



Puro.earth

Biomass Sourcing Criteria

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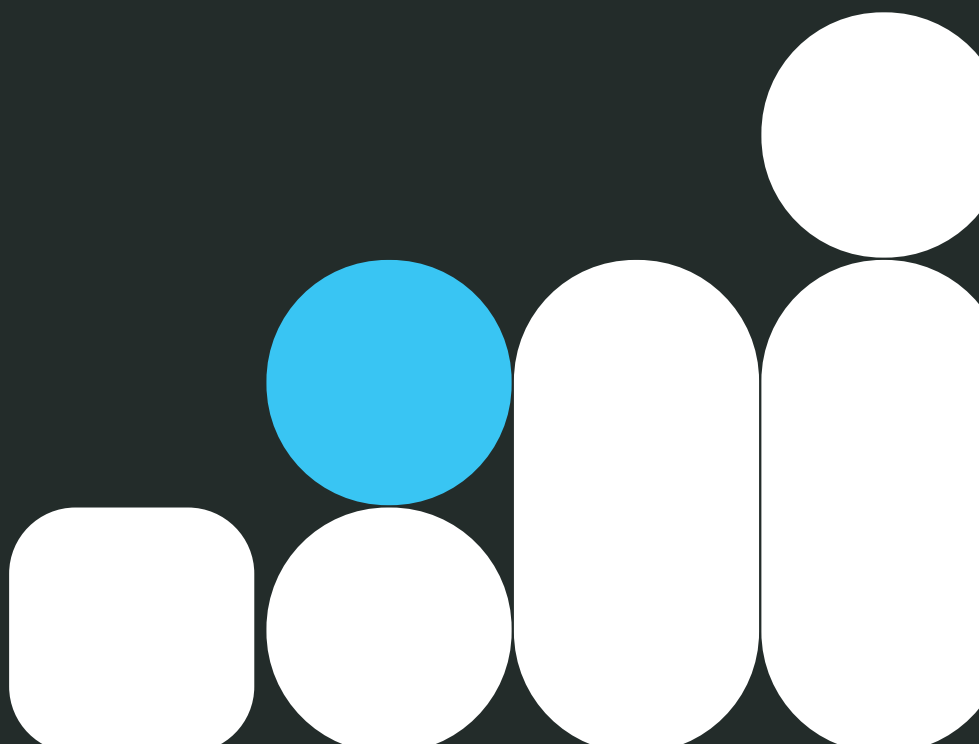


Table of Contents

Introduction	2
1. Categories of biomass feedstocks	3
2. Sourcing criteria.....	5
A. Mixed MSW and assimilated waste	5
B. Sorted food waste and assimilated	5
C. Sorted MSW fractions, other than food	6
D. Green waste.....	7
E. Animal waste	7
F. Municipal sludge and biosolids.....	8
G. Forest biomass	8
H. Pulp and paper sludge and black liquor	11
I. Non-food agricultural crop	14
J. Food Agricultural crop.....	16
K. In-field agricultural residues	18
L. Non-field agricultural residues	19
M. Palm oil biomass and derivatives.....	20
N. Conservation landscape management	22
O. Aquatic biomass.....	23
P. Land clearing biomass.....	24
3. Biomass Counterfactual Storage	25
3.1. Applicability and transition periods	25
3.2. Rules for counterfactual storage assessment.....	25
4. Definitions and clarifications	28
4.1. Definitions	28
4.2. Clarifications	29
5. Examples.....	31
5.1. Identification and traceability information	31
6. References.....	32
7. Document History	33

Introduction

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Biomass *can* contribute to climate change mitigation and carbon dioxide removal (CDR), e.g. via its use as biomaterial, bioenergy, but also as a source of biogenic carbon for storage. Despite being a renewable resource, biomass is available in limited amounts and its use for climate change mitigation purpose must not conflict with ecosystem functions and other human needs, primarily food. Biomass also refers to a very wide range of feedstocks, whether from plants or animals, from forestry, agriculture, or recycling – a diversity which leads to numerous opportunities but also risks to manage. Biomass sourcing for human use has been a significant driver of climate change and ecological damage via land use change. Biomass-based technologies are not always guaranteed to deliver improvements, which has led to numerous frameworks and regulations being developed to ensure that human use of biomass and land leads to actual climate, environmental and social benefits.

In this context, Puro's *Biomass Sourcing Criteria* intend to be pragmatic and operational criteria, differentiated for a range of biomass feedstocks, to ensure that biomass sourced for CDR does not lead to unacceptable environmental and social negative impacts. The criteria also establish requirements for considering the counterfactual fate of biomass carbon, where relevant, to ensure that carbon removal achieved also represents a *near-term* climate benefit. For each biomass feedstock category, the document details required traceability information to be reported, required feedstock sustainability criteria to be evidenced, and options to evidence the sustainability criteria. *Note however that the criteria are only a condition for eligibility of the feedstock and additional rules and exclusions may apply in each applicable methodology (e.g. regarding eligible categories, baseline and leakage).*

The Puro *Biomass Sourcing Criteria* are built upon an analysis of classification schemes of biomass feedstocks, an analysis of the major potential social and environmental issues associated with biomass sourcing, and reviews of related regulations and voluntary programmes. The criteria also build upon Puro's experience of certifying biomass-based CDR projects across the world. Last, it is important to clarify that these criteria are not a certification scheme for biomass suppliers, but a list of rules that must be met and enforced, and this builds upon other certification programmes and regulations.

The Puro *Biomass Sourcing Criteria* are meant to be applicable across the Puro Standard and will be refined and extended over time. The latest version of those criteria must always be used when reporting CORCs.

In practice, CO₂ Removal Suppliers must keep records of the biomass processed, alongside all information needed to demonstrate type, origin and sustainability and, where applicable, its counterfactual fate. This information shall then be *synthesized* as part of the Output Audit procedures. Puro will make templates available to suppliers, to facilitate the reporting of this information.

1. Categories of biomass feedstocks

There are 16 categories of biomass feedstocks (Table 1) distinguished within the Puro Standard. Those categories include multiple types of biomass feedstocks, but these types are of similar nature and require the same type of evidence.

- For the purpose of certification and issuance of CORCs, one biomass feedstock can only belong to one feedstock category, and this category shall be the most directly applicable.
- In case multiple categories would be possible, Puro reserves the right to make a final decision on the classification and update the rules with corresponding clarifications. The categories have however been thought to minimize such situations.

ID	Biomass Feedstock Category	Biomass Feedstock Description
A	Mixed municipal solid waste (MSW) and assimilated waste	The organic fraction of mixed solid waste from normal municipal waste collection service, from collection of assimilated waste from e.g. offices, companies, hospitals, as well as refuse derived fuel and assimilated industrial waste.
B	Sorted food waste & assimilated	Post-consumer source-separated food waste, post-production food waste, expired food, residues from food processing, other industrial food-related biowaste (e.g. sugar molasses, cooking oils), other farm-level food-related waste (e.g. spoiled food or feed harvest, expired seeds).
C	Sorted MSW fractions, other than food	Post-consumer end-of-life paper, end-of-life textile (natural fibres), end-of-life wood materials (of different grades, e.g. untreated and treated, including wood from construction and demolition works, e.g. pallets, wood elements, often treated or contaminated with metals), and assimilated biomaterials, from source-separated waste collection.
D	Green waste	Non-hazardous municipal green waste from urban or rural areas (e.g. park and garden green waste, urban tree cuttings, river debris), including any fraction (e.g. foliage, roots, branches).
E	Animal waste	Abattoir waste and animal manure and its derivatives (e.g. digestate from manure and abattoir waste).
F	Municipal sludge and biosolids	Sewage sludge, digested or not, and biosolids from municipal wastewater treatment plants.
G	Forest biomass	Forest biomass, including any primary feedstock (harvested from forest land) or secondary feedstock (generated during processing of primary feedstock). <i>For clarity, note that a biomass feedstock belonging to this category is only eligible if it meets all the traceability and sustainability criteria. In particular, harvesting of forest biomass in a manner that does not support forest growth and health is not eligible, as per criteria Regeneration, Carbon stocks, Soil quality. Likewise, use of high-quality timber in a CDR pathway is not eligible, as per criteria Material use.</i>

H	Pulp and paper sludge, and black liquor	Pulp and paper mill sludge and black liquor, derived from processing of virgin fibres, recycled fibres or combination of sources.
I	Non-food agricultural crops	Agricultural crops that are neither food nor feed crop (e.g. energy crops, biomaterial crops), cultivated on agricultural land.
J	Food agricultural crops	Agricultural crops that are food or feed crops, whether or not used in such applications (e.g. corn or wheat fermented for biofuel, cereals fermented for beverage production), cultivated on agricultural land.
K	In-field agricultural residues	In-field agricultural residues, originating from the cultivation of a food, feed or material crop, e.g. cereal straw, rice straw, maize straw, stalks, pruning residues (trees, bushes).
L	Non-field agricultural residues	Non-field agricultural residues, originating from the primary processing of a food, feed, or material crop in a factory, e.g. rice husk, maize cob, nutshell and husk, peels, fruit seeds/pits, bagasse, coffee husk, cocoa pods, spent grains.
M	Palm oil biomass and derivatives	Any biomass from oil palm tree plantations (which are not considered forests but agricultural plantations), e.g. palm oil and its fractions, empty fruit bunches, nuts and kernels, cakes, or other side-streams.
N	Conservation landscape management	Invasive species whether on land, in freshwater, or in coastal areas, as well as any biomass from landscape management for conservation purposes of protected areas or assimilated, including forest wildfire mitigation.
O	Aquatic biomass	Cultivated or harvested water-based plants or algae, and associated derivatives.
P	Land clearing biomass (<i>not resulting in CORC issuance</i>)	Land clearing biomass from authorized activities with change in land use (non-renewable biomass), in non-protected and non-high-value ecosystems, with adequate management and compensation measures. Clearing activities can result from, e.g. city urban expansion, pipeline or powerline construction, and similar cases, but does not apply to clearing for agriculture nor plantations. Limitation: <i>this category is allowed to be processed by a CO₂ Removal Supplier but shall not result in the issuance of CORCs (see clarification in section 3.2).</i>

2. Sourcing criteria

For each feedstock category, the tables below detail i) the required feedstock origin and type disclosures (traceability), ii) the required feedstock sustainability criteria, and iii) options to evidence the sustainability criteria. Feedstock origin and type demonstration are based on disclosure of information and adequate record keeping, including delivery notes, photographic evidence, laboratory analyses, as necessary.

A. Mixed MSW and assimilated waste

Feedstock category	Mixed MSW and assimilated waste	
Feedstock description	The organic fraction of mixed waste from normal municipal waste collection service, from collection of assimilated waste from e.g. offices, companies, hospitals, as well as refuse derived fuel and assimilated industrial waste.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	A-O1	Basic information: identification number, date or range of delivery, amount received, type of waste (according to local classification)
	A-O2	Traceability: geographical area of waste supply, name of entity delivering the waste (e.g. entity performing waste collection) <i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	<i>None, provided that origin and type is demonstrated, and that waste is not deliberately produced for the purposes of providing biomass for CDR.</i>	
Sustainability evidence options	<i>Not applicable</i>	

B. Sorted food waste and assimilated

Feedstock category	Sorted food waste and assimilated	
Feedstock description	Post-consumer source-separated food waste, post-production food waste, expired food, residues from food processing, other industrial food-related biowaste (e.g. sugar molasses, cooking oils), other farm-level food-related waste (e.g. spoiled food or feed harvest, expired seeds)	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	B-O1	Basic information: identification number, date or range of delivery, amount received
	B-O2	Traceability: geographical area of waste supply, name of entity delivering the waste

		<i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	<i>None, provided that origin and type is demonstrated, and that waste is not deliberately produced for the purposes of providing biomass for CDR.</i>	
Sustainability evidence options	<i>Not applicable</i>	

C. Sorted MSW fractions, other than food

Feedstock category	Sorted MSW fractions, other than food	
Feedstock description	Post-consumer end-of-life paper, end-of-life textile (natural fibres), end-of-life wood materials (of different grades, e.g. untreated and treated, including wood from construction and demolition works, e.g. pallets, wood elements, often treated or contaminated with metals), and assimilated biomaterials, from source-separated waste collection.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	C-O1	Basic information: identification number, date or range of delivery, amount received, material grade (if considered hazardous or not)
	C-O2	Traceability: geographical area of waste supply, name of entity delivering the waste <i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	Criteria to be evidenced are:	
	C-S1	Adequate management of hazardous waste: if the waste processed is classified as hazardous in the jurisdiction of the project (e.g. chemically treated wood from demolition works), processing of hazardous waste shall be demonstrated to adequately mitigate the associated risks (e.g. air pollutant emissions).
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	C-E1	Authorisation to process such hazardous waste, delivered by local competent authorities
	C-E2	Regulatory framework in place demonstrating the right of the supplier to process such hazardous waste

D. Green waste

Feedstock category		Green waste
Feedstock description	Non-hazardous municipal green waste from urban or rural areas (e.g. park and garden green waste, urban tree cuttings, river debris), including any fraction (e.g. foliage, roots, branches)	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	D-O1	Basic information: identification number, date or range of delivery, amount received
	D-O2	Traceability: geographical area of waste supply, name of entity delivering the waste <i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	<i>None, provided that origin and type is demonstrated, and that waste is not deliberately produced for the purposes of providing biomass for CDR.</i>	
Sustainability evidence options	<i>Not applicable</i>	

E. Animal waste

Feedstock category		Animal waste
Feedstock description	Abattoir waste and animal manure and its derivatives (e.g. digestate from manure and abattoir waste)	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	E-O1	Basic information: identification number, date or range of delivery, amount received
	E-O1	Traceability: geographical area of waste supply, name of entity delivering the waste <i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	<i>None, provided that origin and type is demonstrated, and that waste is not deliberately produced for the purposes of providing biomass for CDR.</i>	
Sustainability evidence options	<i>Not applicable</i>	

F. Municipal sludge and biosolids

Feedstock category	Municipal sludge and biosolids	
Feedstock	Sewage sludge, digested or not, and biosolids from municipal wastewater treatment plants	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	F-01	Basic information: identification number, date or range of delivery, amount received.
	F-01	Traceability: geographical area of waste supply, name of entity delivering the waste <i>Note: the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR.</i>
Sustainability criteria	<i>None, provided that origin and type is demonstrated, and that waste is not deliberately produced for the purposes of providing biomass for CDR.</i>	
Sustainability evidence options	<i>Not applicable</i>	

G. Forest biomass

Feedstock category	Forest biomass	
Feedstock description	Forest biomass, including any primary feedstock (harvested from forest land) or secondary feedstock (generated during processing of primary feedstock). <i>For clarity, note that a biomass feedstock belonging to this category is only eligible if it meets all the traceability and sustainability criteria. In particular, harvesting of forest biomass in a manner that does not support forest growth and health is not eligible, as per criteria Regeneration (G-S3), Carbon stocks (G-S4), Soil quality (G-S5). Likewise, use of high-quality timber in a CDR pathway is not eligible, as per criteria Material use (G-S9).</i>	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	G-01	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery.
	G-02	Type and properties: physical description (e.g. roundwood, chips, sawdust, pellets, shavings, offcuts), feedstock type (e.g. high-grade stemwood, low-grade stemwood, forest residues, processing residues), forestry operation origin (e.g. final harvest, thinning, wood processing), moisture upon delivery, typical carbon content.
	G-03	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing. <i>Note: the geographical area of sourcing shall be as precise as needed to evidence the sustainability criteria, but at minima shall refer to the region of sourcing within the country of origin.</i>

	G-O4	Mix of sources: in case multiple biomass sources are mixed, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration. Non-eligible biomass must then be sourced from controlled sources, i.e. sources that are demonstrated via risk assessment to be legally harvested.
Sustainability criteria	Criteria to be evidenced are:	
	G-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	G-S2	Working conditions: operators have measures in place to ensure safe working conditions during forestry operations.
	G-S3	Regeneration: harvested areas are systematically replanted or regenerated, following local rules or forestry best-practice.
	G-S4	Carbon stocks: 1. In the sourcing area: forest operations along the entire value chain are contributing to long-term maintenance <i>and</i> increase of carbon stocks in the forest, consistent with the objective of global net zero anthropogenic carbon dioxide emissions. 2. In the country of origin: the supplier must publicly disclose whether forest carbon stocks are increasing or decreasing in the country of origin of the biomass.
	G-S5	Soil quality: forest operations along the entire value chain are designed to contribute to maintenance or improvement of soil quality and structure, e.g. by avoiding harvesting of stumps and roots, avoiding harvesting on vulnerable soils, selection of logging techniques that minimize impact of soil quality and habitats, erosion risks are prevented and controlled, nutrient balance is maintained.
	G-S6	Water resources: forest operations along the entire value chain are designed to preserve water quality and quantity (e.g. reasonable use of chemicals, efficient water use) and not disrupt water flow in the watershed.
	G-S7	Air quality: forest operations shall not resort to <u>uncontrolled</u> wood burning as a means of management, as opposed to controlled, documented and safely planned burning events.
	G-S8	Biodiversity: forest operations along the entire value chain <u>must ensure</u> (obligation) the protection of designated nature conservation areas and other high-value areas and ensure that clear-cuts are within maximum thresholds defined locally. Further, forest operations <u>should consider</u> (incitation) multiple factors affecting local biodiversity and resilience of the forest stands, e.g. diversity of tree species, diversity of tree ages, protected water flow, deadwood harvesting rates are ecologically appropriate, among others.

	G-S9	Material use: the forest biomass used in a CDR pathway must not be sourced from material suitable for use in long-lived wood products (e.g. sawtimber or veneer), considering environmental, logistic and economic constraints, due to the climate benefit of such long-lived wood products and their constrained availability. Note that biomass damaged by insects, fire, or other environmental factors that no longer qualifies as suitable for use in long-lived wood products is allowed for use in a CDR pathway.
	G-S10	Local needs: in case the biomass sourced is not used locally, it shall be ensured that the sourcing of biomass does not affect essential needs of the local population, with respect to biomass use (e.g. fuel wood for heating) or related resources (e.g. water supply, access to land)
	G-S11	Indigenous populations: in case the biomass is sourced in a region with presence of indigenous populations, sourcing of biomass must not affect the sites and resources that are fundamental for satisfying the basic necessities of local people.
	G-S12	Surrounding areas: the areas surrounding the forestry operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases.
	G-S13	High-value ecosystem protection: forest biomass must not be sourced from <u>primary forests</u> , <u>highly biodiverse areas</u> , or <u>land recently converted from a high-carbon stock land use</u> , unless otherwise stated. <u>Primary forests</u> refer to woodland of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. Sourcing of biomass may be allowed provided that the harvesting of the biomass does not interfere with those nature protection purposes, and this is either validated in-writing by the relevant competent authority or is performed in-line with management guidelines applicable to such ecosystems alongside adequate 3 rd party verification of implementation of those management guidelines <u>High carbon stock previous land use</u> refers here to wetlands and peatlands. Land that was in such a state after 2008-01-01 and was since then converted to managed forests or plantations is not eligible.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	G-E1	Certification of the forestry management operations and certification of the chain-of-custody, via various certification programmes, regardless of whether they are public or private in nature. Recognized private-sector certification programmes include the Forest Stewardship Council (FSC), the Roundtable on Sustainable Biomaterials (RSB), the Sustainable Biomass Program (SBP), the Sustainable Forestry Initiative (SFI), or the Programme for the Endorsement of Forest Certification (PEFC), among others. Puro.earth reserves the right to make determination of eligibility of other certification programs to evidence the sustainability criteria.

	G-E2	Compliance with relevant regulatory schemes, e.g. EU Renewable Energy Directive (RED) III, other national regulations, or relevant regulation under the UNFCCC (e.g. the Paris Agreement). This may be provided through certificates like ISCC-EU and its material list.
	G-E3	Existence and enforcement of local forest management plans or policies, whether emanating from governmental, regional, or local authorities. This is only applicable in jurisdictions with a Corruption Perception Index (CPI) above or equal to 50.
	G-E4	Primary evidence specific to the sourcing area, compiled by the biomass supplier and verified by a third-party with relevant expertise. The third-party must conduct verifications in line with ISAE 3000 limited assurance engagement or equivalent as a minimum and such verifications shall be updated annually. Note this verification is separate from the Puro Production Facility and Output Audits.

H. Pulp and paper sludge and black liquor

Feedstock category	Pulp and paper sludge and black liquor	
Feedstock description	Pulp and paper mill sludge and black liquor, derived from processing of virgin fibres, recycled fibres or combination of sources.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	H-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery.
	H-O2	Type and properties: sludge fractions or composition (in particular share of virgin fibres in the sludge), moisture upon delivery, typical carbon content
	H-O3	Traceability: description of supply-chain, name of intermediaries up to the factory generating the sludge, country(ies) of origin of virgin materials processed by the factory, geographical area of sourcing of virgin materials processed by the factory. Note: geographical area of sourcing shall be as precise as needed to evidence the sustainability criteria.
	H-O4	Mix of sources: in case multiple biomass sources are mixed, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are only for the share of virgin fibres from forest wood processed by the pulp and paper mill factory. No sustainability criteria need to be evidenced for the recycled fibre share of pulp and paper sludge.	
	H-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	H-S2	Working conditions: operators have measures in place to ensure safe working conditions during forestry operations.

	H-S3	Regeneration: harvested areas are systematically replanted or regenerated, following local rules or forestry best-practice.
	H-S4	Carbon stocks: 1. In the sourcing area: forest operations along the entire value chain are contributing to long-term maintenance <i>and</i> increase of carbon stocks in the forest, consistent with the objective of global net zero anthropogenic carbon dioxide emissions. 2. In the country of origin: the supplier must publicly disclose whether forest carbon stocks are increasing or decreasing in the country of origin of the biomass.
	H-S5	Soil quality: forest operations along the entire value chain are designed to contribute to maintenance or improvement of soil quality and structure, e.g. by avoiding harvesting of stumps and roots, avoiding harvesting on vulnerable soils, selection of logging techniques that minimize impact of soil quality and habitats, erosion risks are prevented and controlled, nutrient balance is maintained.
	H-S6	Water resources: forest operations along the entire value chain are designed to preserve water quality and quantity (e.g. reasonable use of chemicals, efficient water use) and not disrupt water flow in the watershed.
	H-S7	Air quality: forest operations shall not resort to <u>uncontrolled</u> wood burning as a means of management, as opposed to controlled, documented and safely planned burning events.
	H-S8	Biodiversity: forest operations along the entire value chain <u>must ensure</u> (obligation) the protection of designated nature conservation areas and other high-value areas and ensure that clear-cuts are within maximum thresholds defined locally. Further, forest operations <u>should consider</u> (incitation) multiple factors affecting local biodiversity and resilience of the forest stands, e.g. diversity of tree species, diversity of tree ages, protected water flow, deadwood harvesting rates are ecologically appropriate, among others.
	H-S9	Material use: the forest biomass used in a CDR pathway must not be sourced from material suitable for use in long-lived wood products (e.g. sawtimber or veneer), considering environmental, logistic and economic constraints, due to the climate benefit of such long-lived wood products and their constrained availability. Note that biomass damaged by insects, fire, or other environmental factors that no longer qualifies as suitable for use in long-lived wood products is allowed for use in a CDR pathway.
	H-S10	Local needs: in case the biomass sourced is not used locally, it shall be ensured that the sourcing of biomass does not affect essential needs of the local population, with respect to biomass use (e.g. fuel wood for heating) or related resources (e.g. water supply, access to land)
	H-S11	Indigenous populations: in case the biomass is sourced in a region with presence of indigenous populations, sourcing of biomass must not affect the sites and resources that are fundamental for satisfying the basic necessities of local people.
	H-S12	Surrounding areas: the areas surrounding the forestry operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases.

	H-S13	High-value ecosystem protection: forest biomass must not be sourced from <u>primary forests</u>, <u>highly biodiverse areas</u>, or <u>land recently converted from a high-carbon stock land use</u>, unless otherwise stated. <u>Primary forests</u> refer to woodland of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. Sourcing of biomass may be allowed provided that the harvesting of the biomass does not interfere with those nature protection purposes, and this is either validated in-writing by the relevant competent authority or is performed in-line with management guidelines applicable to such ecosystems alongside adequate 3rd party verification of implementation of those management guidelines <u>High carbon stock previous land use</u> refers here to wetlands and peatlands. Land that was in such a state after 2008-01-01 and was since then converted to managed forests or plantations is not eligible.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	H-E1	Certification of the forestry management operations and certification of the chain-of-custody, via various certification programmes, regardless of whether they are public or private in nature. Recognized private-sector certification programmes include the Forest Stewardship Council (FSC), the Roundtable on Sustainable Biomaterials (RSB), the Sustainable Biomass Program (SBP), the Sustainable Forestry Initiative (SFI), or the Programme for the Endorsement of Forest Certification (PEFC), among others. Puro.earth reserves the right to make determination of eligibility of other certification programs to evidence the sustainability criteria.
	H-E2	Compliance with relevant regulatory schemes, e.g. EU Renewable Energy Directive (RED) III, other national regulations, or relevant regulation under the UNFCCC (e.g. the Paris Agreement). This may be provided through certificates like ISCC-EU and its material list.
	H-E3	Existence and enforcement of local forest management plans or policies, whether emanating from governmental, regional, or local authorities. This is only applicable in jurisdictions with a Corruption Perception Index (CPI) above or equal to 50.
	H-E4	Primary evidence specific to the sourcing area, compiled by the biomass supplier and verified by a third-party with relevant expertise. The third-party must conduct verifications in line with ISAE 3000 limited assurance engagement or equivalent as a minimum and such verifications shall be updated annually. Note this verification is separate from the Puro Production Facility and Output Audits.

I. Non-food agricultural crop

Feedstock category		Non-food agricultural crops
Feedstock description	Agricultural crops that are neither food nor feed crop (e.g. energy crops, biomaterial crops), cultivated on agricultural land.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	I-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	I-O2	Type and properties: crop name, crop fraction, moisture upon delivery, typical carbon content
	I-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing. Note: the geographical area of sourcing shall be as precise as needed to evidence the sustainability criteria, and thereby can be required to go up to the agricultural plot or an ensemble of plots.
	I-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	I-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	I-S2	Working conditions: operators have measures in place to ensure safe working conditions during cultivation and harvesting of the crop.
	I-S3	High-value ecosystem protection: cultivation operations must not take place on land that is or used to be <u>highly biodiverse areas</u> , or <u>high-carbon stock land areas</u> , after 2008-01-01 . Only land that was already agricultural land prior to this date may be used to source agricultural crops for CDR. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. <u>High carbon stock previous land areas</u> refer here to wetlands, peatlands, primary forests and forests.
	I-S4	Carbon stocks: agricultural crop cultivation is planned to contribute to long-term maintenance or increase of carbon stocks in cultivated areas.

	I-S5.1 I-S5.2 I-S5.3 I-S5.4 I-S5.5	Competition for food or feed: 1. Cultivation of agricultural crop for CDR is allowed on degraded, marginal, or contaminated land, without significant concerns of competition for food or feed production. Classification as degraded, marginal, or contaminated land shall be recognized by local competent authorities. 2. For any other type of agricultural land, it is assumed that such land can be used for food or feed production, and in that case, the cultivation of agricultural crops for CDR is allowed only if the CDR crop is a <u>cover crop</u> or an <u>intermediary crop</u> . 3. An exception to rule 2. is made for CDR pathways whose <u>main product</u> is a food or feed commodity. 4. An exception to rule 2. is made for agricultural land that has been repeatedly cultivated for bioenergy crops (e.g. corn) for more than 20 years prior to the start of the CDR activity (i.e. typical of retrofitting of existing 1 st -generation biofuel refineries). 5. A <i>time-bound</i> exception to rule 2. is made for crops (whether food, feed, or non-food/feed) that local competent authorities have formally scheduled for a progressive phase-out from existing bioenergy pathways, provided that these crops constitute less than 15% of the biomass (fresh weight) processed by the CDR facility. The progressive phase-out shall not extend beyond 2030-01-01; if local authorities set a later date, the CDR facility shall nonetheless commit to a complete phase-out no later than this date. This exception may apply, for example, to biogas plants that continue to process so-called first-generation biofuel crops during their transition period.
	I-S6	Environmentally sound agriculture: 1. New establishment of agricultural crop cultivation for CDR, starting after 2020-12-31, must follow national guidelines for sound agricultural practices or other best-practice recommendations, with respect to preservation of soil quality, efficient water use, protection of water resources, reasonable use of fertilizers and chemicals, and biodiversity measures. 2. Existing agricultural crop cultivation for bioenergy or other purposes, prior to 2020-12-31, retrofitted for CDR purposes, are recommended to implement such measures, but are not required to evidence it, yet.
	I-S7	Surrounding areas: the areas surrounding the cultivation operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases.
	I-S8	Indigenous populations: in case the biomass is sourced in a region with presence of indigenous populations, sourcing of biomass must not affect the sites and resources that are fundamental for satisfying the basic necessities of local people.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	I-E1	Certification of agricultural practice
	I-E2	Compliance with relevant regulatory schemes, e.g. EU Renewable Energy Directive (RED) III, other national regulations, or relevant regulation under the UNFCCC (e.g. the Paris Agreement)

	I-E3	Existence and enforcement of local agricultural plans, policies, programs, laws, or regulation, whether emanating from governmental, regional, or local authorities.
	I-E4	Primary evidence from the biomass supplier, for the criteria: • I-S1: Legal operations, • I-S2: Working conditions, • I-S4: Carbon stocks, • I-S6: Environmentally sound agriculture, • I-S8: Indigenous populations.
	I-E5	Land use maps, official land register extracts , or other official documentation , specifically to demonstrate eligibility of the agricultural land use with respect to the criteria of non-conversion of high-value ecosystems (I-S3) and non-competition for food or feed (I-S5).

J. Food Agricultural crop

Feedstock category	Food agricultural crops	
Feedstock description	Agricultural crops that are food or feed crops, whether used in such applications or not (e.g. corn or wheat fermented for biofuel, cereals fermented for beverage production), cultivated on agricultural land.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	J-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	J-O2	Type and properties: crop name, crop fraction, moisture upon delivery, typical carbon content
	J-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing. Note: the geographical area of sourcing shall be as precise as needed to evidence the sustainability criteria, and thereby can be required to go up to the agricultural plot or an ensemble of plots.
	J-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	J-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	J-S2	Working conditions: operators have measures in place to ensure safe working conditions during cultivation and harvesting of the crop.

	J-S3	High-value ecosystem protection: cultivation operations must not take place on land that is or used to be <u>highly biodiverse areas</u>, or <u>high-carbon stock land areas</u>, after 2008-01-01. Only land that was already agricultural land prior to this date may be used to source agricultural crops for CDR. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. <u>High carbon stock previous land areas</u> refer here to wetlands, peatlands, primary forests and forests.
	J-S4	Carbon stocks: agricultural crop cultivation is planned to contribute to long-term maintenance or increase of carbon stocks in cultivated areas.
	J-S5.1 J-S5.2 J-S5.3 J-S5.4 J-S5.5	Competition for food or feed: 1. Cultivation of agricultural crop for CDR is allowed on degraded, marginal, or contaminated land, without significant concerns of competition for food or feed production. Classification as degraded, marginal, or contaminated land shall be recognized by local competent authorities. 2. For any other type of agricultural land, it is assumed that such land can be used for food or feed production, and in that case, the cultivation of agricultural crops for CDR is allowed only if the CDR crop is a <u>cover crop</u> or an <u>intermediary crop</u>. 3. An exception to rule 2. is made for CDR pathways whose <u>main product</u> is a food or feed commodity. 4. An exception to rule 2. is made for agricultural land that has been repeatedly cultivated for bioenergy crops (e.g. corn) for more than 20 years prior to the start of the CDR activity (i.e. typical of retrofitting of existing 1st-generation biofuel refineries). 5. A <i>time-bound</i> exception to rule 2. is made for crops (whether food, feed, or non-food/feed) that local competent authorities have formally scheduled for a progressive phase-out from existing bioenergy pathways, provided that these crops constitute less than 15% of the biomass (fresh weight) processed by the CDR facility. The progressive phase-out shall not extend beyond 2030-01-01; if local authorities set a later date, the CDR facility shall nonetheless commit to a complete phase-out no later than this date. This exception may apply, for example, to biogas plants that continue to process so-called first-generation biofuel crops during their transition period.
	J-S6	Environmentally sound agriculture: 1. New establishment of agricultural crop cultivation for CDR, starting after 2020-12-31, must follow national guidelines for sound agricultural practices or other best-practice recommendations, with respect to preservation of soil quality, efficient water use, protection of water resources, reasonable use of fertilizers and chemicals, and biodiversity measures. 2. Existing agricultural crop cultivation for bioenergy or other purposes, prior to 2020-12-31, retrofitted for CDR purposes, are recommended to implement such measures, but are not required to evidence it, yet.
	J-S7	Surrounding areas: the areas surrounding the cultivation operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases.

	J-S8	Indigenous populations: in case the biomass is sourced in a region with presence of indigenous populations, sourcing of biomass must not affect the sites and resources that are fundamental for satisfying the basic necessities of local people.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	J-E1	Certification of agricultural practice
	J-E2	Compliance with relevant regulatory schemes, e.g. EU Renewable Energy Directive (RED) III, other national regulations, or relevant regulation under the UNFCCC (e.g. the Paris Agreement)
	J-E3	Existence and enforcement of local agricultural plans, policies, programs, laws, or regulation, whether emanating from governmental, regional, or local authorities.
	J-E4	Primary evidence from the biomass supplier, for the criteria: • J-S1: Legal operations, • J-S2: Working conditions, • J-S4: Carbon stocks, • J-S6: Environmentally sound agriculture • J-S8: Indigenous populations,
	J-E5	Land use maps, official land register extracts, or other official documentation, specifically to demonstrate eligibility of the agricultural land use with respect to the criteria of non-conversion of high-value ecosystems (J-S3) and non-competition for food or feed (J-S5).

K. In-field agricultural residues

Feedstock category	In-field agricultural residues	
Feedstock description	In-field agricultural residues, originating from the cultivation of a food, feed, or material crop, e.g. cereal straw, rice straw, maize straw, stalks, pruning residues (trees, bushes).	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	K-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	K-O2	Type and properties: crop name, crop fraction, moisture upon delivery, typical carbon content
	K-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing. Note: the geographical area of sourcing shall be as precise as needed to evidence the sustainability criteria, and thereby can be required to go up to the agricultural plot or an ensemble of plots.
	K-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria,

		and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	K-S1	Soil quality and carbon stocks: harvesting of residues is performed in a manner that preserves soil quality and carbon stocks, e.g. using methods that leave a significant share of residues to decompose in the soil (e.g. roots left in place, adjusted cutting height), or following any existing local or national regulation on residue harvesting.
	K-S2	Working conditions: operators have measures in place to ensure safe working conditions during cultivation and harvesting of the residues.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	K-E1	Primary evidence from the biomass supplier, for the criteria Working conditions (K-S2) and Soil quality and carbon stocks (K-S1) , detailing the measures in place
	K-E2	Existence and enforcement of local residue harvesting plans, policies, programs, regulations, or laws, whether emanating from governmental, regional or local authorities, tackling soil quality and carbon stocks, including some level of monitoring, for the criteria Soil quality and carbon stocks
	K-E3	Existence and enforcement of laws tackling working conditions in the agricultural sector, emanating from governmental authorities, for the criteria Working conditions

L. Non-field agricultural residues

Feedstock category	Non-field agricultural residues	
Feedstock description	Non-field agricultural residues, originating from the primary processing of a food, feed, or material crop in a factory, e.g., rice husk, maize cob, nutshell and husk, peels, fruit seeds/pits, bagasse, coffee husk, cocoa pods, spent grain.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	L-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	L-O2	Type and properties: crop name, crop fraction, moisture upon delivery, typical carbon content
	L-O3	Traceability: description of supply-chain, name of intermediaries up to the factory generating the residue, country(ies) of origin of the crop, geographical area(s) of cultivation of the crop.
	L-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.

Sustainability criteria	Criteria to be evidenced are:	
	L-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	L-S2	Working conditions: operators have measures in place to ensure safe working conditions during processing of the residues.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	L-E1	Primary evidence from the biomass supplier, for the criteria Legal operations (L-S1) and Working conditions (L-S2) .
	L-E2	Existence and enforcement of laws tackling working conditions in the agricultural sector, emanating from governmental authorities, for the criteria Working conditions (L-S2)

M. Palm oil biomass and derivatives

Feedstock category	Palm oil biomass and derivatives	
Feedstock description	Any biomass from oil palm tree plantations (which are not considered forests but agricultural plantations), e.g. palm oil and its fractions, empty fruit bunches (EFB), nuts and kernels, cakes, or other side-streams.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	M-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	M-O2	Type and properties: crop name, crop fraction, moisture upon delivery, typical carbon content
	M-O3	Traceability, for fractions derived from processing palm fruit: description of supply-chain, name of intermediaries, country of origin, name and location of processing factory, list of all plots of land from which palm fruits were sourced for this factory.
	M-O4	Traceability, for fractions derived from palm cultivation operations (e.g. tree trunks at end of cultivation cycle): description of supply-chain, name of intermediaries, country of origin, list of all plots of land from which biomass was sourced.
	M-O5	Mix of sources: in case multiple biomass sources are mixed, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	M-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.

	M-S2	Working conditions: operators have measures in place to ensure safe working conditions during cultivation operations.
	M-S3	Carbon stocks: 1. In the sourcing area: cultivation operations along the entire value chain are contributing to long-term maintenance or increase of carbon stocks in the area of the plantations. 2. In the country of origin: the supplier must publicly disclose whether forest carbon stocks are increasing or decreasing in the country of origin of the biomass.
	M-S4	Soil quality: cultivation operations along the entire value chain are designed to contribute to maintenance or improvement of soil quality and structure.
	M-S5	Water resources: cultivation operations along the entire value chain are designed to preserve water quality and quantity (e.g. reasonable use of chemicals, efficient water use)
	M-S6	Air quality: forest operations shall not resort to uncontrolled wood burning as a means of management.
	M-S7	Biodiversity: cultivation operations along the entire value chain <u>must ensure</u> the protection of designated nature conservation areas and other high-value areas. Further, cultivation operations <u>should consider</u> multiple factors affecting local biodiversity and resilience of the ecosystem, e.g. wildlife habitat and corridors, water flows, among others.
	M-S8	Indigenous populations: in case the biomass is sourced in a region with presence of indigenous populations, sourcing of biomass must not affect the sites and resources that are fundamental for satisfying the basic necessities of local people.
	M-S9	Surrounding areas: the areas surrounding the forestry operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases.
	M-S10	High-value ecosystems: biomass from palm plantations must not be sourced from <u>primary forests</u> , <u>highly biodiverse areas</u> , or <u>land recently converted from a high-carbon stock land use</u> . <u>Primary forests</u> refer to woodland of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. <u>High carbon stock previous land use</u> refers to wetlands, peatlands, and primary forests. Land that was in such a state after 2008-01-01 and was since then converted to palm plantations is not eligible.
	Criteria can be evidenced by one or a combination of the following options:	
Sustainability evidence options	M-E1	Certification of the palm agricultural plantation for its management and chain-of-custody, e.g. via various nationally recognised certification programmes.
	M-E2	Compliance with relevant regulatory schemes, e.g. EU Renewable Energy Directive (RED) III, EU Deforestation-free-products (EU DR), relevant regulation under the UNFCCC (e.g. the Paris Agreement), or other national regulations.

	M-E3	Primary evidence specific to the sourcing area, compiled by the biomass supplier and verified by a third-party with relevant expertise. The third-party must conduct verifications in line with ISAE 3000 limited assurance engagement or equivalent as a minimum and such verifications shall be updated annually. Note this verification is separate from the Puro Production Facility and Output Audits.
	M-E4	Land use maps , specifically to demonstrate eligibility of the plantations with respect to the criteria of non-conversion of high-value ecosystems (M-S10) to plantations, in combination with traceability evidence.

N. Conservation landscape management

Feedstock category	Conservation landscape management	
Feedstock description	Invasive species whether on land, in freshwater, or in coastal areas, as well as any biomass from landscape management for conservation purposes of protected areas or assimilated, including forest wildfire mitigation.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	N-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	N-O2	Type and properties: plant name, plant fraction, moisture upon delivery, typical carbon content
	N-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing up to the actual plots of land or coast.
	N-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	N-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	N-S2	Working conditions: operators have measures in place to ensure safe working conditions during harvesting or collection operations.
	N-S3	Environmental conditions: the operators have developed or follow an existing harvesting/collection plan that ensures that only adequate species are harvested/collected, and in a suitable manner with respect to both quantities and methods used. This plan must have been approved by relevant competent authorities in the jurisdiction of sourcing. If the approved operations lead to collection of mix of target and non-target species, then the fraction of non-target biomass must be reported as non-eligible.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following options:	
	N-E1	Primary evidence from the biomass supplier, for the criteria Legal operations (N-S1) and Working conditions (N-S2) .

	N-E2	Primary evidence specific to the sourcing area, compiled by the biomass supplier, for the criteria Environmental conditions (N-S3) , including official documents from relevant competent authorities.
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O. Aquatic biomass

Feedstock category	Aquatic biomass	
Feedstock description	Cultivated or harvested water-based plants or algae, and associated derivatives.	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	O-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	O-O2	Type and properties: plant name, plant fraction, moisture upon delivery, typical carbon content
	O-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing up to the actual plots of land or coast.
	O-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	O-S1	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	O-S2	Working conditions: operators have measures in place to ensure safe working conditions during harvesting or collection operations.
	<i>Further requirements on the production process of water-based plants or algae may be added in the future, e.g. relating to water quality, use of chemicals, and competition for other.</i>	
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following option:	
	O-E1	Primary evidence from the biomass supplier, for the criteria Legal operations (O-S1) and Working conditions (O-S2) .

P. Land clearing biomass

Feedstock category	Land clearing biomass	
Feedstock description	Land clearing biomass from authorized activities with change in land use (non-renewable biomass), in non-protected and non-high-value ecosystems, with adequate management and compensation measures. Clearing activities can result from, e.g. city urban expansion, pipeline or powerline construction, and similar cases, but does not apply to clearing for agriculture nor plantations. Limitation: <i>this category is allowed to be processed by a CO₂ Removal Supplier but shall not result in the issuance of CORCs (see clarification in section 3.2)</i>	
Origin and type evidence	Origin and type of the feedstock shall be specified as follow, for each feedstock delivery received:	
	P-O1	Basic information: identification number, date or range of delivery, amount received, place of delivery, name of organization delivering (transporter), mode of delivery
	P-O2	Type and properties: plant name, plant fraction, moisture upon delivery, typical carbon content
	P-O3	Traceability: description of supply-chain, name of intermediaries, country of origin, geographical area of sourcing, and actual identification of the clearing site
	P-O4	Mix of sources: in case multiple biomass sources are mixed together, information must be retained so that a mass-balance approach can be applied to determine the properties of the mix as well as evidence the sustainability criteria, and thereby determine the share of eligible biomass among the mix. Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration.
Sustainability criteria	Criteria to be evidenced are:	
	P-S1	Clearing authorisation: the clearing must be authorised by a competent authority, clearly identifying the site being cleared and the reason of the clearing (e.g. urban expansion, powerline construction, pipeline construction)
	P-S2	Legal operations: operators and operations are legal in the jurisdiction of sourcing.
	P-S3	Working conditions: operators have measures in place to ensure safe working conditions during harvesting or collection operations.
	P-S4	Non-protected ecosystem: the site cleared must not be in a <u>protected area</u>
	P-S5	High-value ecosystems: the site cleared must not be in <u>primary forests</u> , <u>highly biodiverse areas</u> , or <u>land recently converted from a high-carbon stock land use</u> . <u>Primary forests</u> refer to woodland of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located. <u>Highly biodiverse areas</u> refer to both forests and grasslands as identified by the relevant competent authority. <u>High carbon stock previous land use</u> refers to wetlands, peatlands, and primary forests.
Sustainability evidence options	Criteria can be evidenced by one or a combination of the following option:	
	P-E1	Primary evidence from the biomass supplier and the competent authorities, for all the sustainability criteria.

3. Biomass Counterfactual Storage

Biomass used for carbon dioxide removal contains biogenic carbon previously removed from the atmosphere through biological growth and is part of the short carbon cycle. Requirements on biomass renewability, included across all Puro-defined biomass categories, address whether the carbon removed with the biomass is eventually replenished through regrowth, thereby maintaining the relevant biomass carbon stock. Other sustainability requirements, such as high-value ecosystem protection, soil carbon stock preservation, and leakage avoidance, further address the preservation of carbon stocks in surrounding ecosystems.

While renewability requirements ensure that carbon removal is *ultimately* achieved, an additional safeguard is set regarding transient near-term warming relative to the most plausible counterfactual biomass storage. The notion of counterfactual storage considers whether, and for how long, the removed carbon would have remained stored in the sourced biomass in the absence of the removal activity, rather than returning to the atmosphere through the short carbon cycle.

Requiring low or negligible carbon storage under the most plausible counterfactual is therefore an additional criterion, alongside biomass renewability and other sustainability requirements, to ensure that CORCs represent not only permanent carbon removal, but also *near-term* carbon removal relative to the counterfactual scenario.

3.1. Applicability and transition periods

The requirements in section 3.2 apply to all Production Facilities subject to the Puro Biomass Sourcing Criteria (BSC) according to the transition provisions in rule 3.1.1. A transition period is provided to accommodate Production Facilities for which investment and design decisions were made before these requirements were introduced.

- 3.1.1. Production Facilities shall comply with the requirements in section 3.2 from a point in time defined by the Crediting Period Start Date as follows.
 - (a) Crediting Period Start Date on or after 1 January 2029: Production Facilities shall comply with the requirements in section 3.2 from their first Production Facility Audit.
 - (b) Crediting Period Start Date before 1 January 2029: Production facilities shall comply with the requirements in section 3.2 at the latest upon Crediting Period Renewal but may voluntarily adopt them at any time.
- 3.1.2. Production Facilities complying with the requirements in section 3.2 shall be identifiable as such in the Puro Registry.

3.2. Rules for counterfactual storage assessment

- 3.2.1. The CO₂ Removal Supplier shall assess the counterfactual scenario of all biomass associated with CORC issuance as further defined in subrules (a) and (b).
 - (a) The CO₂ Removal Supplier shall either:
 - (i) demonstrate that the biomass falls under a counterfactual scenario deemed to result in negligible counterfactual storage (see rule 3.2.3), or

- (ii) quantify the amount of carbon stored in the counterfactual scenario (in tCO₂e) and deduct it from the number of CORC issued (see rule 3.2.5).
 - (b) A given counterfactual scenario may apply to the Production Facility as a whole, to a biomass source, or to an aggregated group of biomass sources where the relevant characteristics, sourcing conditions and counterfactual fate are sufficiently similar, as determined by the Issuing Body.
- 3.2.2. The validated counterfactual scenario(s) and any associated quantification of counterfactual storage (see rule 3.2.5) shall by default remain in force for the duration of the Crediting Period (however, see subrule (b) regarding updates due to material changes).
- (a) The CO₂ Removal Supplier shall reassess the validity of the counterfactual scenario(s) and any associated quantification upon Crediting Period Renewal.
 - (b) The CO₂ Removal Supplier shall update the counterfactual scenario(s) and any associated quantification whenever the sourcing of biomass is materially changed (e.g. addition of new biomass sources or sourcing regions), or a material change in the underlying assumptions, data, or other supporting evidence is detected or reasonably suspected.
- 3.2.3. The counterfactual scenarios defined in Table 1 are deemed to result in negligible counterfactual carbon storage. No counterfactual storage deduction (see rule 3.2.5) is required for the proportion of biomass that is demonstrably covered by at least one scenario listed in Table 1 (see also rule 3.2.4 for additional restrictions for retrofit facilities).
- 3.2.4. For retrofit facilities, in cases where biomass consumption increases above the pre-retrofit baseline (including biomass required to compensate for parasitic load or reduced primary output, the scenario CS2 of Table 1 applies only to the baseline biomass quantity. Biomass above that baseline shall separately meet another applicable scenario in Table 1 or be treated according to rule 3.2.5.
- 3.2.5. For any biomass where a negligible counterfactual storage scenario is not demonstrated in accordance with rules 3.2.2 and 3.2.4 (for retrofit facilities), the CO₂ Removal Supplier shall evidence the plausible counterfactual fate(s) of the biomass and conservatively quantify the amount of biomass carbon (in tCO₂e) expected to remain stored outside the atmosphere after 15 years.
- (a) In cases where several material counterfactual fates plausibly apply, these shall be proportionally combined (based on biomass carbon) in the quantification of counterfactual carbon storage.
 - (b) The estimated total amount of biomass carbon (in tCO₂e) expected to remain stored outside the atmosphere after 15 years shall be deducted from the gross durably stored biogenic carbon eligible for CORC issuance.
 - (c) Any biomass for which a plausible counterfactual fate is not demonstrated, or for which the amount of counterfactual carbon storage is not quantified, shall be deemed as non-eligible.

TABLE 1. LIST OF COUNTERFACTUAL SITUATIONS (CS) THAT ARE DEEMED TO RESULT IN NEGLIGIBLE AND NO COUNTERFACTUAL STORAGE.

ID	Counterfactual situation	Evidence to be provided	Applicability	Commonly applicable biomass categories (non-exhaustive)
CS1	Biomass would otherwise be combusted, incinerated or openly burned , resulting in negligible counterfactual carbon storage.	Historical records, contracts, supplier evidence, regulation, or representative statistics.	Individual biomass source / Aggregated biomass sources	Examples: K, L.
CS2	For a retrofit , biomass consumption up to the demonstrated pre-retrofit baseline would have been consumed and its carbon released absent the CDR activity.	Historical facility biomass consumption, sourcing and use records.	Production Facility / Baseline biomass quantity	Any biomass already consumed by the facility.
CS3	Biomass originates from necessary tree removal under a government-supported wildfire mitigation program .	Program documentation, participation and chain-of-custody.	Individual biomass source / Aggregated biomass sources	Examples: N.
CS4	Biomass would otherwise decompose , with all or substantially all carbon released within 15 years.	Applicable decay models, literature or empirical evidence reflecting relevant environmental conditions.	Individual biomass source / Aggregated biomass sources	Examples: D, E, F, K, L.
CS5	Biomass originates from ecosystem-restoration interventions that demonstrably result in a net increase in ecosystem carbon storage over 15 years that is at least equal to the carbon contained in the sourced biomass.	Project/counterfactual ecosystem-carbon assessment covering all material carbon pools and supported by ongoing monitoring plan and activities.	Individual biomass source / Aggregated biomass sources / Sourcing area	Examples: N.
CS6	Biomass would otherwise enter another use or carbon pool (e.g. animal bedding, animal feed, mulching or other demonstrated fate) with negligible counterfactual storage within 15 years.	Evidence of alternative fate and applicable carbon retention/release evidence.	Individual biomass source / Aggregated biomass sources	Examples: G.
CS7	The counterfactual generates sufficiently high CH₄ or other GHG emissions over 15 years (based on GWP ₁₀₀ factors), to offset temporary biogenic carbon storage, and the biomass carbon is predominantly released from the biomass under counterfactual conditions within 100 years.	Counterfactual emissions/decay model, GHG factors and residual carbon-storage evidence.	Individual biomass source / Aggregated biomass sources	Examples: A, E.

4. Definitions and clarifications

4.1. Definitions

The following definitions are used in the above-listed criteria:

Primary forests refer to woodland of native tree species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located. The definition is adapted from EU regulation (2023/1115).

Wetlands refer to areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres. Wetlands include a wide variety of inland habitats such as marshes, wet grasslands and peatlands, floodplains, rivers and lakes, and coastal areas such as saltmarshes, mangroves, intertidal mudflats and seagrass beds, and coral reefs and other marine areas no deeper than six meters at low tide. It may also include human-made wetlands such as dams or reservoirs, if specific valuable ecological features have developed in those built wetlands. The definition is adapted from the Ramsar Convention on Wetlands (2016).

Peatlands refer to a special type of wetland dominated by peat-forming plants such as Sphagnum mosses, where biomass does not completely decompose due to anoxic conditions and nearly permanent water saturation. The definition is adapted from the EU Biodiversity Information System for Europe.

Highly biodiverse areas refer to both forests and grasslands as identified by the relevant competent authority as being highly valuable from the perspective of biodiversity preservation.

Identification number, in the context of the basic information required to demonstrate origin and type, refers to unique numbers (or in fact, any alpha-numerical chain of characters) used to identify deliveries of biomass feedstocks in the project's monitoring and reporting systems. For instance, "B20240506-003".

Geographical area of supply, in the context of traceability information of a biomass feedstock, refers to the approximative geographical area in which the biomass is generated. At minimum, the area of supply shall specify the country and sub-region within the country, and may be a combination of countries and sub-regions in case of mixed feedstocks. In the case of coastal or marine environments, other suitable geographical areas may be defined. Geographical area of supply can be required to be more precise than defined above if needed to support demonstration of sustainability criteria.

4.2. Clarifications

The following clarifications are made about concepts used in the above-listed criteria:

Traceability and Chain of custody

A key aspect to determine the eligibility of the biomass for the carbon dioxide removal activities covered within the Puro Standard lies in providing evidence on its origin, which affects also how sustainability criteria can be evidenced. To that end, we provide additional contextual information based on ISEAL's Chain of custody models and definitions (2016) as follows:

- i. **Chain of custody (CoC):** "the custodial sequence that occurs as ownership or control of the material supply is transferred from one custodian to another in the supply chain." There are several approaches or models taken to demonstrate the physical or administrative link between the verified unit of production and the final product claim. For the purposes of the Puro Biomass Sourcing Criteria, the focus is on segregation and mass-balance approaches.
- ii. **Traceability:** "The ability to verify the history, location, or application of an item by means of documented recorded identification."
- iii. **Segregation CoC approach:** in this case, eligible material is physically kept separate from non-eligible material of the same commodity through all stages of the supply chain. This only allows mixing of eligible materials from different sources. The exact origin/producer information remains available throughout the chain of traceability system.
- iv. **Mass-balance CoC approach:** in this case, eligible material may be mixed with non-eligible material provided that the quantities associated with eligible claims are controlled. For this methodology, only batch-level and site-level mass balances are allowed. This requires that eligible and non-eligible materials remain segregated until the point of mixing, and the proportion or percentage of each component be recorded appropriately. This will allow the proper accounting of the certified material towards the eligible carbon source.

Cut-off dates for land use conversion or management practices

For certain feedstock categories (e.g. forest biomass, agricultural crop), cut-off dates for land use conversion and management practices are used, to specify when certain rules are applicable. Two such dates are used, for different purposes and rationales:

- 2008-01-01, similar to the cut-off date available in EU RED II and RED III
- 2020-12-31, similar to the cut-off date available in EU Regulation on Deforestation-free products

Land use conversion from high carbon stock areas must not have taken place after 2008-01-01, in order for the resulting biomass to be eligible. This is in line with currently enforced EU RED III, as well as conservative for the time being. It should be noted that the EU Regulation on Deforestation-free products, uses a different cut-off year, specifically

for deforestation and forest degradation, but that this regulation is still in its early stage of implementation.

Regarding, agricultural land management practices, for purpose grown biomass, the second cut-off date is used (2020-12-31) to require that any new establishment of purpose grown biomass for CDR on eligible agricultural land follows stricter rules with respect to important environmental factors in agriculture. This is perceived as a necessary condition to ensure a safe and sound scaling of CDR with new establishment of biomass cultivation.

Background on Category P – Biomass from land clearing

Category P corresponds to very specific sources of non-renewable biomass, resulting from the clearing of land as part of e.g. urban infrastructure projects like the construction of housing of public transport infrastructure, in non-protected areas and non-high-value ecosystems. It specifically excludes land clearing activities related to agriculture and plantations.

CO₂ Removal Suppliers are allowed to process feedstock from land clearing activities, only if it meets the requirements of category P. However, any carbon stored from this feedstock shall not result in the issuance of CORCs, and CO₂ Removal Suppliers must make corresponding adjustments to their calculations.

The reason for Puro.earth to introduce this category is to recognise the fact that carbon removal activities, like biochar and bioenergy with carbon capture and storage, can process those types of feedstocks, alongside other renewable biomass feedstocks. For instance, large district heating facilities often process trees cleared by municipal activities. The amount of cleared biomass processed is usually a small share of the total biomass consumption. By having an explicit category, with clear limitations, it enables CO₂ Removal Supplier to improve the transparency of their reporting and limit the incentives of processing cleared biomass to specific accepted and legal sources.

This said, because of the non-renewable feature of biomass from land clearing, Puro.earth decided with its Advisory Board, to not consider carbon stored from this biomass as removal and therefore, not issue CORCs for the corresponding volumes of biomass processed. This decision was made even though the driver of land use change is here not the carbon storage activity (e.g. biochar production), but rather the land conversion activity (e.g. urban infrastructure construction).

Forest biomass and passive carbon uptake

In the category G – Forest biomass, the criterion Carbon stocks mentions the objective of global net zero anthropogenic carbon dioxide emissions, in relation to passive carbon uptake by managed forests. The importance of maintaining and increasing carbon stocks of forests is related to the increased carbon dioxide uptake by forests due to higher atmospheric concentration of carbon dioxide. This is further detailed in the recent work of Allen et al. (2025).

5.Examples

This section includes some examples of reporting traceability information and demonstration of sustainability criteria. More detailed guidance and reporting templates will be made available to CO₂ Removal Suppliers.

5.1. Identification and traceability information

Identification number	Delivery date range (YYYY-MM)	Amount received (metric tonnes, fresh weight)	Type of waste	Geographical area of sourcing	Delivering entity ID
B00001	2024-03	3000	10.1 Household MSW	Stockholm region	SE-XYZ-001
B00002	2024-03	3500	10.1 Household MSW	Stockholm region	SE-XYZ-001
B00003	2024-04	3400	10.1 Household MSW	Imports from United Kingdom	UK-ABC-001

EXAMPLE 2. TRACEABILITY INFORMATION FOR MIXED MSW AND ASSIMILATED WASTE PROCESSED AT A MSW INCINERATOR WITH CCS

- In the example above, the type of waste can be further specified based on local classification schemes for waste (e.g. via the use of European Waste Codes, or similar applicable in the jurisdiction of the project). The classification scheme used will be possible to reference in the reporting templates.
- In the example above, the delivering entity is here represented by an ID (e.g. SE-XYZ-001) which can be defined in a separate table with its legal information (e.g. entity name, business registration ID).

Additional examples will be added in future versions.

6. References

An Introduction to the Convention on Wetlands (previously The Ramsar Convention Manual). 2016, 5th Edition. Ramsar Convention Secretariat, Gland, Switzerland.

<https://www.ramsar.org/document/handbook-1-5th-edition-introduction-convention-wetlands>

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (Text with EEA relevance.)

<http://data.europa.eu/eli/dir/2018/2001/oj>

Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

<http://data.europa.eu/eli/dir/2023/2413/oj>

EU Biodiversity Information System for Europe. Accessed on 26th of March 2024:
<https://biodiversity.europa.eu/natura2000/en/peatlands>

ISEAL. 2016. Chain of custody models and definitions. Accessed on 26th of March 2024:

<https://www.isealalliance.org/get-involved/resources/iseal-guidance-chain-custody-models-and-definitions>

Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (Text with EEA relevance)

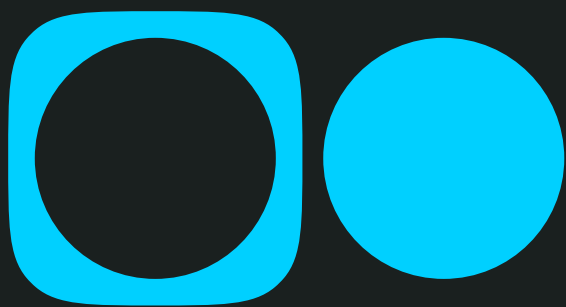
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<https://doi.org/10.1038/s41586-024-08326-8>

7. Document History

Version	Issue Date	Comment
V1.0	30 May 2024	Initial version published
V1.1	12 June 2025	Update of definitions and addition of clarifications for some biomass categories Addition of Land clearing biomass as feedstock category
V1.2	27 November 2025	Addition of exemption under Non-agricultural food crop category
V1.3	10 September 2026	Addition of Biomass Counterfactual Storage requirements. Formatting improvements (indexation of criteria and evidence options). Correction of typographical errors. Clarification of description of Category C. Replicated the sustainability criteria of Category G and Category I in Category H and Category J, respectively.



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Puro.earth is the world's leading market infrastructure provider for engineered carbon dioxide removal (CDR). We provide the certification frameworks, scientific standards, and digital systems that allow engineered CDR to scale as an investment-grade market.

At the core of this infrastructure is the Puro Standard - the world's first dedicated standard built for the needs of an engineered CDR market. We certify suppliers under the Puro Standard that durably store carbon dioxide for at least 100 years, and in many cases over 1,000 years. To date, we have certified over 100 engineered CDR projects, resulting in the issuance of over 1.5 million CO₂ Removal Certificates (CORCs) in the Puro Registry as verified, traceable, investable assets. Our infrastructure is trusted by over 700 companies worldwide to procure carbon removals with confidence.

Nasdaq has owned a majority stake in Puro.earth since 2021. This brings 50+ years of expertise in building and operating the world's most trusted markets, strengthening Puro.earth's ability to deliver the transparency, rigor, and operational capacity needed to make CDR an institutional-grade asset class.

Puro.earth is an ICVCM Eligible Carbon Crediting Programme.