August 25, 2020

Mr. Sami Osman
Climate Action Reserve
818 W. 7th Street, Suite 710
Los Angeles, CA 90017

Dear Mr Osman:

We are a group of scientists committed to ensuring that carbon removal efforts are informed by the best available science and data.

We write with serious concerns about the scientific integrity of the Climate Action Reserve's Soil Enrichment Protocol and its proposed adoption of a 30 cm minimum sampling depth for measuring soil organic carbon (SOC). The peer-reviewed scientific literature clearly documents that this kind of shallow sampling can lead to systematic overestimation of increases in soil organic carbon, jeopardizing the credibility and efficacy of the Protocol. Significantly deeper sampling is required to achieve confidence in the climate benefits created by credited soil management and agricultural practices. If the Reserve fails to address these issues, we are concerned that the Protocol could lead to large-scale over-crediting and harm the development of policies to recognize soil carbon benefits by encouraging the adoption of similarly flawed sampling practices elsewhere.

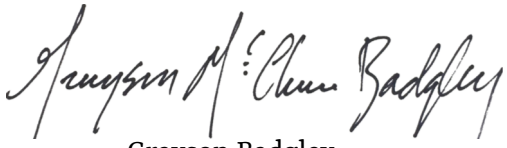
Long-term experimental data from the UC-Davis Century Experiment show that increases in soil organic carbon in the upper soil layers can be accompanied by significant decreases across the microbially active soil profile that extends below the plow layer. As a result, Tautges et al. (2019) caution that "focusing only on the surface layer of soil could result in grossly overestimated SOC gains." Paired measurements of soil organic carbon collected from tilled and non-tilled systems suggest a similar pattern, with changes in tillage practices redistributing soil carbon such that apparent gains at the surface are accompanied by losses at depth. These losses can manifest well below 30 cm (Bai et al. 2019) and can partly offset or even completely negate gains near the surface (Luo et al., 2010). Such losses would not be observed under the Protocol's proposed sampling requirements. These effects are not limited to changes in tillage regime, similar patterns have also been documented with changes in crop type (Ledo et al. 2020), and carbon isotope studies indicate that a substantial fraction of the soil organic carbon below 30 cm is dynamic on decadal timescales (Baisden and Parfitt 2007, Slessarev et al. 2020). Taken together, these studies paint a consistent picture; measuring soil organic carbon only in the "plow layer" (or upper 30 cm of soil) is not a defensible approach for assessing how land management practices affect total soil organic carbon—yet that is all the Protocol requires.

Shallow sampling can also introduce significant measurement bias that is driven by changes in soil bulk density, rather than real accumulation of soil organic carbon. This presents a significant concern with respect to the Protocol because changes in agricultural practices tend to be accompanied by changes in soil density. If sampling depth remains fixed and soil density changes—due to new land management practices credited under the Protocol—then apparent changes in shal-

low soil organic carbon could simply reflect differences in the mass of soil sampled at a fixed depth, rather than real changes in soil organic carbon (Lal 2009, Wendt and Hauser 2013). Density-driven biases are easily avoided through deeper sampling, since changes in density tend to cancel out with depth, or by sampling at multiple depths and reporting changes to soil organic carbon on a mass-equivalent basis. Credible measurements of soil climate benefits require one (or preferably both) of these approaches, but the Protocol treats them as optional, leaving the door open to significant measurement bias.

Together, these shortcomings fundamentally undermine the Protocol's ability to generate real, quantifiable carbon credits. Problems with shallow sampling depths and changes in soil density are well-documented in the peer-reviewed literature and require serious attention in any carbon crediting application. We are concerned that any effort to credit soil carbon benefits that ignores these concerns risks not only over-crediting project benefits, but also prejudices the development of an evidence-based soil carbon management paradigm going forward.

Sincerely,



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