Product Category Rule Module for Roundwood

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Program Operator SCSglobal SERVICES

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17   Period of Validity

18   The final version of this PCR will be valid for five (5) years from the date of its issue.

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20 Table of Contents

54 Introduction

55 This Product Category Rule (PCR) module specifies the requirements for completing Life Cycle
56 Assessment (LCAs) and preparing Environmental Product Declarations (EPDs) for roundwood products.
57 This PCR module conforms to the N505 document,[1] draft LEO-S-002,[2] ISO 14025, 14040 and 14044.

58 This PCR module is intended to be used in conjunction with an accompanying Life Cycle Impact
59 Assessment Methodology (LCIA) Document, which provides details for the LCIA phase, including
60 algorithms for calculating results. Use of these two documents allows for the establishment of LCAs and
61 EPDs for roundwood products. In addition, this PCR module can be used in conjunction with the PCR
62 module for pulp and paper, in order to produce LCAs and EPDs for those products.

63 The LCA methodology contained in these documents is intended to provide standardized protocols for
64 addressing all relevant environmental and human health impacts from wood and paper production.
65 These relevant impacts are based on the observable alterations compared to preindustrial conditions for
66 many impact categories of environmental change, all of which can be linked back to anthropogenic
67 activities related to logging and/or pulp/papermaking. In order to practically and consistently assess the
68 degree of change within these impact categories in different instances, these protocols also contain
69 detailed algorithms and data requirements for each type of evaluation. These algorithms are intended
70 to provide results which are of a high enough precision and accuracy to be useful in decision making,
71 product comparisons, improvement in environmental conditions, and in other applications of LCA in this
72 context. Users of this PCR module are encouraged to become familiarized with the LCIA Methodology
73 Document. In this PCR module, references are made to this document where necessary.

74 This PCR module can be used as the basis of LCAs for product categories besides pulp/paper which use
75 roundwood as a material input, like dimensional lumber, viscose fiber, wood pellets, and doors and
76 windows made from wood. In the future, additional PCR modules for these other product categories
77 should be developed which are consistent with this PCR module and the LCIA methodology document.
78 This will allow for the development of complete and accurate EPDs for these other product categories.

79 In developing this PCR module, existing PCRs for wood were reviewed, including FPInnovations' PCR for
80 North American Structural and Architectural Wood Products. The reason for developing this PCR is
81 because these PCRs do not account for the ecosystem impacts or effects on biogenic carbon storage
82 resulting from logging used to produce roundwood products. This PCR module requires that the LCIA
83 phase include all of the core impact categories associated with roundwood production, in accordance
84 with the impact categories of the LEO-S-002 standard and N505 ballot.

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[1] The N505 document was submitted by representatives from the US Technical Advisory Group to the ISO TC 207 as a formal set of revisions for the ISO 14044 LCA standard. The document contains requirements pertaining to LCA which are applicable in this document and in these PCR modules. Available at: https://www.scsglobalservices.com/resource/technical-review-of-life-cycle-impact-assessment-phase

[2] LEO-S-002, Second Public Comment Version, Available July 2016 at http://www.leonardoacademy.org/programs/standards/life-cycle.html

1 Scope

This PCR module provides rules and guidance for completing LCAs and developing EPDs for roundwood products. The rules and guidance described here can be used in many LCA applications, including:

- LCA reports for internal or external use.

- Decision-making in procurement, policy setting, or other settings.

- Single impact LCA studies (e.g., climate footprint or land use assessment studies), provided these are not used as the basis of comparisons between products or as the basis of EPDs.

- Other tools based in LCA.

2 Normative References

The following documents, in whole or in part, are normatively referenced in this PCR and are indispensable in its application:

- Life Cycle Impact Assessment Methodology for PCR Modules for Roundwood and Pulp/Paper.

- ISO 14025: 2006, *Environmental management – Type III environmental declarations – Principles and Procedure*, International Organization for Standardization, Geneva, Switzerland.

- ISO 14044: 2006, *Environmental management – Life cycle assessment – Principles and Framework,* International Organization for Standardization, Geneva, Switzerland.

- ISO 14044: 2006, *Environmental management – Life cycle assessment – Requirements and guidelines*, International Organization for Standardization, Geneva, Switzerland.

- LEO-S-002 LCA Standard. Being developed under American National Standards Institute Process, administrated by Leonardo Academy.[3]

- N505 Ballot Submission, US Technical Advisory Group Comments on ISO 14040/14044, submitted to ISO TC Secretariat in April 2015.

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[3] This PCR refers to the latest public version of this standard.

110 # 3   Terms and Definitions

111   The following terms and definitions apply under this Product Category Rule. See LCIA Methodology

112   Document for other relevant terms and definitions.

Term	Definition
Declared unit	Quantity of a product for use as a reference unit.
Fiber basket	The combination of the virgin and recycled fiber basket of a virgin or recycled fiber pulp mill.
Forest Analysis Unit	An area of timberland used to represent forest ecosystem impacts resulting from forestry operations within each fiber basket.
Forest Trend Monitoring plan	Forest Trend Monitoring plan includes designing sampling plans to select sample sizes and sampling frequency, identify the forest inventory parameters to be measured and determine sampling strategies for measurements.
Forest Trend Monitoring plot	A site at which various forest ecological conditions are measured. These plots are within a Forest Analysis Unit.
Key unit process	A unit process which contributes 15% or more to a category indicator result.
Land use	The number of acres occupied for one year to produce a certain amount of timber (measured in cubic feet). Calculated considering average production over at least a 10 year period. See Section 6.5.3 for further information. The land use per cubic feet of timber is the inverse of the site harvest productivity.
Net Freshwater Consumption	Water that is taken from surface water or groundwater source and not directly returned.[4]
Primary data	Quantified value of a unit process or an activity obtained from a direct measurement or a calculation based on direct measurements at its original source. [ISO / TS 14067]
Roundwood	Wood in its natural state as felled, with or without bark. This includes logs, bolts, whole-tree wood chips or other round timber generated from harvesting trees for industrial or consumer uses (adapted from US Forest Service[5] and UN Food and Agricultural definitions[6])
Roundwood basket	The region(s) supplying roundwood products considered in the scope. The roundwood basket includes a broad area which is not only restricted to areas subject to harvest in a given year, but includes the entire "patchwork" of areas harvested in different areas at different points in time. The region(s) included in the roundwood basket shall: include the entire area treated by any existing forest management or silvicultural plans; be defined to appropriately represent effects from overall forest management practices, including not only harvests, but also logging roads, staging areas, infrastructure, and other areas which are occupied for logging operations; be defined at a landscape scale sufficient to capture impacts in regions adjacent to where harvests and other logging-related activities are occurring; consider any set aside areas which may be part of the overall forest management plan.
Secondary data	Data obtained from sources other than a direct measurement or a calculation based on direct measurements at the original source. NOTE: Such sources can include databases and published literature validated by competent authorities. [ISO / TS 14067]
Site harvest productivity	The cubic feet of timber produced per acre, per year, in a forested area. Calculated considering average production over at least a 10 year period. See Section 6.5.3 for further information.
Undisturbed Reference Area	Follows definition of Undisturbed Reference Area from the LCIA Methodology Document.

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[4] King, C. W., & Webber, M. E. (2008). Water intensity of transportation. Environmental Science & Technology, 42(21), 7866-7872.

[5] http://www.nrs.fs.fed.us/fia/data-tools/state-reports/glossary/default.asp

[6] http://www.fao.org/docrep/v6530e/v6530e12.htm

4   Abbreviations

The following abbreviations apply under this Product Category Rule Module.

CPC   Central Production Classification
EPD   Environmental Product Declaration
FAU   Forest Analysis Unit
LCA   Life Cycle Assessment
PCR   Product Category Rule
FTM   Forest Trend Monitoring
FWDF   Freshwater Disturbance Factor
M-CF   Midpoint Characterization Factor
TDF   Terrestrial Disturbance Factor

5   General aspects

5.1   Objective of this PCR

This PCR module establishes a set of consistent rules, requirements and additional guidance for the preparation of EPDs for roundwood products and for other LCA applications. This PCR module also specifies the underlying requirements of the LCA upon which the EPD is based.

5.2   Comparability of EPDs based in this PCR

This PCR Module is cradle-to-gate and covers life cycle stages associated with roundwood production. It does not include the use or end-of-life of wood products. Accordingly, EPDs produced under this PCR module shall only be compared if the roundwood products covered have identical functional and end-of-life characteristics, and will be used and disposed of in the same fashion.

5.3   LCA Report

The LCA report shall provide a comprehensive summary of the LCA used to create the results in EPDs and other LCA applications, including methodology, scope, data sources, and other supporting information. The LCA report shall be provided to the EPD verifier (whom may be subject to protect the confidentiality of any information described as "confidential"). The LCA report does not need to be included as part of the public communication.

6   Product Category Rules for LCA

6.1   Goal and Scope Definition for the LCA

In the LCA report, the goal definition shall be described, including the commissioner of the study, reasons for carrying out the study, target audience, intended applications and the review procedure.

6.2   Product Category Definition

This PCR Module addresses roundwood products, including all products in the Central Product Classification (CPC)[7] code 031 (wood in the rough, incl. logs of coniferous and non-coniferous wood, and fuel wood).

6.3   System Boundary

The system boundary for the LCA is cradle-to-gate. The gate ends at the logging site with produced roundwood. The life cycle stages covered by this PCR Module include:

- Logging and forest management activities (e.g., forest fertilization, pest management, forest regeneration, etc.).

- Production of fuel and other inputs used in logging equipment.

- Production of pesticides, herbicides, and fertilizers which may be used in forest management.

The scope does not include employee transportation and production of logging equipment.

   NOTE: The resulting impact level of these unit processes compared to other life cycle stages in roundwood production are very small. Exclusion of these stages from the scope does not affect results materially.

There are two types of LCAs and EPDs types allowed:

- Product-specific LCAs and EPDs. These LCAs and EPDs consider roundwood produced from a single ownership area, from a single region. The roundwood basket for product-specific LCAs and EPDs is this single region.

- Industry-wide LCAs and EPDs. These LCAs and EPDs can be developed to represent roundwood from at least three distinct regions, possibly in multiple ownerships. The roundwood basket for industry-wide roundwood LCAs and EPDs is the complete set of regions included in the scope of the study.

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[7] Central Product Classification System; CPC Ver2.
http://unstats.un.org/unsd/cr/registry/docs/CPCv2_structure.pdf

168 The LCA shall assess the life cycle stages based on present conditions, using the most recent data
169 available. Product-specific LCAs and EPDs can also be presented which show changes against a historical
170 baseline condition, which can be no more than 10 years in the past. The LCA or EPD also projects
171 changes into the future based on the requirements of Section 6.5.1.

172 *FOR EXAMPLE.* A product-specific EPD for a roundwood basket in the state of California is based on
173 current impact levels in 2015. However, impact levels from past years can be included in the EPD,
174 showing changes over time.

6.4 Data quality requirements

176 Data shall be representative of the production conditions according to temporal, geographical and
177 technological requirements. The following specific requirements apply:

178 • Temporal: Data shall be as recent as possible.

179 • Geographical: The geographic region of the roundwood basket included in the calculation of
180 representative data shall be documented in the LCA Report.

181 • Technological: Data will represent technology in use and reflect the physical reality of the
182 product.

183 In order to understand the level of data quality in final results, uncertainty analysis shall be completed
184 for all LCA results. This uncertainty analysis shall provide a reasonable estimate of the 95% confidence
185 interval associated with each LCA result. This confidence interval shall be calculated by first estimating
186 the three main independent contributions to uncertainty in LCA:

187 • Uncertainty associated with data points related to the scope definition (e.g., product half-life in
188 use, fraction of disposed going to landfill, percentage of roundwood sourced from a given
189 region). This can be estimated through reasonable consideration of alternative scenarios or
190 uncertainty which is provided by data providers. If not included in the uncertainty calculation, it
191 should be made clear in the LCA report and EPD what key assumptions were made regarding the
192 scope definition.

193 • Uncertainty associated with Life Cycle Inventory data sources. Generally robust data on
194 uncertainty associated with inventory data is unavailable in the context of specific LCAs.
195 Reasonable estimates shall be made, based on the representativeness of data sources used and
196 examination of other similar datasets.

197 • Uncertainty associated with PP-CF and M-CFs. This uncertainty can generally be calculated
198 directly or derived from published literature sources. If this is not possible, reasonable estimates
199 should be made.

200 Once the confidence intervals in these data sources have been estimated, they shall be combined into a
201 single confidence interval for each indicator result using:

202 • Monte Carlo analysis techniques. These tools are available in available LCA software packages.

203 • Simple error propagation, evaluated by combining uncertainty in quadrature. In this simplified
204 approach, the sum of confidence intervals associated with scoping, inventory, and
205 characterization factors, are combined. The square root of this sum provides an estimated
206 confidence interval for the final LCA result.

207 The estimated 95% confidence interval associated with LCA results shall be in EPDs. The process for
208 estimating this uncertainty shall be described in the LCA report.

209 NOTE. Uncertainty analysis is required in order to interpret results, especially in comparisons. LCA results
210 without quantitative uncertainty analysis will overstate accuracy and can be misleading.

211 6.5 Rules and Guidance for Life Cycle Assessment

212 The requirements of ISO 14044, LEO-S-002, and N505 ballot all apply. The requirements and guidance in
213 Section 6.5 below are specific to Roundwood Production, and serve to ensure comparability of LCAs and
214 EPD results (where applicable) and minimize data collection efforts.

215 6.5.1 Annual Unit of Analysis and Timeframe of Analysis

216 Roundwood is an intermediate product for which the function for the whole life cycle is not specified in
217 this PCR, due to its potential use in multiple applications. A unit of analysis (which can also be referred
218 to as a declared unit) is instead used.

219 This PCR also specifies a timeframe of analysis in order to capture all temporal aspects of the impacts
220 relevant to roundwood production (see Table 2). This timeframe of analysis sets temporal boundaries
221 for the LCA. The unit of analysis is defined on a year-by-year basis within the timeframe of analysis, and
222 so is referred to as the "annual unit of analysis."

223 For all applications of LCA according to this PCR, the annual unit of analysis shall be the production of a
224 given volume of roundwood, which should be at least 1,000 cubic meters of wood, and the timeframe of
225 analysis shall consider a timeframe of analysis of at least 20 years, and at most 100 years.

226 *NOTE.* In general LCA applications, the annual unit of analysis can vary each year over the timeframe of
227 analysis. This can be useful, for example in exploration of the result of increasing procurement of roundwood
228 from a given source. For example, the unit of analysis could be 1,000 cubic meters of roundwood in year 1,
229 1,200 in year 2, 1,400 in year 3, etc.

230 *NOTE.* The 20 year and 100 year timeframes were selected to detect changes occurring in forest systems as a
231 result of different forest management practices, changes which are not perceptible for at least 20 years in

232   most forest ecosystems. Although the uncertainty associated with impacts over a 100 year timeframe is high,
233   this timeframe captures the long rotation cycles of different forest types and accommodates forest systems
234   that take a longer time to regenerate after logging.

235   For EPDs, the annual unit of analysis shall be the production of 1,000 cubic meters of roundwood, with
236   results reported at intervals of every 20 years from 20 to 100 years (i.e., reporting 5 results over time).
237   The EPD shall also include in supporting materials results across the entire time period of 20 to 100
238   years.

239   The scope of all LCAs under this PCR shall consider the annual unit of analysis (which can vary over time)
240   produced over the timeframe of analysis.

241   The average density of the roundwood, as well as the volumetric conversion factor used if density is
242   calculated using a conversion from any board-foot measure, will be included in the definition of the
243   annual unit of analysis.

244   ### 6.5.2   Criteria for the exclusion of inputs and outputs

245   Resource inputs, emissions, land use, and other flows can be excluded only if estimates indicate that
246   these data will not change any indicator result within the estimated margin of error (see Section 6.4).
247   The estimated change in the indicator result will have to be completed using the best available
248   information and expert judgement.

249   ### 6.5.3   Data Requirements

250   For data used to assess the final LCA results, the following requirements and guidance apply:

251   - Primary data shall be used: to assess terrestrial and freshwater ecosystem impacts; and to
252   calculate M-CFs[8] for key unit processes for GLO, PM2.5, Regional Acidification.

253   - For key unit processes affecting other impact categories, primary data should be used, when
254   readily available.

255   - If primary data are unavailable for a key unit process, this should be clearly stated in the
256   "Disclaimer" section of the EPD.

257   - For unit processes which are not "key" unit processes, secondary data may be used from life
258   cycle databases or other peer-reviewed sources. This data may be adjusted to reflect a regional
259   condition if it is believed that such an adjustment will have a significant impact on the reported
260   results.

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[8] Refer to Sections 5.6.1, 5.6.2 and 5.4.1 in the LCIA Methodology Document for description on M-CFs.

261   •   Any data gaps may be filled through use of conservative assumptions using representative data
262   based on a similar process (for example, hardwood production could be estimated from
263   softwood production). Assumptions used for filling data gaps shall be documented in the LCA
264   Report.

265 There are several data points which affect multiple indicator results. The following special requirements
266 apply:

267   •   For all data points related to flows of combustible materials (e.g., fossil fuels), the lower heating
268   value shall be used.

269   •   Site harvest productivity, measured in cubic feet of timber produced per acre, per year, is used
270   in multiple indicators. Site harvest productivity shall be calculated considering average
271   production over a Forest Analysis Unit (FAU), using data averaged over at least a 10 year period
272   (see Section 6.5.3.1 for definition of FAUs). If multiple forests are impacted within a single FAU,
273   site productivity shall be assessed independently for forests within each terrestrial ecoregion.
274   This data shall be collected considering the average annual volume of timber removals over the
275   entire FAU, averaged over at least a 10 year period. Timber removals shall include only timber
276   which can be processed into the roundwood products defined in Section 6.2; residues or other
277   materials left on-site are not included. The approach used to collect data on timber removals
278   shall be described in the Forest Trend Monitoring Plan, and shall, if possible, be collected during
279   monitoring within FTM plots (see Section 6.5.3.1).

280 NOTE: Within the US, total timber removals recorded by the US Forest Service Forest Inventory and
281 Analysis National program[9] can be used in most cases. In other countries, data from national forest
282 inventories can be used in most cases (e.g., average site productivity from the Swedish Forest Inventory).
283 The usefulness of these specific data sources will depend upon the locations and number of plots within
284 Forest Analysis Units. In all cases, during use of plot data from these sources or others, all requirements of
285 Section 6.5.3.1 shall apply.

286   •   The land use is the number of acres occupied for one year to produce a certain amount of
287   timber (measured in cubic feet). The land use per cubic feet of timber is the inverse of the site
288   productivity.

289   •   For roundwood products, emissions by forest carbon fluxes (i.e., net forest regrowth,
290   combustion/decay of aboveground logging residues, decay of tree roots left after harvest), shall
291   be calculated using specific data related to carbon combustion and decay rates, if available. If
292   specific data is unavailable, the following assumptions shall be used as a default:

293   •   Net forest regrowth is assumed to sequester atmospheric CO_2 in the year that it occurs.

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[9] The US Forest Service Forest Inventory and Analysis program provides easy access to detailed data using the Forest Inventory
Database Online tool. See http://apps.fs.fed.us/fia/fido/index.html

294 • Aboveground logging residues (i.e., "slash") combust or decay immediately, with all of the
295   carbon assumed to be converted into emissions of CO_2.

296 • Biomass stored in tree roots left behind after harvest are assumed to decay and be
297   converted entirely into emissions of CO_2 immediately, with all of the carbon assumed to be
298   converted into emissions of CO_2.

299   *NOTE.* These default assumptions regarding combustion or decay of aboveground logging residues and
300   roots are conservatively high. In many regions, carbon will be stored in these biomass pools for much
301   longer periods of time. Specific data from forest carbon models should be used whenever possible.

302 For the assessment of many impact categories, impacts on forest ecosystems across large areas must be
303 considered. For this type of assessment to be practical, representative areas must be chosen for analysis
304 where data can be practically collected on local forest conditions. These representative areas are called
305 FAUs. See Section 6.5.3.1 for requirements on defining FAUs.

306 The modeling of foregone growth's effects on standing biomass and carbon, affecting multiple impact
307 categories, requires special considerations. Modeling of foregone growth must follow the requirements
308 of Section 6.5.3.2.

309 Additional data requirements, by impact category, are described in the LCIA Methodology Document.

6.5.3.1 Defining Forest Analysis Units, Forest Trend Monitoring Plans, and Relating Them to Roundwood Basket

312 For roundwood production, results in many impact categories are affected by disturbances to forest
313 ecosystems. This includes: Wood Resource Depletion; Global Climate Change; Ocean Acidification; all
314 impacts in Terrestrial & Freshwater Ecosystems Impacts (from land use). These impacts result from
315 alterations in the forest ecology across the roundwood basket, with ensuing effects on forests,
316 watersheds, wetlands, species populations and habitats, and levels of stored biogenic carbon.

317 In order to make assessments of impacts across the roundwood basket practical, representative areas
318 must be chosen for analysis where data can be collected on local forest conditions. These representative
319 areas are Forest Analysis Units (FAUs). An FAU is an area of timberland used to represent forest
320 ecosystem impacts resulting from all activities related to forestry within the roundwood basket (i.e.,
321 considering all activities which result in physical alterations to the forest, including site harvests,
322 transportation infrastructure, and others). Within each FAU, measurements of ecological conditions are
323 assessed within Forest Trend Monitoring Plots (FTM plots).

324 NOTE. Thus there are three spatial levels considered in the assessment[10]: (1) the roundwood basket, which
325 considers the entire area subject to harvest; (2) FAUs, nested within the roundwood basket; and (3), FTM
326 plots, nested in FAUs in which specific measurements are completed.

327 Within each FAU, measurements of ecological conditions, carbon storage levels, and forest standing
328 stock are completed. Measurements shall be completed based upon a Forest Trend Monitoring Plan
329 (FTM plan) based on measurements in Forest Trend Monitoring Plots (FTM plot) with transects between
330 each, meeting the following requirements:

331 • FTM plots shall be placed randomly, at least one kilometer apart, and no more than 20
332 kilometers apart.

333 • At least 10 FTM plots must be included in an FAU.

334 • No more than 50 FTM plots shall be included in an FAU.

335 • Each FTM plot can include multiple types of sub-plots contained within a given area. The
336 smallest sub-plot plot within the FTM plot shall be no smaller than 400 m^2.[11] The FTM plot
337 design shall be described in the FTM plan.

338 • FTM Plots and transects must be fixed in space and re-sampled every 10 years at most.

339 • Measurements of ecological conditions within FTM plots across an FAU shall be used only if the
340 95% confidence interval of the result is ±50%.

341 NOTE. If the 95% confidence interval of measurements of conditions across all plots is over +/-50%
342 relative to the mean of the measurement values across all plots, then additional FTM plots must be sampled,
343 or a stratified sampling should be performed by creating multiple FAUs in which there is less sample
344 heterogeneity.

345 The following shall be described in the LCA report: summary of the FTM plan; the total sampled area;
346 frequency of sampling within the area; and size of each FTM plot.

347 *NOTE.* Multiple small landowners can be included in the same FAU.

6.5.3.2 Assessing Impacts from Foregone Growth

349 Assessing impacts to Global Climate Change, Ocean Acidification, Wood Resource Depletion, Terrestrial
350 Disturbances, and any Habitat Disturbances requires estimating the level of impact incurred from

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[10] For different studies of different wood products, different roundwood baskets, FAUs, and FTM plots are used. This characterizes differences in terrestrial disturbance levels in different forests.
[11] This is the area of the sub-plot with a radius of 24.0 ft (7.32m) defined in the US FS FIA Phase 2 / Phase 3 plot design. http://www.fia.fs.fed.us/library/fact-sheets/data-collections/Sampling%20and%20Plot%20Design.pdf
The Canadian Forest Inventory also recommends a ground plot design of 400m^2 to measure attributes of trees.; Canada's National Forest Inventory Ground Sampling Guidelines (October 2008).

351 foregone growth. The foregone growth reflects the improvement in forest ecosystem condition which
352 could be achieved if the forest were no longer subjected to harvests. This PCR quantifies the foregone
353 improvement in: forest carbon storage levels; available wood resources; and forest integrity.

354 *NOTE.* This section describes principles and requirements applicable to considering these impacts for all
355 relevant impact categories. See the relevant sections of the LCIA Methodology Document for guidance and
356 requirements for each impact category, necessary to calculate results.

357 Assessing impacts from foregone growth is based on consideration of the forest growth trajectory under
358 two scenarios:

359 1. Harvest scenario, where the forests in the FAU are maintained according to the forecasted
360 growth in the FAU under planned logging activities.

361 2. No-harvest scenario. The lands in the FAU are not subjected to timber harvests, but recover to
362 the same conditions present in the URA. The initial conditions in this scenario are the current
363 conditions in the FAU, except in the case that the forest was old growth forest (i.e. forests that
364 were never logged and were undisturbed by natural disturbance events such as wildfire, insect
365 infestations, etc.) in 2011. If the forests in the FAU were old growth in 2011, the starting
366 conditions of the no-harvest scenario models are the URA, which does not change over time.

367 For calculations of foregone growth, vegetative growth models should be used where possible.
368 Vegetative growth models which are used shall follow the requirements of Section 5.2.1.2 of the LCIA
369 Methodology Document.

370 In many cases, use of vegetative growth models will not be possible. In these cases, default assumptions
371 for the growth trajectory of each scenario, and site productivity, in each scenario shall be used:

372 • Harvest scenario. Conditions in the FAU shall be assumed to begin with the current disturbance
373 level in the FAU, changing in the future at a linear rate based on the average change in the
374 conditions measured in the FAU over the past 10 years. If data are not available on the trend
375 over the past 10 years, conservative estimates may be made regarding the trend.

376 • No-harvest scenario. It shall be assumed that the forests in the FAU recover to a state equivalent
377 to the undisturbed reference area (URA) using approaches described further in the LCIA
378 Methodology Document.

379 • The average site productivity is assumed to be the same in the future as for the past 10 years.

380 *NOTE.* These default assumptions allow for calculation of impacts from foregone growth using nothing more
381 than data on current conditions in the FAU and URA, which can be forecasted into the future under both
382 scenarios using a spreadsheet calculation.

383   6.5.4   **Streamlining Data Collection**

384   The main data collection requirements for roundwood involve site-specific data on ecological conditions
385   in the regions included in the roundwood basket. Previously collected data should be relied upon
386   wherever it exists; if data do not exist, it may be necessary to use trained field ecologists to measure
387   ecological conditions in various regions. This is usually outside the available budget for LCA studies, and
388   should be used only when necessary.

389   6.5.5   **Allowed allocation procedures**

390   Allocation of multi-output and multi-input processes shall be based on physical properties such as mass
391   or volume, except for special requirements for allocation for the process steps in Table 1. Other
392   allocation approaches (e.g. economic-based allocation) can be explored using sensitivity analysis.

393   **Table 1. Life cycle stage, potential useful co-products, and allowable allocation method. These requirements only apply if the**
394   **process step cannot be subdivided into individual processes for which results can be assessed without allocation.**

Life Cycle Stage	Potential Useful co-products	Allocation method
Roundwood production	Pulpwood of different types (e.g., hardwood, softwood) Trim, slab, scrap, hog fuel Roundwood suitable for milling to produce dimensional lumber and other products	All impacts shall be allocated to roundwood production. When roundwood of different types is produced, impacts shall be allocated based on volume of produced roundwood.[12]

395   6.5.6   **Impact Assessment**

396   The LCIA shall be based upon the LCIA Methodology Document. The core impact categories which must
397   be considered for logging and forest management are also summarized in Table 2.

7   Content of EPD

398

7.1   General information

399

400   The following information is required and shall be included in the EPD:

401   a.   The following information shall be reported on the front page of the EPD.

402   — The commissioner and owner of the EPD,

403   — The geographic location and description of the roundwood basket(s) considered in the
404   scope of the EPD.

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[12] Allocation of impacts to roundwood of different types can be allocated based on mass if the density of the wood types are known, and the mass values are converted to volume.

405　　b.　Identification of the product and a visual representation of the product. This identification shall
406　　　　enable the user to identify the product unambiguously.

407　　c.　Intended use of the roundwood, if known.

408　　d.　A detailed list of the type(s) of wood considered in the EPD, as well as whether it is hardwood or
409　　　　softwood.

410　　e.　Name of the Type III Program Operator, the address and website of the Type III Program
411　　　　Operator, and any verification logo (if relevant).

412　　f.　The date the declaration was issued and the period of validity.

413　　g.　A description of which life cycle stages are included in the EPD.

414　　h.　A description of the allocation approach used for products.

415　　i.　The results from the LCA and the required Disclaimers.

416　　j.　For a product-specific EPD, the name of the product producer shall be listed on the front cover
417　　　　of the EPD.

418　　k.　For an Industry-wide EPD, the names of the producers recognized as participants in the
419　　　　development of the EPD should be included either on the front cover of the EPD or through a
420　　　　web link on the EPD front cover to direct users to a complete list of manufacturers represented
421　　　　by the EPD.

422　　l.　Information on where explanatory material may be found (e.g., website links).

423　　m.　A data quality assessment summary. This assessment can be done either qualitatively or
424　　　　quantitatively (e.g., pedigree matrix approach).

425　　n.　In addition, the following table shall be completed and included in the EPD:

PCR review was conducted by	
	Approved XX/XX/XXXX Valid until XX/XX/XXXX
Independent verification of the declaration and data, according to ISO 14025:2006.	☐ Internal　☐ External
Third party verifier:	

426

7.2 Reporting Requirements for Indicators included

427

428 The LCA results shall be included in a prominent place in the EPD. Results shall include the applicable

429 indicator(s), using the allowed units of measure, described in Table 2. Those category indicator results

430 which require spatially explicit LCIA are noted, calculated according to the approach in the LCIA

431 Methodology document. Additionally, for some impact categories, conditions will worsen over time as

432 the effect of stressors accumulate.[13] Metrics specified in the LCIA Methodology Document reflect the

433 accumulation of impacts over the time horizon considered.

434

435 **Table 2. Impact categories and category indicators relevant to roundwood production, as well as whether assessment of**
436 **each requires spatially explicit LCIA and if the impact is accumulated.**

Impact Categories by Group	Applicable Indicator(s)	Requires Spatial LCIA	Accumulated Impact
Biotic/Abiotic Resource Depletion Impacts			
Energy Resource Depletion	Nonrenewable Energy Resource Depletion	Yes	Yes
	Total Energy Resource Depletion	No	Yes
Water Resource Depletion	Net Freshwater Consumption	No	No
Biotic Resource Depletion	Timber Resource Depletion	Yes	Yes
Global and Regional Climate System Impacts			
Global Climate Impacts	Global Climate Change	Yes	Yes
Regional Climate Hot Spot Impacts	Regional Climate Impacts	Yes	No
Ocean Ecosystem Impacts			
Ocean Acidification	Ocean Acidification	Yes	Yes
Ocean Warming	Ocean Warming	N/A	N/A
Terrestrial & Freshwater Ecosystem Impacts (from Emissions)			
Regional Acidification	Regional Acidification	Yes	No
Freshwater Eutrophication	Multiple indicators possible	Yes	No
Terrestrial & Freshwater Ecosystem Impacts (from Land Use and Conversion)			
Terrestrial Disturbance	Multiple indicators possible	Yes	Yes
Freshwater Disturbance	Multiple indicators possible	Yes	Yes
Wetland Disturbance	Multiple indicators possible	Yes	Yes
Threatened species Habitat Disturbance	Multiple indicators possible	Yes	Yes
Human Health Impacts (from Chronic Exposure to Hazardous Chemicals)			
Ground Level Ozone Inhalation Impact	Ground Level Ozone Inhalation Impact	Yes	No
PM 2.5 Inhalation Impact	PM 2.5 Inhalation Impact	Yes	No
Dermal Inhalation Impact	Multiple indicators possible	Yes	No

437

438 Results shall be reported for at least the year 20 and year 100 in the study time horizon, and should be

439 reported for additional years. In EPDs, results shall be provided in a table using the template of Table 3.

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[13] For example, emissions of long-lived GHGs accumulate in the atmosphere, leading to increasing radiative forcing. Radiative forcing is an accumulating midpoint with respect to emissions of long-lived GHGs.

440 **Table 3. Required reporting format for EPDs. Charts can also be substituted which cover results over the 20-100 year time**
441 **period.**

Impact Categories by Group	Units of measure	Result in Year				
		20	**40**	**60**	**80**	**100**
Biotic/Abiotic Resource Depletion Impacts						
Nonrenewable Energy Resource Depletion	GJ eq.	XX	XX	XX	XX	XX
Total Energy Resource Depletion	GJ	XX	XX	XX	XX	XX
Net Freshwater Consumption	Thous. m^3	XX	XX	XX	XX	XX
Timber Resource Depletion	MMCF of foregone recovery	XX[A]	XX[A]	XX[A]	XX[A]	XX[A]
Global and Regional Climate System Impacts						
Global Climate Change	thous. tons CO_2 eq.	XX[A]	XX[A]	XX[A]	XX[A]	XX[A]
Regional Climate Impacts (if relevant) [B]	thous. tons CO_2 eq.	XX	XX	XX	XX	XX
Ocean Ecosystem Impacts						
Ocean Acidification	Thous. tons H_2CO_3 absorbed	XX[A]	XX[A]	XX[A]	XX[A]	XX[A]
Ocean Warming	N/A	No data	No data	No data	No data	No data
Terrestrial & Freshwater Ecosystem Impacts (from Emissions)						
Regional Acidification	tons SO_2 eq.	XX	XX	XX	XX	XX
Freshwater Eutrophication[B]	tons N/P eq.[C]	XX	XX	XX	XX	XX
Terrestrial & Freshwater Ecosystem Impacts (from Land Use and Conversion)						
Terrestrial Disturbance[B]	Foregone Recovery, eq. acres fully disturbed	XX[D]	XX[D]	XX[D]	XX[D]	XX[D]
Freshwater Disturbance	See table reporting information on freshwater bodies(refers to information in Table 5)					
Wetland Disturbance	See table reporting information on wetlands(refers to information in Table 6)					
Threatened species Habitat Disturbance	# of impacted species[E]	XX	XX	XX	XX	XX
Human Health Impacts (from Chronic Exposure to Hazardous Chemicals)						
Ground Level Ozone Inhalation Impact	prsns * hrs * ppb O_3 eq	XX	XX	XX	XX	XX
PM 2.5 Inhalation Impact	prns * hrs * μg PM2.5e / m^3	XX	XX	XX	XX	XX
Dermal Inhalation Impact[B]	Depends on indicator[F]	XX	XX	XX	XX	XX

442 *A. If multiple FAUs included, assessed as production-weighted average across the roundwood basket.*

443 *B. The results for these impact categories are listed separately by indicator result.*

444 *C. Whether N or P equivalency is used is based on the limiting nutrient. See Section 5.4.4 of the LCIA Methodology Document.*

445 *D. If multiple FAUs included, assessed as production-weighted average across each affected terrestrial ecoregion.*

446 *E. The # of impacted species shall be reported only if the data used to determine the number of threatened species is*

447 *sufficiently comprehensive. If not, this result shall be reported as "Inconclusive", and a reference to the table listing the*

448 *threatened species (see Table 7) shall be provided.*

449 F. *See LCIA Methodology document for information on the indicators reported for this impact category.*

450 Special reporting requirements apply to impacts to forests. LCA reports and EPDs shall include the
451 information in Table 4 listed separately for each terrestrial ecoregion which is disturbed.

452 **Table 4. Required reporting parameters for Terrestrial Disturbance. Results shall be reported for each terrestrial ecoregion in**
453 **the LCA report and in EPDs. All values shall be calculated according to the LCIA Methodology Document.**

Description	Value Reported
Terrestrial Ecoregion Disturbed	*Name*
Current Terrestrial Ecoregion Status	*To be reported as Critical, Endangered, Vulnerable, Relatively Stable, or Intact.[A]*
Current Disturbance Level	*Percent Disturbance (Terrestrial Disturbance Factor)*
Land Use	*Thousand acres to produce one thousand cubic feet*
Current Disturbance Trend[B]	*To be reported as Increasing Disturbance, Stable, Recovering, or Unknown. If data are available, the rate of change in disturbance level over the past 10 years shall be reported as a decadal average (i.e., +/-Percent Disturbance change per decade)*
Potential Maximum Terrestrial Recovery Rate[C]	*Percent Disturbance per decade reduction*
Foregone Terrestrial Recovery Each Decade	Difference between Potential Maximum Recovery Rate and Measured Disturbance Trend
Current Level of Terrestrial Carbon Storage Reduction	*Percent Reduction compared to URA, assessed per hectare (Reported as percent and tons C per hectare lost)*
Current Trend in Terrestrial Carbon Storage[D]	*To be reported as Decreasing Carbon Storage, Stable, Recovering Carbon Storage, or Unknown. If data are available, the rate of change in carbon storage level over the past 10 years shall be reported as a decadal average (i.e., +/-tons C per hectare change per decade)*
Potential Maximum Terrestrial Carbon Recovery Rate[C]	*tons carbon per decade increase*
Foregone Terrestrial Carbon Storage Recovery Each Decade	Difference between Potential Maximum Terrestrial Carbon Recovery Rate and Measured Trend in Terrestrial Carbon Storage

454 A. *Based on condition of the terrestrial ecoregion in which the forest is present, as reported in WWF Wildfinder*
455 *database.*

456 B. *This shall be reported as:*
457 *i. Recovering: The TDF has decreased over the past 10 years.*
458 *ii. Increasing Disturbance: The TDF has increased over the past 10 years.*
459 *iii. Stable Condition: The TDF has not changed over the past 10 years.*
460 *iv. Unknown: The condition of the TDF is not known over the past 10 years.*

461 C. *This is the recovery rate in the No Harvest Scenario, modeled according to requirements of this PCR Module*
462 *and the LCIA Methodology Document.*

463 D. *This shall be reported as:*
464 *i. Recovering Carbon Storage: The average carbon storage level per hectare has increased over the past 10 years.*
465 *ii. Decreasing Carbon Storage: The average carbon storage level per hectare has decreased over the past 10 years.*
466

467   Special reporting requirements apply to impacts to freshwater bodies. LCA reports and EPDs shall
468   include a table which includes all information from Table 5 for every affected or possibly affected
469   freshwater body.

470   **Table 5. Required reporting parameters for the impact category of Freshwater Disturbance, by freshwater body. Results shall**
471   **be reported for each freshwater body in the LCA report and in EPDs. All values shall be calculated according to Section 5.5.2**
472   **of the LCIA Methodology Document.**

Description	Value Reported
Freshwater Disturbed	*Name of Freshwater Body or Watershed*
Area of Watershed	*Area in acres or hectares of watershed*
Current Freshwater Disturbance Level	*Percent Disturbance (Freshwater Disturbance Factor, FWDF) or "Unknown"*
Disturbance Trend[(A)]	*To be reported as "Increasing Disturbance", "Stable", "Recovering", or "Unknown" along with the documented change in FWDF each decade*

473   (A)   This shall be reported as:
474   i. Recovering: The FWDF has decreased over the past 10 years.
475   ii. Increasing Disturbance: The FWDF has increased over the past 10 years.
476   iii. Stable Condition: The FWDF has not changed over the past 10 years.
477   iv. Unknown: The condition of the FWDF is not known over the past 10 years.

478

479   Special reporting requirements apply to impacts to wetlands. LCA reports and EPDs shall include a table
480   which includes all information from Table 6 for every affected or possibly affected freshwater body.

481   **Table 6. Required reporting parameters for the impact category of Wetland Disturbance, by wetland. Results shall be**
482   **reported for each wetland in the LCA report and in EPDs. All values shall be calculated according to Section 5.5.3 of the LCIA**
483   **Methodology Document.**

Description	Value Reported
Wetland Disturbed	*Name of Wetland or Watershed*
Area of Wetland	*Area in acres or hectares of wetland*
Watershed of which Wetland is a Part	*Name*
Current Wetland Disturbance Level	*Percent Disturbance (Wetland Disturbance Factor, WDF) or "Unknown"*
Disturbance Trend[(A)]	*To be reported as "Increasing Disturbance", "Stable", "Recovering", or "Unknown" along with the documented change in WBDF each decade*

484   (A) This shall be reported as:
485   i. Recovering: The WDF has decreased over the past 10 years.
486   ii. Increasing Disturbance: The WDF has increased over the past 10 years.
487   iii. Stable Condition: The WDF has not changed over the past 10 years.
488   iv. Unknown: The condition of the WDF is not known over the past 10 years.

489   Special reporting requirements apply to impacts to threatened species. LCA reports and EPDs shall
490   include a table which includes all information from Table 7 for every affected threatened species.

491 **Table 7. Required reporting parameters for the impact category of Threatened Species Habitat Disturbance. A table shall be**
492 **provided in the LCA report and in EPDs which includes this information for all threatened species. All values shall be**
493 **determined according to Section 5.5.4 of the LCIA Methodology Document.**

Description	Value Reported
Species Name	*Common Name* *Latin Name*
Threatened Category	*Threatened, Endangered, etc.**
Total Population Reduction from Historic Total Population Trend	*Percent Reduction, or Unknown*** *Increasing, Stable, Decreasing, Unknown***

494 **Shall include a reference of the list used to determine this threatened category (e.g., IUCN Red List).*

495 ***Shall include a reference to the source of this information. References including this information are the IUCN*

496 *Red List of Threatened Species[14], the NatureServe Explorer Database[15], and other resources.*

497

7.2.1 Requirements for Industry-Wide EPDs

499 For industry-wide EPDs, all indicator results must be reported as the median value. A range of results
500 must also be presented, based on the 90% confidence interval, or the maximum and minimum of the
501 sample included.

7.3 Disclaimers

503 The following statements shall be provided in the EPD near where the results are provided:

504 — Statements regarding any limitations in the use of primary data for "key" unit processes.

505 — Statements regarding limitations in the ability to assess terrestrial disturbances,
506 threatened species habitats disturbances, or impacts from terrestrial carbon storage
507 losses, due to a lack of data.

508 — Statements regarding data gaps which could have a significant effect on results reported
509 in the EPD.

510 — The following statement: "*EPDs developed under this PCR Module can only be compared*
511 *if the products covered can be used in an identical fashion, and are intended for the same*
512 *use and disposal.*"

513 — The following statement: "*EPDs address only impacts associated with environmental and*
514 *human health impacts, and do not consider all sustainability issues.*"

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[14] http://www.iucnredlist.org/
[15] http://explorer.natureserve.org/

7.4   Additional Environmental Information

Other, optional, additional environmental information which can be reported includes:

- Improvement of indicator results over time, compared to baseline which is disclosed.

- Optional impact assessment results may be reported using CML-IA baseline LCIA methodology[16] or other LCIA methodologies.

- Wood use, in tons.

- Net total energy use (including renewable sources).

- Solid waste production (which could be expressed as tons per year of material either landfilled, composted, recycled, or combusted).

- Categorization of sources of wood fiber according to their forest management or certification systems, in accordance with ASTM D7612-10.

8   Special Critical Review Requirements for the LCA

The following LCA methodological elements should be reviewed by independent reviewers:

- The definition of undisturbed reference areas used in assessments.

- The Forest Trend Monitoring (FTM) plan used to assess ecological conditions in forests.

- List of threatened species included.

- For the assessment of terrestrial disturbance levels, alternative approaches for evaluating the deviation and terrestrial disturbance factors for a given measurement of an ecological condition, if used.

- List of ecological conditions included in the measurement of disturbance and forest carbon effects.

- Approach for estimating measurements of ecological conditions for assessment of terrestrial disturbance factors (used if site data are not available).

- Quality of data used to measure ecological conditions.

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[16] CML 4.1 baseline, from Institute of Environmental Sciences Faculty of Science University of Leiden, Netherlands (April 2013).

539 Reviewers should be a balanced stakeholder group. The findings of the critical reviewer(s) shall be
540 provided with the LCA report.

9   Verification and Validity of an EPD

542 EPD verification shall follow ISO 14025. EPDs are valid for a three year period. During the three year
543 period, an EPD shall be updated to account for any changes that affect the content or accuracy of the
544 EPD. A change in results of +/- 10% should be reported to the verifier and the EPD may need to be
545 updated.

10 Informative References

547 Life Cycle Assessment of Reincarnation 100 Coated Freesheet Paper, Compared to Virgin Paper Baseline.
548 October 8, 2015. Prepared by SCS Global Services.[17]

549 Product Category Rule for North American Structural and Architectural Wood Products Version 1.1 (May
550 2013), FPInnovations.[18]

551 Product Category Rules for Market Pulp Version 1 (February 2015), FPInnovations.[19]

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[17] https://www.scsglobalservices.com/files/resources/lcs_rpt_reincarnation100_mainbody_100815.pdf
[18] https://fpinnovations.ca/ResearchProgram/environment-sustainability/epd-program/Documents/wood-products-pcr-version-v1.1-may-2013-lastest-version.pdf
[19] https://fpinnovations.ca/ResearchProgram/environment-sustainability/epd-program/Documents/Market%20Pulp%20PCR%20February%202015.pdf