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Terrestrial Storage of Biomass

Public Consultation Feedback summary

26th June, 2023

Context

Puro.earth held an initial public consultation with the intention to revise its Woody Biomass Burial methodology, now called Terrestrial Storage of Biomass. The revision was meant to evolve the methodology beyond the pilot stage and develop the several aspects of significant importance.

This initial public consultation was announced on Puro's home page on June 1st, 2023 and in Puro Newsletter on the same day. The period of consultation was 1st to 22nd June 2023. The public consultation was structured as a set of 10 questions tackling key aspects of the methodology.

The feedback received during this public consultation has been considered for incorporation into the revised methodology. The revised methodology was then submitted to Puro's Scientific Advisory Board for further feedback in June 2023. Following incorporation of the feedback from the Advisory Board, a second public consultation will be held. This second public consultation is currently scheduled for July/August 2023, before a potential approval of the methodology by the Advisory Board in August/September 2023.

During the initial public consultation, feedback was received from 15 organizations. This document summarizes the feedback and how Puro is addressing it.

We want to thank all participants for your time and devotion to co-developing the Carbon Removal Methodologies together with our ecosystem.

Questions, feedback summaries, and resolutions

Question	1. What types of biomass should be eligible to be sourced for durable storage? Should non-lignin containing biomass be considered?
Summary of feedback	<p>The comments received were either supporting of a) limiting the scope to lignin-rich biomass (3), b) expanding to all biomass types (6), or c) undecided (5).</p> <p>Arguments for limiting the scope to lignin-rich biomass included: better use of biomass for other purposes; lack of scientific evidence of long-term storage under anaerobic storage conditions, and currently used stability factor deriving from woody biomass in anaerobic storage conditions.</p> <p>Arguments for expanding to all biomass types focused on the fact that storage conditions are the primary factor of storage durability, rather than inherent properties of the biomass, in particular for dry-storage conditions.</p>
Resolution	<p>From the feedback received, Puro notes that a) the type of storage affects what type of biomass may be suitable for Terrestrial Storage, b) there is a lack of evidence for certain storage conditions and biomass types, c) lignin-rich biomass remains the type of biomass for which most knowledge is available and d) for which risks are lower due to its inherent recalcitrance and if storage is compromised the repair actions have more time than with fast decaying biomass types.</p> <p>Due to the varied reactions to this question, Puro will continue limiting the biomass eligibility to lignin-rich biomass. Future revisions of the methodology might include other types of biomass, provided evidence is available by then.</p>

Question	2. How can methane levels be measured and monitored through time to guarantee net negativity of projects? Please provide practical examples of both what would be measured and how it would be measured.
Summary of feedback	<p>The majority of comments expressed three main approaches to methane monitoring:</p> <ul style="list-style-type: none"> a) direct near-continuous measurement of <i>storage conditions</i> where methane is formed, e.g. temperature, relative humidity b) direct periodic measurement of CH₄ concentration from the airflow from a storage site (mainly, below-ground storage, including control measurement) c) direct periodic testing of carbon content of the biomass in storage <p>Two answers specifically provided names of equipment suited for measurement of CH₄ with low detection limits suited for the purpose, using either infrared technology or gas chromatography.</p>
Resolution	Puro will keep the requirement on methane monitoring. Puro will mention as examples the types of equipment and measurement techniques for CH ₄ in the

	text of the methodology. However, it remains unclear how requirements will be tailored to fit the 3 types of storage currently envisioned in the methodology (namely, above-ground storage, below-ground storage, and subterranean injection). Puro will continue to add detail and clarity on this matter.
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Question	3. What is the most reliable way to physically measure biomass decomposition and how can this help build understanding of the process through time?
Summary of feedback	The answers received were divided. The division mainly arises from differences in storage type (namely, above-ground storage, below-ground storage, and subterranean injection). For subterranean injection, it appears unpractical to directly sample the biomass to assess changes. For below-ground storage in sealed chambers, such direct sampling poses risks to affect storage conditions. For above-ground storage, in aerated conditions, it seems possible.
Resolution	Due to the varied reactions to this question, Puro notes the need and will maintain to have differentiated monitoring requirements to reflect differences in storage types and will continue to work on this matter.

Question	4. What property title and associated easement or legal caveat in your relevant jurisdiction protects the storage of eligible biomass for 100+ years?
Summary of feedback	<p>The majority of comments received recognized the need for legal documents but noted that there are several options possible and that this may vary with both jurisdiction and storage type. The main risk to be addressed is the change of ownership of the land where biomass is stored and the rights to access the stored biomass. Subterranean injection seemed less affected than other storage types.</p> <p>Feedback was received for the USA, Australia, and Europe. One respondent mentioned on-going work with lawyers for defining the right type of easement. One respondent referred to other schemes of land tenure management for land restoration projects in Africa.</p> <p>Overall, the options mentioned by the respondents can be grouped as:</p> <ul style="list-style-type: none"> - Direct ownership of the land, with an explicit Conservation easement - Long-term lease of the land, with specific clauses and conservation easement - Government-backed land lease (e.g. state-owned land, landfills, long-term state holdings) - Title insurance transferred to a land trust with conservation mission <p>Some noted that appropriate easements do not necessarily exclude the area of land above the (below-ground) storage site for a non-competing use (e.g. re-vegetation, recreation facilities).</p>
Resolution	Puro notes the consensus that legal documents are needed, but also acknowledges that there may be variation in terms of what type of legal documents may be obtained in different jurisdictions where Terrestrial Storage

	<p>projects are established and that subterranean injection might not require the same legal documents as below-ground and above ground storage.</p> <p>Puro agrees with the majority of stakeholders and will maintain the requirements that legal documents are needed. Puro will continue to interact with projects and lawyers to further refine those requirements.</p>
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Question	5. How can risk of re-emission be practically managed?
Summary of feedback	The majority of comments expressed an agreement that there is a need for measurement to be performed at the project-level, that measurement requirements will vary with storage type, and that re-emission risks must be prevented by sound design rather than mitigated by corrective measures.
Resolution	Puro will continue highlighting the preventive measures in project design to identify and mitigate the re-emission risks. Puro will take into consideration the feedback and add a dedicated chapter on management of re-emission risks, distinguishing between different storage types, and monitoring measurements that must be implemented by projects.

Question	<p>6. Should a Fund which provides an accountability buffer against unexpected re-emissions, be required for:</p> <p>A) All projects, irrelevant of the size.</p> <p>B) Only large projects (e.g. +10,000 tonne of biomass).</p> <p>C) No projects.</p>
Summary of feedback	<p>The answers received were divided.</p> <p>Two answers supported establishment of a fund for A) All projects, irrelevant of the size. These answers noted the possibility to have different fund requirements for different project types.</p> <p>Two answers supported the idea that C) No projects would need to establish a Fund. Instead, other mechanisms could be put in place such as insurance.</p> <p>Three other respondents were rather unsure on what mechanisms to use but were supportive of the existence of a mechanism. One answer was explicitly against making differences linked to project size. One answer explicitly mentioned that projects should remain liable in case of unexpected re-emissions.</p>
Resolution	Puro will change the requirement so that projects should remain accountable and liable in case of unexpected re-emissions and demonstrate the funding for repair or compensation if a storage is compromised. The trust fund will remain as an example of acceptable means for re-emissions liability mechanism.

Question	<p>7. Given uncertainties in measurement and the scientific understanding of decay rates of various biomass compositions in various environments, is a buffer required, if so what size and why?</p> <p>o o%</p>
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	<ul style="list-style-type: none"> o 10% o 50% o Other, please specify
Summary of feedback	<p>The majority of respondents highlighted that the currently used 8.8% re-emission factor derived from woody biomass decomposition in landfills (derived from IPCC inventory guidelines) is mainly applicable to below-ground storage in anaerobic conditions, and that other storage methods are expected to easily outperform this value.</p> <p>As a consequence, several answers suggested that projects should be allowed to submit project-specific values for the stability factor as well as fraction of methane re-emission and oxidation factors.</p> <p>One respondent also suggested that a time lag could be introduced before issuance of credits, e.g. 6 months, to verify that storage conditions in the storage chambers are maintained and constantly as expected.</p>
Resolution	<p>Puro will maintain the current re-emission factor, but agrees with the majority of respondents that the IPCC default value may be conservative in many cases. Puro will further discuss with the Scientific Advisory Board the different options to allow project-specific values to be used, and/or to introduce a time-lag between storage and issuance of credits.</p>

Question	<p>8. How would you revise the assessment of environmental impacts for each project?</p>
Summary of feedback	<p>The majority of respondents agreed with existing requirements, and in particular the need for compliance with local environmental regulation and permitting procedures.</p> <p>One respondent highlighted the need for environmental impact assessments (EIAs) and environmental risks assessments (ERAs) to be reviewed by a third party.</p> <p>One respondent highlighted the need for such assessments to be project and location specific, but noted that standardization is possible. Another respondent noted that a given assessment should be valid for multiple projects, within the same geography.</p> <p>Other replies mentioned the need to ensure protection of water resources, to clarify the definition of sustainable sourcing of biomass, and to revise the notion of consent.</p>
Resolution	<p>Puro will maintain the existing requirements and work on incorporating details and examples of the above mentioned suggestions</p>

Question	9. Should the life cycle assessment be performed in a static-manner, in-line with other methodologies?
Summary of feedback	The majority of respondents were neutral to positive to changing the life cycle assessment to a static LCA, in-line with other methodologies.
Resolution	Puro will change from the current LCA quantification and adopt this change.

Question	10. Is there enough new information and understanding of relevant processes for this method of carbon sequestration to remove the 'pilot' phase status?
Summary of feedback	The majority of respondents were positive to removing the pilot phase status, mentioning knowledge gains in the past two years.
Resolution	Puro agrees with the majority and will remove the pilot phase status. This further aligns with how other carbon removal methodologies with needs for further research and development are being dealt with in the Puro Standard, e.g. Enhanced Rock Weathering. Puro hope that this will contribute to further and faster advances in emperical knowledge about Terrestrial Storage of biomass.