its salts(such as ammonium salt, potassium salt and sodium salt)	Rotterdam Convention
Dinoseb and its salts and esters	Rotterdam Convention
1,2-dibromoethane(EDB)	Rotterdam Convention
Ethylene dichloride	Rotterdam Convention
Ethylene oxide	Rotterdam Convention
Fluoroacetamide	Rotterdam Convention
HCH (mixed isomers)	Rotterdam Convention

Ingredient	International Regulation
Heptachlor 76-44-8	Rotterdam Convention
Hexachlorobenzene	Rotterdam Convention
Lindane	Rotterdam Convention
Mercury compounds, including inorganic mercury compounds, alkyl mercury compounds and alkyloxyalkyl and aryl mercury compounds	Rotterdam Convention
Monocrotophos	Rotterdam Convention
Parathion	Rotterdam Convention
Pentachlorophenol and its salts and esters	Rotterdam Convention
Toxaphene	Rotterdam Convention
Dustable powder formulations containing a combination of: - Benomyl at or above 7 per cent, - Carbofuran at or above 10 per cent, - Thiram at or above 15 per cent	Rotterdam Convention
(1) Monocrotophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)	Rotterdam Convention
Methamidophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)	Rotterdam Convention
Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/l)	Rotterdam Convention
Methyl-parathion (emulsifiable concentrates (EC) at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)	Rotterdam Convention

Ingredient	International Regulation
(1) Parathion (all formulations – aerosols, dustable powder (DP), emulsifiable concentrate (EC), granules (GR) and wettable powders (WP) - of this substance are included, except capsule suspensions (CS)	Rotterdam Convention
Aldrin	Stockholm Annex A - prohibit
Alpa hexachlorocyclohexane	Stockholm Annex A - prohibit
Beta hexachlorocyclohexane*	Stockholm Annex A - prohibit
Chlordane	Stockholm Annex A - prohibit
Chlordecone*	Stockholm Annex A - prohibit
Dieldrin*	Stockholm Annex A - prohibit
Endrin	Stockholm Annex A - prohibit
Heptachlor	Stockholm Annex A - prohibit
Hexabromobiphenyl*	Stockholm Annex A - prohibit
Hexabromodiphenyl ether*and heptabromodiphenyl ether	Stockholm Annex A - prohibit
Hexachlorobenzene	Stockholm Annex A - prohibit
Lindane	Stockholm Annex A - prohibit
Mirex*	Stockholm Annex A - prohibit
Pentachlorobenzene	Stockholm Annex A - prohibit
Polychlorinated biphenyls (PCB)*	Stockholm Annex A - prohibit
Tetrabromodiphenyl ether*and pentabromodiphenyl ether*	Stockholm Annex A - prohibit
Toxaphene	Stockholm Annex A - prohibit
Polychlorinated biphenyls	Stockholm Annex A - prohibit
Technical endosulfan and its related isomers	Stockholm Annex A - prohibit
Aldicarb	WHO 1a
Brodifacoum	WHO 1a
Bromadiolone	WHO 1a

Ingredient	International Regulation
Bromethalin	WHO 1a
Calcium cyanide	WHO 1a
Captafol	WHO 1a
Chlorethoxyfos	WHO 1a
Chlormephos	WHO 1a
Chlorophacinone	WHO 1a
Difenacoum	WHO 1a
Difethialone	WHO 1a
Diphacinone	WHO 1a
Disulfoton	WHO 1a
EPN	WHO 1a
Ethoprophos	WHO 1a
Flocoumafen	WHO 1a
Hexachlorobenzene	WHO 1a
mercuric chloride	WHO 1a
Mevinphos	WHO 1a
Parathion	WHO 1a
Parathion-methyl	WHO 1a
Phenylmercury acetate	WHO 1a
Phorate	WHO 1a
Phosphamidon	WHO 1a
Sodium fluoroacetate	WHO 1a
Sulfotep	WHO 1a
Tebupirimfos	WHO 1a
Terbufos	WHO 1a
Acrolein	WHO 1b
Allyl alcohol	WHO 1b
Azinphos-ethyl	WHO 1b

Ingredient	International Regulation
Azinphos-methyl	WHO 1b
Blasticidin	WHO 1b
Butocarboxim	WHO 1b
Butoxycarboxim	WHO 1b
Cadusafos	WHO 1b
Calcium arsenate	WHO 1b
Carbofuran	WHO 1b
Chlorfenvinphos	WHO 1b
3-Chloro-1,2-propanediol	WHO 1b
Coumaphos	WHO 1b
Coumatetralyl	WHO 1b
Cyfluthrin	WHO 1b
Beta-cyfluthrin	WHO 1b
Zeta-cypermethrin	WHO 1b
Demeton-S-methyl	WHO 1b
Dichlorvos	WHO 1b
Dicrotophos	WHO 1b
Dinoterb	WHO 1b
DNOC	WHO 1b
Edifenphos	WHO 1b
Ethiofencarb	WHO 1b
Famphur	WHO 1b
Fenamiphos	WHO 1b
Flucythrinate	WHO 1b
Fluoroacetamide	WHO 1b
Formetanate	WHO 1b
Furathiocarb	WHO 1b
Heptenophos	WHO 1b

Ingredient	International Regulation
Isoxathion	WHO 1b
Lead arsenate	WHO 1b
Mecarbam	WHO 1b
Mercuric oxide	WHO 1b
Methamidophos	WHO 1b
Methidathion	WHO 1b
Methiocarb	WHO 1b
Methomyl	WHO 1b
Monocrotophos	WHO 1b
Nicotine	WHO 1b
Omethoate	WHO 1b
Oxamyl	WHO 1b
Oxydemeton-methyl	WHO 1b
Paris green	WHO 1b
Pentachlorophenol	WHO 1b
Propetamphos	WHO 1b
Sodium arsenite	WHO 1b
Sodium cyanide	WHO 1b
Strychnine	WHO 1b
Tefluthrin	WHO 1b
Thallium sulfate	WHO 1b
Thiofanox	WHO 1b
Thiometon	WHO 1b
Triazophos	WHO 1b
Vamidothion	WHO 1b
Warfarin	WHO 1b
Zinc phosphide	WHO 1b

Annex 6: Guidelines for the calculation of land carbon stocks for the purpose of criterion 6.1 of the Production Standard

1. INTRODUCTION

These guidelines establish the rules for the calculation of land carbon stocks, both for the reference land use (CSR , as defined in point 7 of Annex V to Directive 2009/28/EC) and the actual land use (CSA , as defined in point 7 of Annex V to Directive 2009/28/EC).

In point 2 rules are provided in order that land carbon stocks are consistently determined. Point 3 provides the general rule for the calculation of carbon stocks, which consist of two components: soil organic carbon and carbon stock in the above and below ground vegetation.

Point 4 provides detailed rules for determining the soil organic carbon stock. For mineral soils it provides the option of following a method that allows the use of values provided for in the guidelines, while the option of using alternative methods is also provided for. For organic soils methods are described, but the guidelines do not contain values for determining soil organic carbon stock in organic soils.

Point 5 provides detailed rules for carbon stock in vegetation, but is only relevant in the case the choice is made not to use values for above and below ground vegetation carbon stock provided in point 8 of the guidelines (the use of the values provided in point 8 is not obligatory and for certain cases it may not contain the appropriate values).

Point 6 provides the rules to select the appropriate values in case the choice is made to use the guidelines' values related to soil organic carbon in mineral soils (these values are provided in points 6 and 7). In these rules reference is made to data layers on climate regions and soil type available through the online Transparency platform established by Directive 2009/28/EC. Those data layers are detailed layers underlying figures 1 and 2 below.

Point 8 provides values for carbon stock in the above and below ground vegetation and related parameters. Points 7 and 8 provide values for four different land use categories: cropland, perennial crops, grassland and forest land.

Figure 1 Climate regions

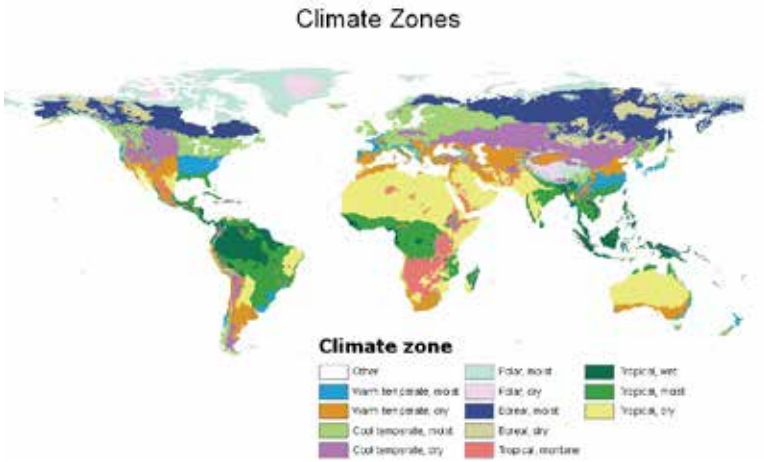
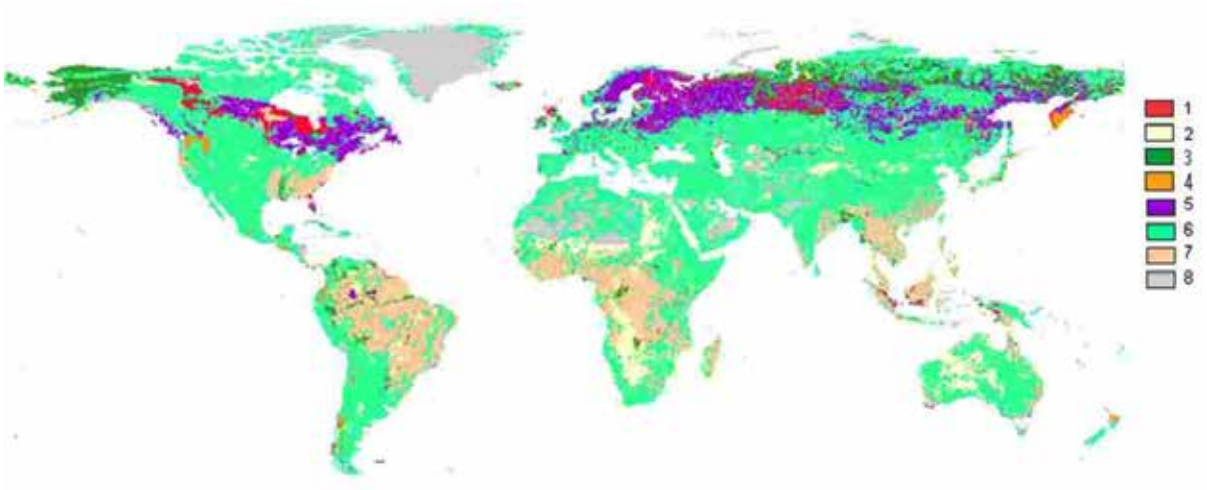


Figure 2 Geographic distribution of soil types



2. CONSISTENT REPRESENTATION OF LAND CARBON STOCKS

For determining the carbon stock per unit area associated with CS_{R} and CSA the following rules shall apply:

(1) the area for which the land carbon stocks are calculated shall for the entire area have similar:

(a) biophysical conditions in terms of climate and soil type;

(b) management history in terms of tillage;

(c) input history in terms of carbon input to soil.

(2) the carbon stock of the actual land use, CS_{A} , shall be taken as:

— in the case of loss of carbon stock: the estimated equilibrium carbon stock that the land will reach in its new use,

— in the case of carbon stock accumulation: the estimated carbon stock after 20 years or when the crop reaches maturity, whichever the earlier.

3. CALCULATION OF CARBON STOCKS

For the calculation of CS_{R} and CSA the following rule shall apply:

$$CS_{i} = (SOC + CVEG) \times A$$

where:

$CS_{I=}$ the carbon stock per unit area associated with the land use i (measured as mass of carbon per unit area, including both soil and vegetation);

SOC= soil organic carbon (measured as mass of carbon per hectare), calculated in accordance with point 4;

C_{VEG}= above and below ground vegetation carbon stock (measured as mass of carbon per hectare), calculated in accordance with point 5 or selected from the appropriate values in point 8;

A= factor scaling to the area concerned (measured as hectares per unit area).

4. SOIL ORGANIC CARBON STOCK

4.1. Mineral soils

For the calculation of SOC the following rule may be used:

$$SOC = SOC_{ST} \times FLU \times FMG \times FI$$

where:

SOC= soil organic carbon (measured as mass of carbon per hectare);

SOC_{ST}= standard soil organic carbon in the 0-30 centimetre topsoil layer (measured as mass of carbon per hectare);

F_{LU}= land use factor reflecting the difference in soil organic carbon associated with the type of land use compared to the standard soil organic carbon;

F_{MG}= management factor reflecting the difference in soil organic carbon associated with the principle management practice compared to the standard soil organic carbon;

F_{I}= input factor reflecting the difference in soil organic carbon associated with different levels of carbon input to soil compared to the

standard soil organic carbon.

For SOC_{ST} the appropriate values presented in point 6 shall apply.

For F_{LU}, FMG and FI the appropriate values presented in point 7 shall apply.

As an alternative to using the above rule, other appropriate methods, including measurements, may be used to determine SOC. As far as such methods are not based on measurements, they shall take into account climate, soil type, land cover, land management and inputs.

4.2. Organic soils (histosols)

For determining SOC, appropriate methods shall be used. Such methods shall take into account the entire depth of the organic soil layer as well as climate, land cover and land management and input. Such methods may include measurements.

Where carbon stock affected by soil drainage is concerned, losses of carbon following drainage shall be taken into account by appropriate methods. Such methods may be based on annual losses of carbon following drainage.

5. ABOVE AND BELOW GROUND VEGETATION CARBON STOCK

Except where a value for C_{VEG} set out in point 8 is used, for the calculation of CVEG the following rule shall apply:

$C_{VEG} = CBM + CDOM$

where:

C_{VEG}= above and below ground vegetation carbon stock (measured as mass of carbon per hectare);

C_{BM}= above and below ground carbon stock in living biomass (measured as mass of carbon per hectare), calculated in accordance with

point 5.1;

C_{DOM}= above and below ground carbon stock in dead organic matter (measured as mass of carbon per hectare), calculated in accordance with point 5.2.

For C_{DOM} the value of 0 may be used, except in the case of forest land — excluding forest plantations — having more than 30 % canopy cover.

5.1. Living biomass

For the calculation of C_{BM} the following rule shall apply:

$C_{BM} = CAGB + CBGB$

where:

C_{BM}= above and below ground carbon stock in living biomass (measured as mass of carbon per hectare);

C_{AGB}= above ground carbon stock in living biomass (measured as mass of carbon per hectare), calculated in accordance with point 5.1.1;

C_{BGB}= below ground carbon stock in living biomass (measured as mass of carbon per hectare), calculated in accordance with point 5.1.2.

5.1.1. Above ground living biomass

For the calculation of C_{AGB} the following rule shall apply:

$C_{AGB =} BAGB \times CFB$

where:

C_{AGB}= above ground carbon stock in living biomass (measured as mass of carbon per hectare);

B_{AGB}= weight of above ground living biomass (measured as mass of dry matter per hectare);

CF_B= carbon fraction of dry matter in living biomass (measured as mass of carbon per mass of dry matter).

For cropland, perennial crops and forest plantations the value for B_{AGB} shall be the average weight of the above ground living biomass during the production cycle.

For CF_B the value of 0,47 may be used.

5.1.2. Below ground living biomass

For the calculation of C_{BGB} one of the following two rules shall be used:

(1) $C_{BGB} = B_{BGB} \times CF_B$

where:

C_{BGB}= below ground carbon stock in living biomass (measured as mass of carbon per hectare);

B_{BGB}= weight of below ground living biomass (measured as mass of dry matter per hectare);

CF_B= carbon fraction of dry matter in living biomass (measured as mass of carbon per mass of dry matter).

For cropland, perennial crops and forest plantations the value for B_{BGB} shall be the average weight of the below ground living biomass during the production cycle.

For CF_B the value of 0,47 may be used.

(2) $C_{BGB} = C_{AGB} \times R$

where:

C_{BGB}= below ground carbon stock in living biomass (measured as mass of carbon per hectare);

C_{AGB}= above ground carbon stock in living biomass (measured as mass of carbon per hectare);

R= ratio of below ground carbon stock in living biomass to above ground carbon stock in living biomass.

Appropriate values for R set out in point 8 may be used.

5.2. Dead organic matter

For the calculation of C_{DOM} the following rule shall apply:

$C_{DOM} = CDW + CLI$

where:

C_{DOM}= above and below ground carbon stock in dead organic matter (measured as mass of carbon per hectare);

C_{DW}= carbon stock in dead wood pool (measured as mass of carbon per hectare), calculated in accordance with point 5.2.1;

C_{LI}= carbon stock in litter (measured as mass of carbon per hectare), calculated in accordance with point 5.2.2.

5.2.1. Carbon stock in dead wood pool

For the calculation of C_{DW} the following rule shall apply:

$C_{DW} = DOMDW \times CFDW$

where:

C_{DW}= carbon stock in dead wood pool (measured as mass of carbon per hectare);

DOM_{DW}= weight of dead wood pool (measured as mass of dry matter per hectare);

CF_{DW}= carbon fraction of dry matter in dead wood pool (measured as mass of carbon per mass of dry matter).

For CF_{DW} the value of 0,5 may be used.

5.2.2. Carbon stock in litter

For the calculation of C_{LI} the following rule shall apply:

$C_{LI} = DOMLI \times CFLI$

where:

$C_{LI=}$ carbon stock in litter (measured as mass of carbon per hectare);

$DOM_{LI=}$ weight of litter (measured as mass of dry matter per hectare);

$CF_{LI=}$ carbon fraction of dry matter in litter (measured as mass of carbon per mass of dry matter).

For CF_{LI} the value of 0,4 may be used.

6. STANDARD SOIL CARBON STOCK IN MINERAL SOILS

A value for SOC_{ST} shall be selected from table 1, based on the appropriate climate region and soil type of the area concerned as set out in points 6.1 and 6.2.

TABLE 1 SOCST, STANDARD SOIL ORGANIC CARBON IN THE 0-30 CENTIMETRE TOPSOIL LAYER

(tonnes of carbon per hectare)						
Climate Region	**Soil type**					
	High activity clay soils	Low activity clay soils	Sandy soils	Spodic soils	Volcanic soils	Wetland soils
Boreal	68	—	10	117	20	146
Cold temperate, dry	50	33	34	—	20	87
Cold temperate, moist	95	85	71	115	130	87
Warm temperate, dry	38	24	19	—	70	88
Warm temperate, moist	88	63	34	—	80	88
Tropical, dry	38	35	31	—	50	86
Tropical, moist	65	47	39	—	70	86
Tropical, wet	44	60	66	—	130	86
Tropical, montane	88	63	34	—	80	86

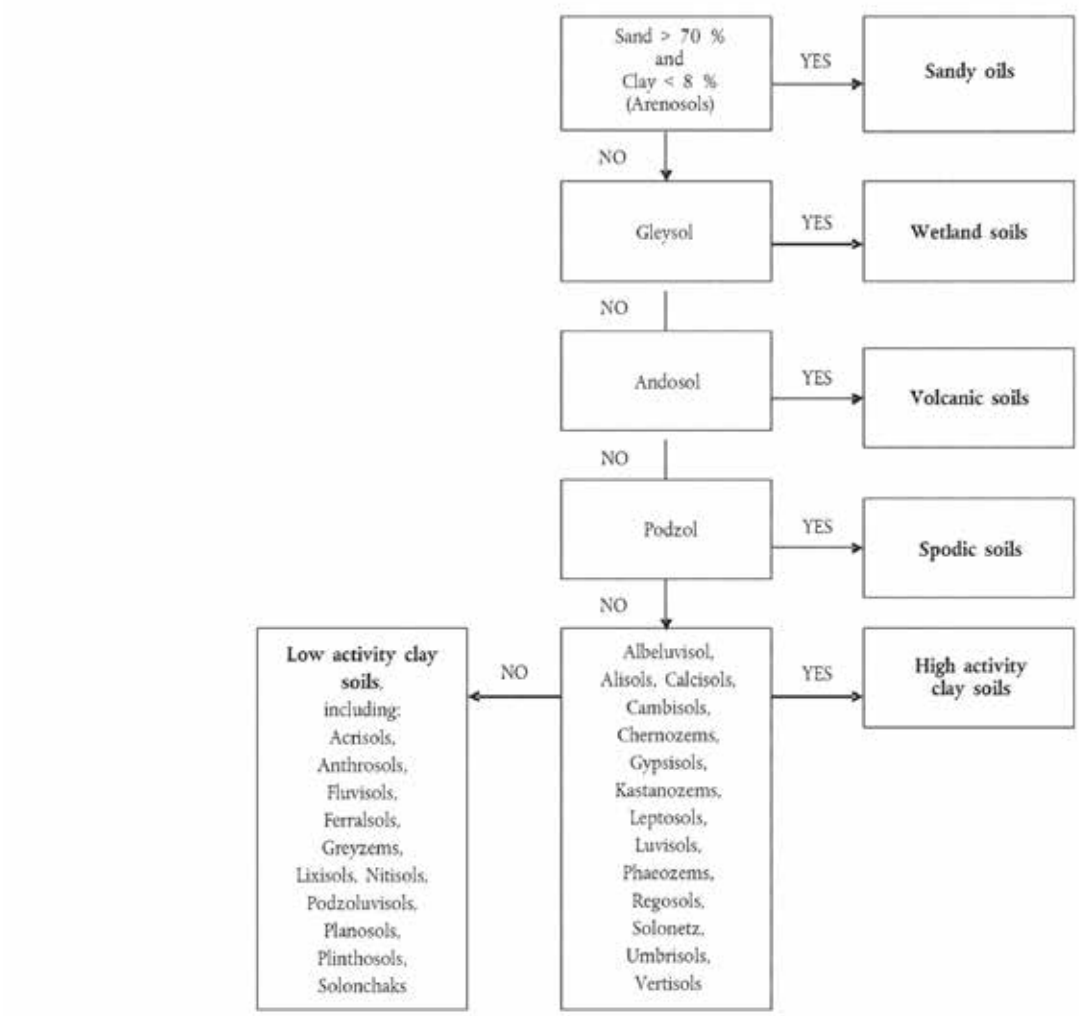
6.1. CLIMATE REGION

The appropriate climate region for the selection of the appropriate value for SOC_{ST} shall be determined from the climate region data layers available through the Transparency platform established by Article 24 of Directive 2009/28/EC.

6.2. Soil type

The appropriate soil type shall be determined according to figure 3. The soil type data layers available through the Transparency platform established by Article 24 of Directive 2009/28/EC may be used as guidance to determine the appropriate soil type.

FIGURE 3 CLASSIFICATION OF SOIL TYPES



7. FACTORS REFLECTING THE DIFFERENCE IN SOIL ORGANIC CARBON COMPARED TO THE STANDARD SOIL ORGANIC CARBON

Appropriate values for $F_L U$, FMG and FI shall be selected from tables in this point. For the calculation of CSR the appropriate management and input factors are those that were applied in January 2008. For the calculation of CSA the appropriate management and input factors are those that are being applied and will lead to the equilibrium carbon stock concerned.

7.1. Cropland

Table 2 Factors for cropland

Climate region	Land use (FLU)	Manage-ment (FMG)	Input (FI)	FLU	FMG	FI
Temperate/Boreal, dry	Cultivated	Full-tillage	Low	0,8	1	0,95
			Medium	0,8	1	1
			High with manure	0,8	1	1,37
			High without manure	0,8	1	1,04
		Reduced tillage	Low	0,8	1,02	0,95
			Medium	0,8	1,02	1
			High with manure	0,8	1,02	1,37
			High without manure	0,8	1,02	1,04
		No till	Low	0,8	1,1	0,95
			Medium	0,8	1,1	1

Climate region	Land use (FLU)	Manage-ment (FMG)	Input (FI)	FLU	FMG	FI
Temperate/Boreal, dry	Cultivated	No till	High with manure	0,8	1,1	1,37
			High without manure	0,8	1,1	1,04
Temperate/Boreal, moist/wet		Full-tillage	Low	0,69	1	0,92
			Medium	0,69	1	1
			High with manure	0,69	1	1,44
			High without manure	0,69	1	1,11
		Reduced tillage	Low	0,69	1,08	0,92
			Medium	0,69	1,08	1
			High with manure	0,69	1,08	1,44
			High without manure	0,69	1,08	1,11
		No till	Low	0,69	1,15	0,92
			Medium	0,69	1,15	1
			High with manure	0,69	1,15	1,44
			High without manure	0,69	1,15	1,11
Tropical, dry	Cultivated	Full-tillage	Low	0,58	1	0,95
			Medium	0,58	1	1
			High with manure	0,58	1	1,37
			High without manure	0,58	1	1,04
		Reduced tillage	Low	0,58	1,09	0,95
			Medium	0,58	1,09	1
			High with manure	0,58	1,09	1,37
			High without manure	0,58	1,09	1,04
		No till	Low	0,58	1,17	0,95
			Medium	0,58	1,17	1
			High with manure	0,58	1,17	1,37
			High without manure	0,58	1,17	1,04

Climate region	Land use (FLU)	Manage-ment (FMG)	Input (FI)	FLU	FMG	FI
Tropical, moist/wet	Cultivated	Full-tillage	Low	0,48	1	0,92
			Medium	0,48	1	1
			High with manure	0,48	1	1,44
			High without manure	0,48	1	1,11
		Reduced tillage	Low	0,48	1,15	0,92
			Medium	0,48	1,15	1
			High with manure	0,48	1,15	1,44
			High without manure	0,48	1,15	1,11
		No till	Low	0,48	1,22	0,92
			Medium	0,48	1,22	1
			High with manure	0,48	1,22	1,44
			High without manure	0,48	1,22	1,11
Tropical Montane	Cultivated	Full-tillage	Low	0,64	1	0,94
			Medium	0,64	1	1
			High with manure	0,64	1	1,41
			High without manure	0,64	1	1,08
		Reduced tillage	Low	0,64	1,09	0,94
			Medium	0,64	1,09	1
			High with manure	0,64	1,09	1,41
			High without manure	0,64	1,09	1,08
Tropical Montane	Cultivated	No till	Low	0,64	1,16	0,94
			Medium	0,64	1,16	1
			High with manure	0,64	1,16	1,41
			High without manure	0,64	1,16	1,08

Table 3 provides guidance for selecting appropriate values from Tables 2 and 4.

TABLE 3 GUIDANCE ON MANAGEMENT AND INPUT FOR CROPLAND AND PERENNIAL CROPS

Management/ Input	Guidance
Full-tillage	Substantial soil disturbance with full inversion and/or frequent (within year) tillage operations. At planting time, little (e.g. < 30 %) of the surface is covered by residues.
Reduced tillage	Primary and/or secondary tillage but with reduced soil disturbance (usually shallow and without full soil inversion) and normally leaves surface with > 30 % coverage by residues at planting.
No till	Direct seeding without primary tillage, with only minimal soil disturbance in the seeding zone. Herbicides are typically used for weed control.
Low	Low residue return occurs when there is due to removal of residues (via collection or burning), frequent bare-fallowing, production of crops yielding low residues (e.g. vegetables, tobacco, cotton), no mineral fertilisation or nitrogen-fixing crops.
Medium	Representative for annual cropping with cereals where all crop residues are returned to the field. If residues are removed then supplemental organic matter (e.g. manure) is added. Also requires mineral fertilisation or nitrogen-fixing crop in rotation.
High with manure	Represents significantly higher carbon input over medium carbon input cropping systems due to an additional practice of regular addition of animal manure.
High without manure	Represents significantly greater crop residue inputs over medium carbon input cropping systems due to additional practices, such as production of high residue yielding crops, use of green manures, cover crops, improved vegetated fallows, irrigation, frequent use of perennial grasses in annual crop rotations, but without manure applied (see row above).

7.2. PERENNIAL CROPS

TABLE 4 FACTORS FOR PERENNIAL CROPS, NAMELY MULTI-ANNUAL CROPS WHOSE STEM IS USUALLY NOT ANNUALLY HARVESTED SUCH AS SHORT ROTATION COPPICE AND OIL PALM

Climate region	Land use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
Temperate/Boreal, dry	Perennial crop	Full-tillage	Low	1	1	0,95
			Medium	1	1	1
			High with manure	1	1	1,37
			High without manure	1	1	1,04
		Reduced tillage	Low	1	1,02	0,95
			Medium	1	1,02	1
			High with manure	1	1,02	1,37
			High without manure	1	1,02	1,04
		No till	Low	1	1,1	0,95
			Medium	1	1,1	1
			High with manure	1	1,1	1,37
			High without manure	1	1,1	1,04
Temperate/Boreal, moist/ wet	Perennial crop	Full-tillage	Low	1	1	0,92
			Medium	1	1	1
			High with manure	1	1	1,44
			High without manure	1	1	1,11
		Reduced tillage	Low	1	1,08	0,92
			Medium	1	1,08	1
			High with manure	1	1,08	1,44
			High without manure	1	1,08	1,11
		No till	Low	1	1,15	0,92
			Medium	1	1,15	1
			High with manure	1	1,15	1,44
			High without manure	1	1,15	1,11

Climate region	Land use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
Tropical, dry	Perennial crop	Full-tillage	Low	1	1	0,95
			Medium	1	1	1
			High with manure	1	1	1,37
			High without manure	1	1	1,04
		Reduced tillage	Low	1	1,09	0,95
			Medium	1	1,09	1
			High with manure	1	1,09	1,37
			High without manure	1	1,09	1,04
		No till	Low	1	1,17	0,95
			Medium	1	1,17	1
			High with manure	1	1,17	1,37
			High without manure	1	1,17	1,04
Tropical, moist/wet	Perennial crop	Full-tillage	Low	1	1	0,92
			Medium	1	1	1
			High with manure	1	1	1,44
			High without manure	1	1	1,11
		Reduced tillage	Low	1	1,15	0,92
			Medium	1	1,15	1
			High with manure	1	1,15	1,44
			High without manure	1	1,15	1,11
		No till	Low	1	1,22	0,92
			Medium	1	1,22	1
			High with manure	1	1,22	1,44
			High without manure	1	1,22	1,11

Climate region	Land use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
Tropical Montane	Perennial crop	Full-tillage	Low	1	1	0,94
			Medium	1	1	1
			High with manure	1	1	1,41
			High without manure	1	1	1,08
		Reduced tillage	Low	1	1,09	0,94
			Medium	1	1,09	1
			High with manure	1	1,09	1,41
			High without manure	1	1,09	1,08
		No till	Low	1	1,16	0,94
			Medium	1	1,16	1
			High with manure	1	1,16	1,41
			High without manure	1	1,16	1,08

(2) n/a = not applicable;

in these cases FMG and FI shall not apply and for the calculation of SOC the following rule may be used: SOC = SOCST x FLU .

Table 3 in point 7.1 provides guidance for selecting appropriate values from Table 4.

7.3. Grassland

Table 5 Factors for grassland, including savannahs

Climate region	Land Use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
Temperate/Boreal, dry	Grassland	Improved	Medium	1	1,14	1
			High	1	1,14	1,11
		Nominally managed	Medium	1	1	1
		Moderately degraded	Medium	1	0,95	1
		Severely degraded	Medium	1	0,7	1
Temperate/Boreal, moist/wet	Grassland	Improved	Medium	1	1,14	1
			High	1	1,14	1,11
		Nominally managed	Medium	1	1	1
		Moderately degraded	Medium	1	0,95	1
		Severely degraded	Medium	1	0,7	1
Tropical, dry	Grassland	Improved	Medium	1	1,17	1
			High	1	1,17	1,11
		Nominally managed	Medium	1	1	1
		Moderately degraded	Medium	1	0,97	1
		Severely degraded	Medium	1	0,7	1
Tropical, moist/wet	Savannah	Improved	Medium	1	1,17	1
			High	1	1,17	1,11
		Nominally managed	Medium	1	1	1
		Moderately degraded	Medium	1	0,97	1
		Severely degraded	Medium	1	0,7	1

Climate region	Land Use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
Tropical Montane, dry	Grassland	Improved	Medium	1	1,16	1
			High	1	1,16	1,11
		Nominally managed	Medium	1	1	1
		Moderately degraded	Medium	1	0,96	1
		Severely degraded	Medium	1	0,7	1

Table 6 provides guidance for selecting appropriate values from Table 5.

TABLE 6 GUIDANCE ON MANAGEMENT AND INPUT FOR GRASSLAND

Management/ Input	Guidance
Improved	Represents grassland which is sustainably managed with moderate grazing pressure and that receive at least one improvement (e.g. fertilisation, species improvement, irrigation).
Nominally managed	Represents non-degraded and sustainably managed grassland, but without significant management improvements.
Moderately degraded	Represents overgrazed or moderately degraded grassland, with somewhat reduced productivity (relative to the native or nominally managed grassland) and receiving no management inputs.
Severely degraded	Implies major long-term loss of productivity and vegetation cover, due to severe mechanical damage to the vegetation and/or severe soil erosion.
Medium	Applies where no additional management inputs have been used.
High	Applies to improved grassland where one or more additional management inputs/ improvements have been used (beyond that is required to be classified as improved grassland).

7.4. Forest land

Table 7 Factors for forest land having at least 10 % canopy cover

Climate region	Land use (FLU)	Management (FMG)	Input (FI)	FLU	FMG	FI
All	Native forest (non-degraded)	n/a (1)	n/a	1		
All	Managed forest	All	All	1	1	1
Tropical, moist/dry	Shifting cultivation-shortened fallow	n/a	n/a	0,64		
	Shifting cultivation-mature fallow	n/a	n/a	0,8		
Temperate/Boreal, moist/dry	Shifting cultivation-shortened fallow	n/a	n/a	1		
	Shifting cultivation-mature fallow	n/a	n/a	1		

Table 8 provides guidance for selecting appropriate values from Table 7.

Table 8 Guidance on land use for forest land

Land use	Guidance
Native forest (non-degraded)	Represents native or long-term, non-degraded and sustainably managed forest.
Shifting cultivation	Permanent shifting cultivation, where tropical forest or woodland is cleared for planting of annual crops for a short time (e.g. 3-5 years) period and then abandoned to regrowth.
Mature fallow	Represents situations where the forest vegetation recovers to a mature or near mature state prior to being cleared again for cropland use.
Shortened fallow	Represents situations where the forest vegetation recovery is not attained prior to reclearing.

8. CARBON STOCK VALUES FOR ABOVE AND BELOW GROUND VEGETATION CARBON STOCK

For $C_V EG$ or R the appropriate values laid down in this point may be used.

8.1. Cropland

Table 9 Vegetation values for cropland (general)

Climate region	CVEG (tonnes carbon/hectare)
All	0

Table 10 Vegetation values for sugar cane (specific)

Domain	Climate region	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Tropical	Tropical dry	Tropical dry forest	Africa	4,2
			Asia (continental, insular)	4
		Tropical scrubland	Asia (continental, insular)	4
	Tropical moist	Tropical moist deciduous forest	Africa	4,2
			Central and South America	5
	Tropical wet	Tropical rain forest	Asia (continental, insular)	4
			Central and South America	5

Domain	Climate region	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Subtropical	Warm temperate dry	Subtropical steppe	North America	4,8
	Warm temperate moist	Subtropical humid forest	Central and South America	5
			North America	4,8

8.2. Perennial crops, namely multi-annual crops whose stem is usually not annually harvested such as short rotation coppice and oil palm

Table 11 Vegetation values for perennial crops (general)

Climate region	CVEG (tonnes carbon per hectare)
Temperate (all moisture regimes)	43,2
Tropical, dry	6,2
Tropical, moist	14,4
Tropical, wet	34,3

Table 12 Vegetation values for specific perennial crops

Climate region	Crop type	CVEG (tonnes carbon per hectare)
All	Coconuts	75
	Jatropha	17,5
	Jojoba	2,4
	Oil palm	60

8.3. Grassland

Table 13 Vegetation values for grassland — excluding scrubland (general)

Climate region	CVEG (tonnes carbon per hectare)
Boreal — Dry & Wet	4,3
Cool Temperate — Dry	3,3
Cool Temperate — Wet	6,8
Warm Temperate — Dry	3,1
Warm Temperate — Wet	6,8
Tropical — Dry	4,4
Tropical — Moist & Wet	8,1

Table 14 Vegetation values for Miscanthus (specific)

Domain	Climate region	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Subtropical	Warm temperate dry	Subtropical dry forest	Europe	10
			North America	14,9
		Subtropical steppe	North America	14,9

Table 15 Vegetation values for scrubland, namely land with vegetation composed largely of woody plants lower than 5 meter not having clear physiognomic aspects of trees

Domain	Continent	CVEG (tonnes carbon per hectare)
Tropical	Africa	46
	North and South America	53
	Asia (continental)	39
	Asia (insular)	46
	Australia	46

Subtropical	Africa	43
	North and South America	50
	Asia (continental)	37
	Europe	37
	Asia (insular)	43
Temperate	Global	7,4

8.4. Forest land

Table 16 Vegetation values for forest land — excluding forest plantations — having between 10 % and 30 % canopy cover

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Tropical	Tropical rain forest	Africa	40	0,37
		North and South America	39	0,37
		Asia (continental)	36	0,37
		Asia (insular)	45	0,37
	Tropical moist forest	Africa	30	0,24
		North and South America	26	0,24
		Asia (continental)	21	0,24
		Asia (insular)	34	0,24
	Tropical dry forest	Africa	14	0,28
		North and South America	25	0,28
		Asia (continental)	16	0,28
		Asia (insular)	19	0,28
	Tropical mountain systems	Africa	13	0,24
		North and South America	17	0,24
		Asia (continental)	16	0,24
		Asia (insular)	26	0,28

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Subtropical	Subtropical humid forest	North and South America	26	0,28
		Asia (continental)	22	0,28
		Asia (insular)	35	0,28
	Subtropical dry forest	Africa	17	0,28
		North and South America	26	0,32
		Asia (continental)	16	0,32
		Asia (insular)	20	0,32
	Subtropical steppe	Africa	9	0,32
		North and South America	10	0,32
		Asia (continental)	7	0,32
		Asia (insular)	9	0,32
Temperate	Temperate oceanic forest	Europe	14	0,27
		North America	79	0,27
		New Zealand	43	0,27
		South America	21	0,27
	Temperate continental forest	Asia, Europe (≤ 20 y)	2	0,27
		Asia, Europe (> 20 y)	14	0,27
		North and South America (≤ 20 y)	7	0,27
		North and South America (> 20 y)	16	0,27
	Temperate mountain systems	Asia, Europe (≤ 20 y)	12	0,27
		Asia, Europe (> 20 y)	16	0,27
		North and South America (≤ 20 y)	6	0,27
		North and South America (> 20 y)	6	0,27

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Boreal	Boreal coniferous forest	Asia, Europe, North America	12	0,24
	Boreal tundra woodland	Asia, Europe, North America (≤ 20 y)	0	0,24
		Asia, Europe, North America (> 20 y)	2	0,24
	Boreal mountain systems	Asia, Europe, North America (≤ 20 y)	2	0,24
		Asia, Europe, North America (> 20 y)	6	0,24

TABLE 17 VEGETATION VALUES FOR FOREST LAND — EXCLUDING FOREST PLANTATIONS — HAVING MORE THAN 30 % CANOPY COVER

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Tropical	Tropical rain forest	Africa	204
		North and South America	198
		Asia (continental)	185
		Asia (insular)	230
	Tropical moist deciduous forest	Africa	156
		North and South America	133
		Asia (continental)	110
		Asia (insular)	174
	Tropical dry forest	Africa	77
		North and South America	131
		Asia (continental)	83
		Asia (insular)	101
	Tropical mountain systems	Africa	77
		North and South America	94
		Asia (continental)	88
		Asia (insular)	130

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Subtropical	Subtropical humid forest	North and South America	132
		Asia (continental)	109
		Asia (insular)	173
	Subtropical dry forest	Africa	88
		North and South America	130
		Asia (continental)	82
		Asia (insular)	100
	Subtropical steppe	Africa	46
		North and South America	53
		Asia (continental)	41
		Asia (insular)	47
Temperate	Temperate oceanic forest	Europe	84
		North America	406
		New Zealand	227
		South America	120
	Temperate continental forest	Asia, Europe (≤ 20 y)	27
		Asia, Europe (> 20 y)	87
		North and South America (≤ 20 y)	51
		North and South America (> 20 y)	93
	Temperate mountain systems	Asia, Europe (≤ 20 y)	75
		Asia, Europe (> 20 y)	93
		North and South America (≤ 20 y)	45
		North and South America (> 20 y)	93

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)
Boreal	Boreal coniferous forest	Asia, Europe, North America	53
	Boreal tundra woodland	Asia, Europe, North America (≤ 20 y)	26
		Asia, Europe, North America (> 20 y)	35
	Boreal mountain systems	Asia, Europe, North America (≤ 20 y)	32
		Asia, Europe, North America (> 20 y)	53

Table 18

Vegetation values for forest plantations

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Tropical	Tropical rain forest	Africa broadleaf > 20 y	87	0,24
		Africa broadleaf ≤ 20 y	29	0,24
		Africa Pinus sp. > 20 y	58	0,24
		Africa Pinus sp. ≤ 20 y	17	0,24
		Americas Eucalyptus sp.	58	0,24
		Americas Pinus sp.	87	0,24
		Americas Tectona grandis	70	0,24
		Americas other broadleaf	44	0,24
		Asia broadleaf	64	0,24
		Asia other	38	0,24

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Tropical	Tropical moist deciduous forest	Africa broadleaf > 20 y	44	0,24
		Africa broadleaf ≤ 20 y	23	0,24
		Africa Pinus sp. > 20 y	35	0,24
		Africa Pinus sp. ≤ 20 y	12	0,24
		Americas Eucalyptus sp.	26	0,24
		Americas Pinus sp.	79	0,24
		Americas Tectona grandis	35	0,24
		Americas other broadleaf	29	0,24
		Asia broadleaf	52	0,24
		Asia other	29	0,24
Tropical	Tropical dry forest	Africa broadleaf > 20 y	21	0,28
		Africa broadleaf ≤ 20 y	9	0,28
		Africa Pinus sp. > 20 y	18	0,28
		Africa Pinus sp. ≤ 20 y	6	0,28
		Americas Eucalyptus sp.	27	0,28
		Americas Pinus sp.	33	0,28
		Americas Tectona grandis	27	0,28
		Americas other broadleaf	18	0,28
		Asia broadleaf	27	0,28
		Asia other	18	0,28
	Tropical shrubland	Africa broadleaf	6	0,27
		Africa Pinus sp. > 20 y	6	0,27
		Africa Pinus sp. ≤ 20 y	4	0,27
		Americas Eucalyptus sp.	18	0,27
		Americas Pinus sp.	18	0,27
		Americas Tectona grandis	15	0,27
		Americas other broadleaf	9	0,27
		Asia broadleaf	12	0,27
		Asia other	9	0,27

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Tropical	Tropical mountain systems	Africa broadleaf > 20 y	31	0,24
		Africa broadleaf ≤ 20 y	20	0,24
		Africa Pinus sp. > 20 y	19	0,24
		Africa Pinus sp. ≤ 20 y	7	0,24
		Americas Eucalyptus sp.	22	0,24
		Americas Pinus sp.	29	0,24
		Americas Tectona grandis	23	0,24
		Americas other broadleaf	16	0,24
		Asia broadleaf	28	0,24
		Asia other	15	0,24
Subtropical	Subtropical humid forest	Americas Eucalyptus sp.	42	0,28
		Americas Pinus sp.	81	0,28
		Americas Tectona grandis	36	0,28
		Americas other broadleaf	30	0,28
		Asia broadleaf	54	0,28
		Asia other	30	0,28
Subtropical	Subtropical dry forest	Africa broadleaf > 20 y	21	0,28
		Africa broadleaf ≤ 20 y	9	0,32
		Africa Pinus sp. > 20 y	19	0,32
		Africa Pinus sp. ≤ 20 y	6	0,32
		Americas Eucalyptus sp.	34	0,32
		Americas Pinus sp.	34	0,32
		Americas Tectona grandis	28	0,32
		Americas other broadleaf	19	0,32
		Asia broadleaf	28	0,32
		Asia other	19	0,32

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Subtropical	Subtropical steppe	Africa broadleaf	6	0,32
		Africa Pinus sp. > 20 y	6	0,32
		Africa Pinus sp. ≤ 20 y	5	0,32
		Americas Eucalyptus sp.	19	0,32
		Americas Pinus sp.	19	0,32
		Americas Tectona grandis	16	0,32
		Americas other broadleaf	9	0,32
		Asia broadleaf > 20 y	25	0,32
		Asia broadleaf ≤ 20 y	3	0,32
		Asia coniferous > 20 y	6	0,32
		Asia coniferous ≤ 20 y	34	0,32
Subtropical	Subtropical mountain systems	Africa broadleaf > 20 y	31	0,24
		Africa broadleaf ≤ 20 y	20	0,24
		Africa Pinus sp. > 20 y	19	0,24
		Africa Pinus sp. ≤ 20 y	7	0,24
		Americas Eucalyptus sp.	22	0,24
		Americas Pinus sp.	34	0,24
		Americas Tectona grandis	23	0,24
		Americas other broadleaf	16	0,24
		Asia broadleaf	28	0,24
		Asia other	15	0,24

Domain	Ecological zone	Continent	CVEG (tonnes carbon per hectare)	R
Temperate	Temperate oceanic forest	Asia, Europe, broadleaf > 20 y	60	0,27
		Asia, Europe, broadleaf ≤ 20 y	9	0,27
		Asia, Europe, coniferous > 20 y	60	0,27
		Asia, Europe, coniferous ≤ 20 y	12	0,27
		North America	52	0,27
		New Zealand	75	0,27
		South America	31	0,27
	Temperate continental forest and mountain systems	Asia, Europe, broadleaf > 20 y	60	0,27
		Asia, Europe, broadleaf ≤ 20 y	4	0,27
		Asia, Europe, coniferous > 20 y	52	0,27
		Asia, Europe, coniferous ≤ 20 y	7	0,27
		North America	52	0,27
		South America	31	0,27
Boreal	Boreal coniferous forest and mountain systems	Asia, Europe > 20 y	12	0,24
		Asia, Europe ≤ 20 y	1	0,24
		North America	13	0,24
	Boreal tundra wood-land	Asia, Europe > 20 y	7	0,24
		Asia, Europe ≤ 20 y	1	0,24
		North America	7	0,24