From: Bradley Rochlin <brad@runningtide.com>
Sent: Wednesday, 12 October, 2022 1:53
To: Supervisory-Body <Supervisory-Body@unfccc.int>
Subject: Call for input 2022 - activities involving removals under the Article 6.4 Mechanism of the Paris Agreement

Hello Supervisory Body,

Thank you again for the opportunity to respond to this critical work of defining Removal activities under the Article 6.4 mechanism.

Running Tide is a global ocean health company - our response to the call for input is attached below. Thank you for your consideration and for your continued work in combating the climate crisis.

Best,

Brad

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Running Tide response to: Call for input 2022 - Activities involving removals under the Article 6.4 Mechanism of the Paris Agreement

October 2022

Dear Supervisory Body,

Thank you again for the opportunity to respond to this critical work of defining Removal activities under the Article 6.4 mechanism.

Running Tide is a global ocean health company. Ocean health is critical to planetary and human health — but ocean health is in rapid and accelerating decline. At Running Tide, our mission is to restore ocean health and productivity, rebalance the carbon cycle, decarbonize global supply chains, and revitalize coastal communities. We do this by developing integrated software and hardware systems, designing cutting-edge monitoring and measurement capabilities, and deploying comprehensive solutions.

In regards to the Annex 5 and Annex 6 documents, Running Tide has several primary points of feedback which we hope will inform the Supervisory Body's future deliberations:

1) We believe the IPCC Glossary's definition of carbon removal should be amended to reflect carbon removal as the intentional net movement of carbon from the fast carbon cycle (atmosphere, biosphere, and upper ocean) to the slow carbon cycle (geological and deep ocean reservoirs).
2) We feel it is critical that Types of Removal Activities (Annex 6, Section 3) remain open to new project types, given the litany of new approaches and emerging technologies that are directed at durably removing carbon.
3) Please update the "Long-term carbon storage methods in removal activities" from land-based removal activities (Annex 6, Section 4.8.199) to include the storage of biomass in the deep ocean, and please amend the "Long-term carbon storage methods in removal activities" from engineered removal activities (Annex 6, Section 5.8.283(b)) to include storage in the deep ocean.
4) We hope as this process progresses that the Supervisory Body makes explicit their views on ownership and treatment of removals that occur in international waters and outside of country boundaries.

1) Definition of carbon removal activities

In the IPCC glossary, carbon dioxide removal is currently defined as *"Anthropogenic activities removing carbon dioxide from the atmosphere and durably storing it in geological, terrestrial, or*

ocean reservoirs, or in products." While this definition is not incorrect, we feel it is incomplete - and as such leads to incomplete solutions and complicated accounting. **Carbon removal should be defined as the intentional net transfer of fast carbon to the slow carbon.**

With a fast-to-slow definition of carbon removal, the carbon cycle can be divided into two systems:

- A slow carbon cycle, which involves the deep ocean, geological reservoirs, and inorganic material like rocks, where carbon is trapped and circulated through geological and volcanic activity, over many thousands and often millions of years.
- A fast carbon cycle that is dynamic and volatile, where carbon more quickly circulates (on human and other organic timescales) between the atmosphere, biosphere, and upper ocean. It can be best understood as the flow of carbon through living ecosystems from days to years.

Ecosystem restoration projects such as reforestation, afforestation, and coastal rehabilitation aim to rebuild natural carbon sinks within the fast carbon cycle, which are critically important to reestablishing system equilibrium, promoting a stable climate, and reducing disruption to natural ecosystems and human communities. However, because most restoration projects address only fast cycle carbon sinks, restoration projects alone cannot rebalance the greater carbon cycle at a scale that effectively combats climate change. For this, we must engage in carbon removal by transferring carbon from fast cycle sinks (i.e., biosphere, atmosphere, and upper ocean) to slow carbon sinks (i.e., deep ocean and marine sediments) - an exercise in physically moving that mass back into durable storage.

The surface ocean and the atmosphere are coupled systems, and CO_2 levels in both rise and fall in parallel; as anthropogenic activities have dramatically increased concentrations of carbon dioxide in the atmosphere, they have also increased dramatically in the ocean. By some estimates, the ocean has absorbed 30% or more of the CO_2 emitted since the beginning of the industrial era, mostly through photosynthetic activity, and in doing so has reduced the catastrophic warming impact of those emissions. As a result, the ocean has been subject to warming (absorbing 90% of anthropogenic warming), acidification, and deoxygenation at a global scale, threatening coastal communities and food security, and putting the natural processes that regulate our climate systems at extreme risk of collapse. Simply put, there is no path to effectively combating the climate crisis that does not include addressing ocean acidification and warming collectively not in isolation.

As currently defined, the IPCC definition of carbon removal promotes a singular focus on atmospheric carbon, to the detriment of the ocean and the anthropogenic carbon it continues to absorb. An alternative, more straightforward way to address this could be to include "the ocean" in the current definition of carbon removal; i.e. *"anthropogenic activities removing carbon dioxide from the atmosphere **or ocean** and durably storing it in geological, terrestrial, or ocean reservoirs, or in products."*

Additional detail on this fast-to-slow definition is detailed here and here, which was originally suggested as a framework by NASA.

2) Types of removal activities

We appreciate that the current list of removal activities and associated carbon storage methods considered in Annex 6, Section 3 is clearly highlighted as *"illustrative and not exhaustive"*. Given the litany of new carbon removal technologies and approaches, we encourage the Supervisory Body to continue to update this list regularly and to ensure that decisions that are made in regard to the Article 6.4 process remain flexible as to the potential approaches that could be eligible for inclusion.

As an example, two such methods that are not listed but should be included include Terrestrial Biomass Sinking and Ocean Biomass Sinking. The former uses plants or algae to remove CO_2 from the atmosphere via photosynthesis, and sinks that biomass into the deep ocean to achieve long-term carbon storage, while the latter uses macroalgae to remove CO_2 from surface ocean, which in turn enhances the ability of the surface ocean to drawdown atmospheric CO_2, and the aquatic biomass is sunk into the deep ocean to achieve long-term carbon storage.

While illustrative, both of these methods are currently being researched and tested by Running Tide and a number of other academic, scientific, and private organizations to determine their efficacy and potential for scale.

It is our hope that the Supervisory Body will continue to update the list of removal activities regularly, and remain supportive of a wide range of solutions that have the capacity to scale to climatically relevant levels.

3) "Deep ocean storage" inclusion as a long-term carbon storage method in removal activities

For both land-based removal activities from harvested biomass (Annex 6, Section 4.8.199) and engineered removal activities (Annex 6, Section 5.8.283), the deep ocean is not currently included as a reservoir for durable storage.

The ocean contains upwards of 38,000 gigatons of carbon today, and offers a number of natural pathways to sequester carbon. These include the dissolution of alkaline materials in the surface ocean via geologic weathering processes and the growing and sinking of photosynthetic material to the deep ocean for durable storage via the ocean's "biological pump". Along with these natural pathways, the ocean presents a number of advantages that enable solutions to scale, including long-term durability for the carbon that is removed, greater available space with less competition for human uses (i.e., "land use trade-offs), and the ability to co-locate carbon removal alongside existing economic activities.

Worldwide, the ocean's biological pump transfers about 2 gigatons of CO_2 from the atmosphere to the deep ocean (depths greater than 1,000m) each year, where it is projected to remain, on average, for longer than 1,000 years. Once in the deep ocean, this biomass is either remineralized as dissolved inorganic carbon, or buried in marine sediments. This is true for both terrestrial biomass and aquatic biomass, as detailed above.

We would request that the Supervisory Body updates these "Long Term Carbon Storage Methods in removal activities" in sections 4.8 and 5.8 of Annex 6 to reflect this.

4) Treatment of removals outside of country boundaries

It is our belief that the Supervisory Body should make explicit their views on ownership of removals that occur in international waters to avoid any risks of double counting and to provide clear incentives for countries enabling ocean-based removals activities to benefit from the activity that they are enabling.

While this seems likely to be a discussion for future Supervisory Body work, we feel it is crucial to highlight this topic now to ensure the success of ocean-based removals under an Article 6.4 mechanism.

Removal activities that occur in international waters from the Supervisory Body's established list (Annex 6, Section 3) could potentially include enhanced rock weathering, ocean alkalinization, and ocean fertilization, along with terrestrial biomass sinking and ocean biomass sinking as described above. It is likely that these removal activities will include inputs from multiple countries of origin in their process (such as alkaline materials from Europe and a shipping fleet for deployment from North America), leading to the potential for conflicting ownership claims. Clarifying this ownership will be especially critical as ocean-based removal solutions scale and could make a meaningful contribution to countries achieving (and exceeding) their nationally determined contribution goals.

One such solution could be to make clear that removals occurring in international waters and outside of country boundaries can only be claimed by the country that has permitting authority, that has issued any required permits for the deployment specific to the removals activity being conducted, and that was the port of origin for the deployment prior to transfer into international waters.

Thank you for your consideration and for your continued work in combating the climate crisis.

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