CLIMATE ACTION RESERVE

SUMMARY OF COMMENTS & RESPONSES
DRAFT SOIL ENRICHMENT PROTOCOL VERSION 1.0

Twenty-two comments were received during the public comment period for the Climate Action Reserve (Reserve) draft Soil Enrichment Protocol Version 1.0. Staff from the Reserve provides responses to the comments below. The first public comment period for the draft protocol was April 17 to May 18, 2020.

The comment letters can be viewed on Reserve's website at http://www.climateactionreserve.org/how/protocols/soil-enrichment/.

COMMENTS RECEIVED BY:

1. American Carbon Registry **(ACR)**
2. California Association of Sanitation Agencies **(CASA)**
3. CalRecycle **(CalRecycle)**
4. Carbon Cycle Institute **(CCI)**
5. CarbonPlan et al. **(CarbonPlan)**
6. Climate Smart Group and CCSI **(CSG and CCSI)**
7. Ducks Unlimited **(DU)**
8. Environmental Defense Fund **(EDF)**
9. Erika Foster, Soil Biogeochemist and Postdoctoral Researcher **(Foster)**
10. Evergreen Carbon **(Evergreen Carbon)**
11. Florian Forster **(Forster)**
12. Food Program at World Resources Institute **(Food Program at WRI)**
13. Hancock Natural Resources Group **(HNRG)**
14. Kyle Hemes, Postdoctoral Fellow **(Hemes)**
15. Natural Capital Partners **(NCP)**
16. Patagonia **(Patagonia)**
17. Richard Scharf, Senior Soil Scientist **(Scharf)**
18. Ruby Canyon Environmental **(RCE)**
19. Sally Brown, Research Professor **(Brown)**
20. Sierra View Consulting **(SVC)**
21. Steven Apfelbaum **(Apfelbaum)**
22. Xuesong Zhang, Research Scientist **(Zhang)**

General Comments

1. In my experience, the stakeholders need to be directly involved in development of broad protocols such as the SEP, as these methods may expand beyond use in the US and set an example for future programs. After listening to the Webinars posted online, it is unclear to me how any agricultural land managers were involved in the creation of this protocol. I am uncertain how much time a producer would have to read such a protocol during the month of public comment, which in many regions coincides with the start of the cropping season in the US. I think their involvement is paramount to launching a successful, fair program. I specifically think that the protocol must be more clear about the benefits, and potential profits of the aggregators. I appreciate that the CAR acknowledges that farmers often operate on thin margins. Before adoption of this protocol, producers should have a longer opportunity to read this protocol, ask questions, and receive specific answers on how aspects of this protocol, specifically aggregation of projects, will alter the economic outcome of enrolling in the program. **(Foster)**

   RESPONSE: Thank you for your comment. We agree that a transparent, stakeholder-driven process is paramount to the success of any of our offset protocols. A full list of the workgroup members, which includes two agricultural land managers, can be found on our website. A number of the other workgroup members work extensively with agricultural land managers. In addition to the workgroup members, we encourage any other interested members of the public to join in on our workgroup process as observers, and to submit feedback to us at any time (even prior to the public comment period). Due to the volume of public comments received during the first public comment period, we have decided to extend the process for this protocol, which will include a second public comment period and additional public webinar. Please note we have also engaged extensively with observers and those submitting public comments, to discuss the feedback provided, resulting in extensive refinement of the protocol.

2. Conflicts of Interest – We appreciate that the Reserve has been transparent about its financial relationship with Indigo Ag, but a sponsored protocol development process raises concerns about the integrity of the proposed methods. That concern is particularly important because many of the critical methodological options in the Draft Protocol are not fully specified and are instead left open to the design and determination of Project Owners – presumably including the Reserve's financial sponsor. This could leave project projects extensive discretion to develop their own calculation methods involving confidential information that is not made public. Relying on the Reserve to evaluate the integrity of methodological choices of its protocol financial sponsor is neither ethically appropriate nor commercially sound, especially if any aspect of that review is conducted in private and cannot be independently replicated. We are also interested to know whether or not the Reserve checked for conflicts among its expert working group members. Although the Reserve explicitly acknowledge Indigo Ags direct financial sponsorship of a direct involvement in developing the Draft Protocol, it did not specify whether any members of the working group might also have financial conflicts of interest with Indigo Ag. We respectfully request the Reserve to disclose whether it asked expert working group members to report conflicts of interest, and if so, which members reported conflicts. **(CarbonPlan)**

   RESPONSE: Thank you for your comments, and follow up discussions. With each of our protocol development efforts, we always invite a balanced group of intended project

developers, sector experts, researchers, and verifiers, as well as all manner of other key stakeholders, to participate in the protocol development process. Our emphasis on a very public, transparent stakeholder process for all the work that we do ensures that diverse viewpoints will be represented. Moreover, our emphasis on a standardized additionality approach for protocol development ensures that the applicability of any protocol will be for the widest audience reasonably possible. We are a small, independent non-profit organization, and for each of our protocol development efforts, we must seek funding in order to support the work. In the past, we have received funding from foundation grants, and more recently we have begun receiving funding from private entities like Indigo Ag. However, the source of the funding has no impact on our process for protocol development. With respect to any financial ties between workgroup members, that is not something we asked of workgroup members. We can disclose that we have had prior dealings with a good number of the workgroup members, as well as a significant number of parties who participated in this process as observers, and parties putting forward public comments. Given the highly specialized nature of this work, that cross-fertilization is inevitable. We have now also asked Indigo Ag to disclose any financial ties with workgroup members, and with the parties' permission will publish that list on our website, along with a summary of total remuneration paid by Indigo Ag to such parties. Given the relatively small community of various experts we work with on a particular issue it is not surprising to us that there are past or current working relationships between workgroup participants. We do not believe these types of relationships affect the impartiality or quality of our work.

3. Selling GHG credits in an agricultural offset program requires a high level of certainty and a robust risk management account system as offset sales result in GHG emissions to the atmosphere elsewhere and many credits are reversible. It is our position that achieving that level of certainty and risk management capabilities cannot be achieved at the project-scale but rather requires a regionally coordinated landscape-scale program structure. Regional verification will be required to ensure that there are real net changes in carbon stocks and reductions in other GHG emissions. The complexity of the project level framework proposed in the SEP could lead to perverse outcomes, inadvertent and deliberate, that will result in little confidence that when all the actions taken in a region are considered that the projects will reflect a net GHG reduction in the atmosphere – the key test of the viability of the approach being outlined. **(EDF)**

   RESPONSE: Thank you for your comments, and follow up discussions. We believe the protocol provides sufficient mechanisms to ensure accounting for GHG impacts are robust and conservative. Based on your comments, and follow up discussions with you, we have added new guidance to make it clear that the protocol will be most effective at larger-scale. We will also continue to explore options to simplify protocol requirements and guidance, but we acknowledge the protocol will remain complex and will thus require relatively high levels of expertise in order to effectively implement projects.

4. We support the Reserve advocating to include the SEP among its CORSIA compliant programs and hope other compliance markets, such as members of the Western Climate Initiative, will consider adopting it. **(HNRG)**

   RESPONSE: Thank you for your comment.

5. Extensive feedback provided on grammatical edits. **(SVC)**

   RESPONSE: Thank you for your comments, and follow up discussions. Based on your comments, and follow up discussions with you, we have made a significant number of edits in response to your feedback.

2.2.1 Defining the Project Activities

6. On page 4, Section 2.2.1, please insert compost as one of the land management practices considered for soil enrichment projects like the following:
   - *Compost application; and /or*
   - *Fertilizer (organic or inorganic) and/or compost application; and/or*
   - *Compost application and cover cropping as an integrated strategy*

   Compost and mulch were not specifically identified as land management practices that can help store carbon in the soil, despite evidence their addition can provide benefits towards furthering the SEP goals of sequestering soil organic carbon (SOC) and reducing greenhouse gas (GHG) emissions.
   (CalRecycle)

   RESPONSE: Thank you for your comment. Based on your comments, and follow up discussions with you, we have added reference to compost in several more places in the protocol. The protocol refers to 'organic amendments' throughout, and specifically to 'compost' in multiple places, with the intent that the addition of compost be considered an eligible activity. We have updated protocol guidance in several places to make this intent clearer.

7. The use of biosolids is not recognized anywhere in the protocol as an organic fertilizer/soil amendment that results in the reduction of GHG emissions and sequestration of carbon in the soil below. **(CASA)**

   RESPONSE: We thank you for your comment. Based on your comments, and follow up discussions with you, we have added reference to biosolids as an amendment which may be eligible to generate emission reductions. Whether any given activity will be eligible to generate offsets will ultimately be determined by whether the impacts of such activities can be estimated using the available suite of quantification options. We anticipate that it will be possible to estimate the GHG Impacts of biosolids using this protocol.

8. Acceptable Land Management practices (p.4) fail to include agroforestry practices. Indeed, riparian areas and agroforestry features (hedgerow, windbreaks, etc.) are explicitly excluded from acreage considered under the Protocol. Given the importance of such practices and landscape features in building long---term carbon reserves on farm, enhancing farm---scale microclimates for improved productivity (i.e., enhanced C capture) and supporting ancillary ecosystem services (Bentrup et al 2018, Dollinger and Jose 2018, Shrestha et al 2018, Schoenberger et al 2012, Udawatta et al 2012), this gap constitutes a significant deficiency. **(CCI)**

   RESPONSE: We intend not to include agroforestry in this first version of this protocol, but certainly hope to be able to include such activities in future versions. Given the current lack of ability to model the GHG impacts of such activities, and the anticipated smaller GHG

impacts relative to activities already included in the protocol, we have chosen to forgo inclusion at this point.

9. Significantly, compost is not mentioned in the Protocol, except as "organic fertilizer," and as a source of N. We highlighted this gap in our comments on the March draft of the Protocol, and were assured compost would be addressed in subsequent drafts. Unfortunately, compost remains unrecognized as an opportunity for rapid carbon enhancement of the agricultural ecosystem in the April draft as well. Compost is not a fertilizer, and its soil carbon enhancing characteristics are only marginally related to its available N content (which is minimal). The protocol further appears to erroneously quantify nitrous oxide emissions from compost using total N content, when it is the readily available mineral N, not total N, that drives N_2O emissions from organic soil amendments (Chadwick et al 2011, Yamulki 2006). While compost does contain some N (typically 1---2%), treating it as a nitrogen fertilizer within the Protocol misses the enormous opportunity to rapidly build soil C with compost production and use, and erroneously treats organic N as equivalent to mineral N. The Protocol also ignores the direct carbon conservation benefits of composting organic materials, and the avoidance of methane and black carbon emissions associated with compost production and use (Sustainable Conservation 2015, Vaughan et al. 2014, Delonge et al 2013). Table 4.1 (p. 27) should include compost and the Protocol should include appropriate analysis to quantify the benefits of both compost manufacture and use. **(CCI)**

   RESPONSE: Thank you for your comment. We have added reference to compost in several more places in the protocol. Whether and how any given activity will be eligible to generate offsets will ultimately be determined by whether the impacts of such activities can be estimated using the available suite of quantification options. Available quantification approaches include use of USDA Blue Book equations, and biogeochemical models, which we believe should adequately account for the impacts of using compost. This protocol is not intended to capture any GHG impacts associated with the creation of compost, as we believe it's unlikely that project activities will cause material increases in GHG impacts due to increased compost production.

10. We support the Reserve's inclusion of a wider set of regenerative practices within a single protocol. We also support including mechanisms to account for different practices across landscapes within a single project. As the manager of over 470,000 acres of farmland, we have significant experience with the diversity of agricultural practices that are used from grower to grower and even from field to field. We applaud the Reserve for proposing a Protocol that recognizes different practices and provides significant flexibility. **(HNRG)**

    RESPONSE: Thank you for your comment. Our intent has been to develop a protocol that accommodates as many practices as can be reasonably included, understanding there are limits owing to issues concerning quantification and practicality, among others. Nevertheless, the protocol is purposefully being crafted in a way that provides flexibility so that projects can be developed at the landscape scale rather than being limited to individual landholdings or fields.

11. The language pertaining to land management practices is confusing, specifically as it pertains to the application of fertilizers that emit GHG's. This section identifies changes to fertilizer application as a covered land management practice, yet also says that another covered practice includes the application of synthetic inputs "other than fertilizer." The intent of this is unclear. For example, changing land management practices that substitute organic inputs (including fertilizers) for synthetic inputs (fertilizers) can reduce the emissions of

certain GHG's. That change/conversion should be covered. Relatedly, the prefatory language (before the bulleted list of land changes/results) in this Section and in Appendix B should be consistent. **(Patagonia)**

RESPONSE: Thank you for your comment. Based on your comments, and follow up discussions with you, we have made edits to the protocol to simplify and clarify the guidance.

2.2.2 Defining the Project Area

12. Glad to see a 10 year no-conversion history of native ecosystems required. The term "native ecosystem" is a bit ambiguous though; for example, CRP planted acres would not be considered a "native ecosystem" by the scientific community, but it would be inappropriate to award a PD for plowing expiring CRP and claiming soil enrichment immediately thereafter. Consider further defining "native ecosystem" and to include established/restored grasslands and all types of wetlands. **(DU)**

    RESPONSE: Thank you for your comment. Based on your comments, and follow up discussions with you, the criterion regarding native ecosystems has been expanded to include established and restored grasslands. Safeguards pertaining to wetlands are already included in other project area criteria.

13. The meaning of "continuous" is not defined. The use of "within" seems to point to what's inside a particular field's boundary, i.e. a geographic boundary. This term can also refer to a temporal continuity. We recommend that the protocol defined consistency be congruent with the definition of what constitutes a 'field' and a field's subsections, meeting the field's designation for continuity. **(Evergreen Carbon)**

    RESPONSE: Thank you for your comments, and follow up discussions. We are indeed referring to area within a field's geographic boundary. Based on your comments, and follow up discussions with you, we have added some clarifying text to note acceptable minor breaks in this delineation. The project area section deals purely with geographic boundaries, not temporal ones.

2.2.3 Project Aggregation

14. Would it be possible to aggregate any number of fields across the United States into one project as long as the same practice (e.g., no-till, cover cropping) is conducted on all the fields? What would be reasons fields cannot be grouped into one project? **(Forster)**

    RESPONSE: Correct, any number of fields may aggregate into one project. This is not limited to the same practice – fields utilizing different practices may aggregate together so long as those practices are properly accounted for. The only requirement for aggregation is that there is one common Project Owner for the entirety of the project. Fields with different Project Owners could not enter a single aggregated project.

2.3.1 The Landowner and the Field Manager

15. Allowing Field Managers access to these projects is understandable given the tenant farmer percentages in many parts of the country. However, I find it quite dangerous to allow the managers to "transfer ownership of the GHG reduction rights of a project" without basic acknowledgment from the landowner. Some sort of basic acknowledgement (not necessarily a formal contract, co-signature stipulation, or deeded agreement) from the landowner for the tenant to engage in ownership transfer and transaction seems more than appropriate. Without it, you are unnecessarily garnering risk to the sustainability of these projects. **(DU)**

    RESPONSE: Thank you for your comments, and follow up discussions. We agree that there is some risk inherent in undertaking a project without landowner consent. Based on your comments, and follow up discussions with you, we have revised the protocol to encourage Project Owners to try to obtain some written acknowledgement from the landowner. We have chosen not to mandate this level of acknowledgement, as we believe it will be infeasible, in many cases, to identify the correct landowner and obtain such an agreement. However, if it can be done, we agree that it adds value.

2.3.2 The Project Owner

16. This section requires the Project Owner to attest to the Reserve that they have exclusive claim to the GHG reductions resulting from the project. Each time the project is verified, the Project Owner must attest that no other entities are reporting or claiming (e.g., for voluntary reporting or regulatory compliance purposes) the GHG reductions caused by the project. The intent behind the attestation requirement for reporting – as opposed to claiming – is unclear and unnecessarily stringent. For example, there may be voluntary certifications or agricultural-related services for which a landowner/farmer is expected to measure and report Soil Organic Carbon or related GHG emissions associated with their operations. Such reporting may not be legally required, nor part of any law or regulatory scheme, such that it does not implicate the additionality concern. Nor does such reporting necessarily relate to any "claim" of carbon credits. Requiring that the Project Owner attest that no other entity is reporting GHG reductions caused by the project is unnecessary and overly constraining. Voluntary reporting should be allowed – if not outright encouraged. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. The intent with the guidance in this section is to set out clear guidance to prevent parties from double counting the specific GHG benefits inherent in offsets issued to SEP projects. The intent with this guidance is not to restrict claims relating to broader or more general positive impacts of these projects, including any non-GHG impacts we hope will be recognized in accordance with the guidance in Section **Error! Reference source not found.** on Non-GHG Impacts of Project Activities. Based on your comments, and follow up discussions with you, we have therefore updated the guidance in this section to try and clarify our intent, and we encourage parties to consult the Reserve regarding any questions associated with how best to recognize GHG or non-GHG impacts associated with SEP projects.

2.4 Non-GHG Impacts of Project Activities

17. We support the Reserve's position that reporting non-carbon co-benefits is not and should not be required, while maintaining flexibility to include co-benefits if desired, for example

with respect to land where early adoption of SEP practices makes land ineligible or to the extent required by a program such as CORSIA. We question the need to encourage reporting of co-benefits if they are not required by the Protocol. **(HNRG)**

RESPONSE: Thank you for your comment. We tend to encourage reporting of co-benefits on an optional basis for all our natural and working lands protocols. This is optional, but many market participants appreciate this information.

18. The Reserve requires project developers to demonstrate that their GHG projects will not undermine progress on other environmental issues such as air and water quality, endangered species and natural resource protection, and environmental justice. This is an important component of the Protocol, yet there is no guidance concerning how a project developer can demonstrate this, nor what would constitute an undermining of progress on those elements such that a project was disqualified. This demonstration is – and should be – distinct from the required attestation that the project materially complies with all applicable laws. The Reserve indicates that it would like to recognize certain co-benefits associated with the projects, including prior adoption of sustainable practices, reductions in other air pollutants, improvements in water quality, and enhancement of wildlife habitat. Although this is considered to be an optional accounting, with no bearing on the eligibility of issuance of carbon credits, the Reserve should identify reported co-benefits (noting lack of verification, as appropriate) associated with any project. When listing soil enrichment projects for purpose of third-party purchases of credits, those prospective purchasers should have available to them any reported information concerning co-benefits to allow them to differentiate amongst project to support. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. The intent with this guidance is to encourage parties to better highlight the ways in which their projects positively affect such goals. The guidance in this section does not create any specific obligations for a project to demonstrate, and a verifier to verify, that projects are not undermining progress with respect to these broader non-GHG goals. For this protocol we rely primarily on existing laws and regulatory programs to ensure community standards for such issues are met. The regulatory compliance requirements in Section **Error! Reference source not found.** set out guidance for ensuring no laws are broken, including laws relating to broader non-GHG impacts of projects.

3.1 Location

19. Consider expanding eligible projects to those outside of the United States, in this or in future related protocols. As noted earlier in the draft, the IPCC states that global emissions in the agriculture, forestry, and other land use categories constitute nearly a quarter of global GHG emissions, and many soil enrichment activities are ongoing in countries outside of the United States for whom carbon credit markets would incentivize GHG emission reductions. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. We do hope to expand the applicability of this project type throughout North America, either through future expansion of this protocol, or new protocols for such jurisdictions.

3.2 Project Start Date

20. Why was June 10th chosen? How does this align with on-farm practices, or is it based on the expected publication of the protocol? Might be wise to align with growing season start dates/calendar events, not the release of the protocol itself. It is even noted in 3.4.1 that "additionality for a project is demonstrated by the adoption, during the growing season which defines the project start date." Why not have more alignment between eligible start date and the actual growing season? **(DU)**

    RESPONSE: Thank you for your comments, and follow up discussions. June 10th was inserted as a placeholder in relation to the earliest anticipated adoption of the protocol by the Reserve's Board of Directors. It reflects a programmatically defined period of time (24 months) prior to the adoption of a given Reserve protocol for which early actors will be recognized (see Section 2.4.3 of the Reserve Offset Program Manual). We recognize that this rule is not perfect, as it may exclude some additional early actors. However, programmatically, this is where we have chosen to draw the line, in order to reduce the risk of non-additional projects joining the program. The actual date included in the final version of the protocol will be based on the date of adoption by the Reserve Board.

3.3 Project Crediting Period

21. Notwithstanding the behavioral economics discussion in Appendix section A.2, evidence of actual on-the-ground land management changes is acknowledged in A.3 ("For certain crops, in certain regions, certain practices have increased adoption, while other combinations of these have seen flat or decreasing adoption rates.") Because changes happen on much shorter timescales than 30 years, baselines will become inaccurate long before the end of the crediting period. It appears, however, that the time necessary for build-up of soil organic carbon is the Reserve's overriding consideration. In that case, if such a long crediting period is allowed, a stringent measure of additionality at the outset is critical. The draft protocol, however, proposes a liberal additionality threshold, one that considers to be additional any of 40+ soil enrichment practices that were not previously occurring on a particular field, without regard to common practice or regional variation. This risks thirty years of misdirected carbon finance. **(NCP)**

    RESPONSE: Thank you for your comment. Based on your comments, and follow up discussions with you, we have revised the crediting period for this protocol to be 10 years, with the potential for 2 further crediting periods.

22. Is the full crediting period based on the baseline at the original start date? What measures are in place to reassess if the adopted projects are even additional/not status quo, say in 10-20 years? Have a static baseline would be inaccurate and irresponsible of a registry. All other land-based protocols require such. Why not factor in adoption rates, and at appropriate locales. See general comment at end of document on why you didn't choose to implement a moving baseline. **(DU)**

    RESPONSE: Thank you for your comment. Based on your comments, and follow up discussions with you, we have revised the crediting period for this protocol to be 10 years, with the potential for 2 further crediting periods.

23. **Length of crediting period.** In a highly dynamic sector such as crop agriculture, a 30-year crediting period is too long for a baseline to be considered valid and static and be accurately credited against, thus bringing into question whether the offsets generated over this crediting period are REAL. U.S. agriculture is a highly dynamic and diverse environment (what is grown and how it is grown). USDA (ERS or NRCS) and state agriculture agency data supports that practice change, including crop rotation and land fallowing, can happen rapidly within certain geographies based on subsidies or lack thereof, market conditions, land conditions or other factors. In developing methodologies for the activities of fertilizer reduction and changes in rice cultivation practices ACR received stakeholder comments suggesting that farm operators are making management decisions on a week by week basis. This draws into question the validity of the assumption of sustained practice on individual fields for a 30-year period. A shorter crediting period, such as five years, would improve the accuracy of the baseline cropping scenario under current conditions and ensure that the emission reductions that results from the practice change are real. **(ACR)**

    RESPONSE: Thank you for your comment. Based on your feedback we have revised the crediting period for this protocol to be 10 years, with the potential for 2 further crediting periods.

3.4.1 Performance Standard Test (Additionality)

24. While the protocol requires that a project demonstrate a change in practice, there is no comparison to any kind of common practice metric that ensures additionality. Treating any change in practice that reduces emissions as additional is contrary to the core tenets of additionality – which require some kind of comparison to common practice or business-as-usual. This comparison should be done, as in the Improved Forest Management protocol, with the use of some sort of reliable, continuously updated, and spatialized data. I worry that soil carbon offsets will be granted for projects with questionable additionality. **(Hemes)**

    RESPONSE: Thank you for your comment. We will continue to assess means to ensure additionality, including the use of some form of common-practice assessment.

25. The protocol does not establish a reliable additionality standard because it credits any change in land management practice without evaluating whether or not that change is financially feasible in the absence of carbon offset credits. This is a departure from the additionality standards required by governments' compliance carbon offset programs as well as the Reserve's own program manual and past practices with respect to private offset markets. In order to accurately inform prospective credit buyers, the Reserve should acknowledge that it is not evaluating the financial feasibility of credited projects and therefore is not testing for additionality. We appreciate that some land management practices are so uncommon and potentially risky for farmers or ranchers to adopt that they might automatically be considered additional under a reasonable analysis of what constitutes "common practice" today. On the other hand, relatively common changes – such as switching what crops are grown on a given field, or choosing among conventional crop rotation practices – are also eligible to earn credits under the Draft Protocol. **(CarbonPlan)**

    RESPONSE: Thank you for your comments, and follow up discussions. We will continue to assess means to ensure additionality, including the use of some form of common-practice assessment. Based on our previous experience in this sector, we expect a financial additionality assessment to add relatively little value in an agricultural setting. Such an

analysis will likely result in inclusion of almost every conceivable practice change (as most practices do not reduce input costs or immediately raise production, but instead would add resource requirements). We would also expect such an assessment to result in the exclusion of nitrogen-use efficiency related changes. With respect to nitrogen-use efficiency changes, there are significant opportunities for improvement around the US, so excluding this practice could leave significant environmental benefits on the table. We don't expect the results to be representative of actual conditions, and would likely contrast sharply to results of a common practice assessment.

26. According to the performance standard described in Appendix A, the SEP considers any practice change that may result in emission reductions as additional, regardless of the rates of localized adoption and the rates of change of adoption for specific practices. This is not a robust approach to additionality, is inconsistent with other protocols/methodologies in the market, and undermines the legitimacy of any emission reductions that would be claimed using the SEP by allowing that agriculture be categorized as a special sector that cannot meet the same rigorous standards for additionality as other sectors.

    The SEP provides a list of 40+ illustrative practices that could all potentially be considered additional if adopted and shown to sequester carbon that was not being previously sequestered. The SEP provides for too much flexibility in crop, region and geography for a common practice performance standard to reliably demonstrate additionality. The large number of crops grown in the U.S. are each subject to different risks and economic drivers, including the U.S. Farm Bill, regional environmental concerns, trade negotiations, available payment programs, regulations, demand and natural events.

    A performance standard based on regional adoption rates would therefore be more appropriate and should utilize USDA ERS, USDA NRCS or other publicly available data of current adoption rates of specific practices by crop and region to determine in which geographies and under which conditions a particular practice would be additional. A positive list of practices by region, updated at the frequency at which data is available, would increase transparency and usability of the protocol. **(ACR)**

    RESPONSE: Thank you for your comment. We will continue to assess means to ensure additionality, including the use of some form of common-practice assessment.

27. We note that the proposed Protocol recognizes emission reductions from projects that adopted SEP practices two years prior to adoption of the Protocol, thus allowing growers who previously adopted SEP practices to participate. However, we believe there are certain cases where growers that adopted SEP practices more than two years ago also should be eligible to participate. Specifically, we are thinking about growers who adopted SEP practices to participate in programs like Walmart's Project Gigaton, where the driver for adopting SEP practices was value derived from emission reductions. Because carbon value played a critical role in the grower's decision to change practices, such changes meet the performance standard for additionality. The Reserve allows existing projects that are registered with other carbon offset programs to transfer to the Reserve if they meet the Reserve's protocol requirements. We recommend that the Reserve add a mechanism to the Protocol to allow growers who adopted SEP practices to participate in programs such as Project Gigaton to be considered for transfer to the SEP. **(HNRG)**

    RESPONSE: The Reserve strives to include early actors to the extent possible when adopting new protocols. In the context of agricultural land management, being able to draw

on the experiences of land managers who have already implemented such activities is particularly critical, to help overcome many barriers to adoption. At the same time, we must balance that desire with the need to ensure projects are providing additional emission reductions that go beyond business-as-usual. As such, our Reserve Offset Program Manual allows for early actors to be included if they began operation of their project no more than 24 months prior to the adoption date of the protocol (see Section 2.4.3 of the Reserve Offset Program Manual). We recognize that this rule may exclude some additional early actors. However, programmatically, this is where we have chosen to draw the line, in order to reduce the risk of non-additional projects joining the program.

28. "In any case, the magnitude of the practice change must be such that a reasonable person, knowing the context of the baseline scenario in the relevant region, would consider it to be a new management practice."

    Natural Capital Partners supports this position. The draft protocol should be revised to align with this statement. As written, the protocol does not incorporate regional baselines. Rather, the baseline scenario is the pre-existing practice on any given field, anywhere in the country. For an illustration of why regional, forward-looking baselines need to be incorporated, we can look at the practice of no-till farming in South Dakota. No-till, already at 37% of total cropping systems in 2004, reached 50% in 2019. In 20 counties, the figure exceeds 75%. It is a common practice trending towards ubiquity. In the Reserve's Discussion Paper, Standardized GHG Accounting for Soil Organic Carbon Accrual on Non-Forest Lands: Challenges and Opportunities, dated September 23, 2019, the Reserve states the following:

    > *Under a common practice approach, if a practice is undertaken by no more [than] a certain percentage of farmers in a particular region (commonly 5%) it can be treated as additional. A balance typically needs to be made between excluding some early adopters (often seen as unjustly penalizing critical early movers), as they may have implemented the activity without an offset motive, and rewarding laggards (those who "should have" already adopted the GHG-reducing practices, but for some reason have not).*

    In South Dakota, no-till likely exceeded 5% long before 2004, and we now appear to be at a stage when offsets would reward "laggards." As written, the protocol will likely reward farmers in certain regions who would have or should have implemented the practice without offset revenue. **(NCP)**

    RESPONSE: Thank you for your comment, and follow up discussion. We will continue to assess means to ensure additionality, including in particular, the use of some form of common-practice assessment. We do not think we will have sufficient data our resources to develop regional baselines at this point in time, at least not for as broad a suite of practices we hope will be adopted by projects. Once data availability improves, we can reconsider the use of regional baselines, as well as the development of default emission factors using such data.

3.4.1.1 Baseline Setting

29. Did you consider following the path of forestry and require the development of a baseline scenario based on 'typical' management practices (cropland and grazing lands) in a relevant, defined geography that can evolve with broadscale evolution of practices? To which, any producer performing above that baseline can be rewarded. It seems farfetched to

develop a 'historic' baseline on each field and then granting all gains over a 30-year period. This essentially assumes that farm practices would have remained the same over 30 years, correct? Hard to believe in this day and age with shifting markets, consumer access, and technology advances. The latter would be way less data intensive and seemingly evolve with changes in technology and broadscale application to ensure additionality over the entire reporting period. It would also allow tenant farmers to access these markets immediately on a newly rented field. Curious why this approach doesn't work as well as that proposed. **(DU)**

RESPONSE: Thank you for your comments, and follow up discussions. We did consider a range of options for additionality, including regional baselines, and have received extensive feedback on the various options from our workgroup and others. We do not think we will have sufficient data our resources to develop regional baselines at this point in time, at least not for as broad a suite of practices we hope will be adopted by projects. There are no doubt pros and cons associated with any method of setting the baseline, but we feel the approach we are pursuing should provide for accurate modelling of GHG impacts, and allow us to take into account effects of climate change, which we think are most critical. Once data availability improves, we can reconsider this approach, as well as the development of default emission factors using such data.

30. We're concerned about the use of a "historical baseline period to produce a baseline schedule of activities". To determine 'baseline' conditions in a project period, the 3 previous years may not be appropriate to represent baseline carbon sequestration if the land is being put into agricultural production for the first time, or transitioned from another type of crop. For example: a new almond orchard is planted and uses winter cover crops in tree inter-rows. The baseline should be a comparable to "new almond orchard without winter cover crops", as opposed to the land use during the 3 previous years (which may have been cotton, a nitrogen fixing species, other crop, or just left fallow by the land owner) to accurately represent the impact of the soil enrichment practice within the current cropping scenario. **(Evergreen Carbon)**

    RESPONSE: Thank you for your comments, and follow up discussions. We have updated protocol guidance to make it clearer that the protocol does not allow for land-use change from something like grasslands to intensive cropping. We believe it is more accurate and appropriate to require the baseline to reflect actual historical conditions, even when this includes a change in primary crop between the baseline and project scenario. We believe this would be more appropriate than using a counter-factual version of growing the same crop grown during the reporting period. This type of approach will also allow us to assess the opportunity costs (in terms of GHG impacts) associated with changes in crop type, which may drive farmers towards cultivation of crops for which their land is ultimately more suitable, from a GHG perspective. Incidentally, this type of opportunity cost type assessment is something that has been advocated in emerging work undertaken by the WRI, which they have encouraged us to encapsulate in this protocol.

3.4.3.2 Payment Stacking

31. The Enhancement Payments section can be updated to include 2018 Farm Bill. This bill provides for NRCS Conservation Innovation Grants program: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/ **(Evergreen Carbon)**

RESPONSE: Thank you for your comment. Please note this section is not intended to be a comprehensive list of complementary programs, but instead puts project developers and verifiers on notice that they themselves will need to undertake this type of study for fields enrolled in the given project. Please also note that participation in a CIG grant would not necessarily or foreseeably be a barrier to being able to earn offsets under the SEP.

3.5 Requirements for Permanence

32. **Alternative mechanisms for ensuring permanence.** The standard approach in the SEP to satisfy CAR's permanence requirements is for the Project Owner to maintain active monitoring and reporting of reversals for 100 years after CRT issuance as detailed in the Project Implementation Agreement (PIA). However, the SEP proposes allowing for alternative mechanisms to ensure permanence (3.5.5) without details on those mechanisms. Without the specific information on how alternative mechanisms would be structured and implemented, stakeholders cannot provide input or feedback. Once determined, the proposed alternative mechanisms should be specified in the SEP text and stakeholders given the opportunity to provide comments in an additional public consultation. Because reversal risk mitigation and compensation is integral to offset integrity, standardization and transparency for addressing non-permanence risk is paramount. **(ACR)**

    RESPONSE: Thank you for your comments. Please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol. The Reserve is committed to maintaining the integrity of the credits in its own system. Please note that the Reserve is committed to stepping in to make whole any reversals the buffer pool is unable to address (please see Section 2.8.1 of the Reserve Offset Program Manual for the means by which the Reserve would make good on any reversals not covered by the buffer pool).

33. **Requirements for permanence.** Section 3.5 Requirements for Permanence: Requires that GHG emission reductions be quantified for 100 years from the beginning of the crediting period. It is unclear what happens if ownership changes with the new owner changing practices or if the land is developed for housing, commercial or other purposes. Must the buffer pool then be utilized for the remaining compliance period? Or should the Tonne-year accounting option be utilized? **(CASA)**

    RESPONSE: Thank you for your comments, and follow up discussions. If a reversal of soil carbon occurs, the party that is responsible for replacing the associated offsets will depend on the nature of the event that caused the reversal (as set out in Section 3.5.1). If land is converted to another use, that is considered an avoidable reversal, and it will be the project owner that needs to replace any offsets issued for soil carbon gains on that land. It's only for unavoidable reversals, such as natural disasters, that credits would be replaced using the buffer pool. The Reserve's Project Implementation Agreement provides further details for what happens when project ownership (and, therefore, liability for reversals) changes. The tonne-year accounting option can be utilized in instances where the Project Owner is interested in receiving credits with a reduced time commitment for ongoing MRV.

34. Is the second option under Section 3.5.4 essentially considering changing the permanence period for the project owner from 100 yrs post last issuance to 5 years, as it currently reads? I completely get the need to shrink this timeline, but 5 years is a lot different than 100. Your reasoning is based simply on 5 years of compliance without payment. Again, that seems

dangerously shortsighted when predicting risk to a 100 permanence requirement of specific on-farm practices. Remember you are trying to incentivize practices that currently have around a 10% retention rate according to NRCS and industry experts. Risk of reversals is very high. I'd argue your decision making should be a lot more encompassing than that, as a simple change in ownership after that 5 years could easily result in a reversal. Rather, the registry shall assess convincing social, economic, and cultural shifts at that time, by which tillage is the vast minority and market economics differentiate that practice type, prior to granting such approval. I'd be all for lowering the commitment if that arises. At this point, this doesn't even acknowledge basic threats from inevitable succession. **(DU)**

RESPONSE: Thank you for your comments, and follow up discussions. Please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol. The Reserve is committed to maintaining the integrity of the credits in its own system. Please note that the Reserve is committed to stepping in to make whole any reversals the buffer pool is unable to address (please see Section 2.8.1 of the Reserve Offset Program Manual for the means by which the Reserve would make good on any reversals not covered by the buffer pool).

35. Land-based offsets struggle with the fact that carbon stocks are relatively easily disturbed and released into the atmosphere. This is especially true in agriculture, where a single large tillage or disturbance event can reverse decades of carbon storage. Without true permanence (recognizing that 100-year permanence is a useful, but arbitrary time limit), offsets are simply short delays in inevitable emissions, or very temporary storage activities. To assume, without monitoring, that reversal risk is de minimis for years to decades after monitoring ceases (as in section 3.5.5), just because a grower has kept up a practice for "at least 5 years following the conclusion of the crediting period," seems unwise and shortsighted, and will inevitably result in reversals that aren't accounted for. **(Hemes)**

    RESPONSE: Thank you for your comments. Please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol. The Reserve is committed to maintaining the integrity of the credits in its own system. Please note that the Reserve is committed to stepping in to make whole any reversals the buffer pool is unable to address (please see Section 2.8.1 of the Reserve Offset Program Manual for the means by which the Reserve would make good on any reversals not covered by the buffer pool).

36. We support the Reserve's inclusion of alternative mechanisms for monitoring permanence, which have the potential for reducing the burden of ongoing monitoring over the 100-year permanence period. From our perspective as a participant in carbon markets and as a land manager, the 100-year permanence requirement remains a challenge, as it is in other Reserve protocols. However, we support the Reserve's recognition that a grower's maintenance of SEP practices for five years after the end of carbon crediting (and carbon revenue) demonstrates long-term adoption of those practices. Based on our twenty-nine years of experience, we concur that growers are necessarily risk-averse and require incentives and stable markets in order to change their established land management practices. We support the Reserve's recognition that if growers maintain SEP practices in the absence of payment, the Reserve reasonably can assume growers will continue to maintain those practices for the project's duration. **(HNRG)**

RESPONSE: Thank you for your comments. Please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol.

37. We have two concerns about the permanence of soil enhancement credited under the Draft Protocol. The first relates to the duration of commitments projects make under the Draft Protocol. Although the Draft Protocol offers 100-year guarantees on carbon permanence, it only requires physical soil carbon monitoring for 30 years. It also allows Project Operators to select any shorter time frame in a private contract: at the end of that contract period, the Reserve would establish that certain unspecified management practices will ensure ongoing carbon storage through year 100. Recommendation: In order to accurately inform prospective credit buyers, the Reserve should designate the permanence of any credits issued under the protocol as the lesser of (1) the period of time over which projects must physically monitor soil-carbon and (2) any shorter time period the Project Owner elects in its Project Implementation Agreement. Second, the Draft Protocol uses a buffer pool to insure projects against any reversals, but doesn't provide evidence to support its choice of buffer pool parameters. The buffer pool rules also include a series of loopholes that do not protect against the possibility that private Project Owners might default on their contracts within a 100-year period. Recommendation: The Reserve should justify the choice of parameters used to calculate the contribution of its buffer pool and eliminate loopholes that allow private parties to avoid contributing to the buffer pool to mitigate the risk that they might default on their long-term contracts. **(CarbonPlan)**

    RESPONSE: Thank you for your comments, and follow up discussions. The permanence standard for the Reserve's offset program is 100 years. Sequestration related offsets will only ever be issued ex-post, and will each be subject to a full 100 years of permanence. We then utilize various means to monitor for reversal. If any threat of reversal is detected, we then require an appropriate quantification of such impacts. With respect to how reversed carbon is made whole, the primary mechanisms we seek to use here are a contract (Project Implementation Agreement) which will span the full 100 years, and/or use of the buffer pool. Please also note that the Reserve is committed to stepping in to make whole any reversals the buffer pool is unable to address (please see Section 2.8.1 of the Reserve Offset Program Manual for the means by which the Reserve would make good on any reversals not covered by the buffer pool). With respect to *potential* 'alternative means to monitor and address reversals, please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol. With respect to how we set buffer pool contributions, it has long been our approach to consider a wide-range of factors that contribute to reversal risk, including social and financial drivers. Unfortunately, the exact level of risk for a given project type is largely unknown, particularly when developing a new protocol and particularly when considering the range of potential risks that may arise over 100 years. Thus, these parameters, and the means for reducing risk-based contributions, must largely be policy decisions. The approach taken for SEP is consistent with our approaches taken for buffer pool contributions under the forest and grassland protocols.

38. This protocol also takes into consideration the extent to which a Project Owner has contributed towards the reversal through negligence, gross negligence, or willful intent. How is this assessed? Evidence requirements? **(CSG and CCSI)**

    RESPONSE: Any reversal that is not caused by a natural disturbance is generally deemed to be the responsibility of the Project Owner. If there are any cases that are ambiguous (for

instance, if there are cases where it is unclear whether erosion has been exacerbated by natural causes or man-made causes), we will have to assess these on a case-by-case basis.

39. The Project Owner receives written approval from the Reserve for an alternative mechanism for ensuring permanence on the project area. Can you confirm that these will be made public if approved, so others can follow the same methodology? For example, if a certain high percentage of Field Managers maintain their SEP practices consistently throughout the crediting period and for at least 5 years following the conclusion of the crediting period, then permanence monitoring may conclude. A certain high percentage seems a little vague – I think we'd need some more detail on the methodology for determining this. **(CSG and CCSI)**

    RESPONSE: Thank you for your comment. Please note that following public comments and extensive further deliberations with parties we have removed that section of the protocol.

40. The Project Owner elects to be issued credits based on tonne-year accounting (see Section 3.5.6), with credit issuance based on the tonne-year values associated with the length of the term of enforcement of the PIA. Not sure how this would work in practice – e.g. if there's a 30-year crediting period, followed by a 100-year permanence period, if the enforcement of the PIA is say 30 years following credit issuance, then what credits are left to be issued via a tonne/year system? **(CSG and CCSI)**

    RESPONSE: If a project plans to implement a 100-year permanence period, then the full tonne-tonne value of credits would be issued. It is anticipated that tonne-year accounting would be used for shorter PIA commitments. So, with your example of a 30 year PIA commitment – approximately 30% of the credits would be issued compared to a 100-year PIA (as we employ a 1% tonne-year accounting approach for the sake of simplifying project accounting). Please refer to Box 5.2 in the protocol for a more detailed example of how this accounting works with different length PIAs.

41. [Related to Alternative Methods for Ensuring Permanence and Tonne-Year Accounting] We note an absence of any discussion on aggregation. Can an aggregator use different mechanisms (a mix) in a project for ensuring permanence and/or in opting for TYA? This appears not to be an option for the PIA. Can different crediting scenarios be entertained by an aggregator, meeting the disparate needs for an aggregated large group of Field Managers. **(Evergreen Carbon)**

    RESPONSE: Thank you for your comments, and follow up discussions. We are open to considering the use of multiple permanence mechanisms across a single project.

42. This section begins with, "Additional reductions of atmospheric CO_2 are realized immediately when CO_2 is sequestered in a carbon pool at levels beyond "business as usual." This statement and the proposed framework that ensues seemingly assumes that these gains happen immediately following any practice adoption. That is simply not true. Rather, there is substantial published data that shows (statistically significant) CO_2 gains don't occur for many years following project adoption for nearly of the included practices (outside of direct input reductions). Furthermore, this framework seems to be addressing a permanence criterion with a relative discount, not anything substantive around risk of reversals. Shouldn't the integrity of 1 ton of offset receive the same level of oversight of 100K+? I'm curious if this has been done before and how CAR maintains this approach upholds the critical

permanence component of any one offset. To the reader, it seemingly does not. **(DU)**

RESPONSE: Thank you for your comments, and follow up discussions. The reference to "additional reductions" here is to those achieved beyond "business as usual," as opposed to a recognition of further reductions that are likely to be realized in the future based on reported carbon stock increases for the current year. Tonne-year accounting (TYA) is intended to recognize the value of CO_2 being held out of the atmosphere for a given length of time less than what is otherwise considered to be permanent (the Reserve considers 100 years to be permanent). The underlying principle is that the removal of CO_2 from the atmosphere, even if only remaining temporarily sequestered, has some climatic benefit. Per the *IPCC Special Report on Land Use, Land-Use Change, and Forestry* (2000), the principle of attributing value to short-term sequestration "is made clearer by considering the converse case: emission of 1 t CO_2 followed 20 years later by removal of 1 t CO_2. Although the net emission over the entire period is zero, there clearly has been an effect on the atmosphere." Similarly, removing CO_2 from the atmosphere for a limited period of time will have an effect on the atmosphere.

Under the protocol, TYA is applied only to carbon stocks that have already been sequestered in the soil, and reported and verified as such. Rather than issue a full credit for each tonne of CO_2 sequestered, only a portion of a credit is issued relative to the length of time for which the project owner has provided assurances as to the maintenance of the sequestered tonne in the soil. Those assurances can come in the form of the simple fact that a sequestered tonne, upon verification, has been maintained out of the atmosphere for 1 year (yielding a credit issuance of 1% relative to additional tCO_2 sequestered) or in the form of a PIA, which sets the length of the permanence (the examples around TYA in the protocol use a the case of 20-year PIA) and allows credit issuance to increase based the length of time committed to in the PIA. If a reversal occurs, the impact in relation to previously issued credits is determined by the basis of those issuances. If either no PIA is employed and a project is only being issued credits at a rate of 1% of additional tonnes reported and verified each year or the project is already beyond its PIA term of commitment, a reversal has no impact on previously issued credits—only the fully realized time-value of the sequestered tonnes have been issued as credits. If a PIA is employed and reversal occurs before the PIA term expires, the reversed credits must be compensated for according to the requirements specified in Section 5.3.2. Although the application of TYA is not currently widespread in carbon markets, it is employed under the Reserve's Mexico Forest and Canada Grassland Protocols.

43. No alternative mechanism based on *de minimis* risk should be allowable, for multiple reasons (extensive rationale given). **(NCP)**

RESPONSE: Thank you for your comments, and follow up discussions. Based on feedback received we have since removed these alternative mechanisms.

44. Permanence of reversible credits for 100 years is the only way to assure meaningful climate benefit. For example, the recently adopted California Tropical Forest Standard (as well as CAR's Forest Standard) which involve reversible C stocks, require 100-year permanence of reversible credits. However, guaranteeing permanence of reversible SOC in agricultural systems for 100 years using a project-based program is not realistic. As currently proposed, the mechanisms to provide for permanence of reversible emissions over 100 years in the SEP are inadequate. In a regional landscape-based system, it might be possible to achieve the equivalent of 100-year permanence through the use of buffer pools and integration of

serial actions across a region. The proposed ton-year accounting system trades off current benefits at the expense of future impacts to the climate (and to future generations.). If the SOC sequestration is later reversed, the atmosphere will see higher [CO_2] and more severe climate impacts. Furthermore, ton-year accounting provides little incentive to prevent reversal after the project period ends. **(EDF)**

RESPONSE: Thank you for your comments, and follow up discussions. Having operated our forest offset protocols for 15 years now, we feel our approaches to permanence can be effective. We do employ buffer pools as you mentioned, as we do expect most feasible projects to span wide geographies. We don't believe the tonne-year accounting approach provides a tradeoff in climate benefits. Its intended use is to shorten the period over which permanence must be assured by appropriately scaling the credited emission reductions and removals. See further discussion about TYA under the response to comment 42 above.

4 GHG Accounting Boundary

45. While the "Soil Enrichment Protocol" has very detailed description about the soil carbon and nitrogen stocks and vertical fluxes of GHGs, it seems little attention was paid to the lateral fluxes of carbon that leave the edge of field. Note that, soil erosion and runoff cause lateral movement of sediment and C from terrestrial to aquatic ecosystems, which not only modify soil health and terrestrial biogeochemical cycles but also impact trophic states as well as C stocks and flows in aquatic ecosystems. Specifically, for agroecosystems, soil erosion mobilizes a large amount of sediment from land to water bodies. Clearly, the magnitude of land to inland waters C fluxes indicates that lateral C movement regulates terrestrial C storage. Furthermore, the large magnitude of C storage, emissions, and discharge of inland waters highlight the need of including those components in GHG balance. Hope lateral carbon and nutrient fluxes could be included into future versions of the "Soil Enrichment Protocol". **(Zhang)**

    RESPONSE: Thank you for your comment. The lateral movement of carbon away from the project area could be captured in direct soil samples, and potentially also in the model that a project chooses. We are not aware of any default equations or emission factors which could be employed to estimate GHG impacts of the same. We should also note that the reduction of soil erosion is a co-benefit that is a foreseeable result of the adoption of many of the practices identified as potentially eligible. We will continue to study this area and consider how to more comprehensively include lateral soil movement in the future.

46. Table 4.1 (3) Fertilizer Use – Only seems to look at N_2O emissions from fertilizer use. Recommend also including the carbon sequestration from organic fertilizers including biosolids. Table 4.1 (7) – Fossil fuel use – Only considers fuel use for equipment. Should include benefit from avoiding the fossil fuel required to produce inorganic nitrogen fertilizer. **(CASA)**

    RESPONSE: Thank you for your comments, and follow up discussions. With respect to Table 4.1 (3) please note that the impacts that any activity has on soil carbon levels will be captured in estimates of soil carbon changes, (i.e. the first row in Table 4.1). Please note that with respect to N_2O emissions, we will capture relevant impacts associated with the use of any organic fertilizer, which would include biosolids (where relevant). With respect to Table 4.1(7), please note we do not credit for displacing fossil fuel usage, as that creates potential double counting with respect to existing GHG regulatory programs such as the

California Cap-and-trade program.

47. This section delineates the GHG sources, sinks, and reservoirs (SSRs) that must be assessed by project developers in order to determine the net change in emissions caused by a soil enrichment project. Among the listed SSRs is manure deposition. There should be specification about whether the deposited manure was produced onsite or imported to the project site. Because transportation of manure can yield additional GHG emissions – mainly associated with trucks powered by fossil fuels – importation of deposited manure can impact overall GHG emissions associated with a project. Relatedly, there is a possibility of leakage if an exporter of manure compost then uses more GHG-intensive synthetic fertilizers as a substitute. **(Patagonia)**

    RESPONSE: Thank you for your comment, and follow up discussions. We believe the risk of project activities materially increasing the long-distance transportation of manure, such that associated GHG impacts are material, is minimal. It is likely going to be cost prohibitive to transport manure long distances, due to project activities. Any changes in inputs on a project farm, such as switching between using manure and synthetic nitrogen inputs, would be accounted for.

48. While the SEP does include consideration of soil N_2O emissions, it doesn't require consideration of the potential increases in direct and indirect N_2O emissions when considering SOC enhancements. As the C and N cycle are inextricably linked, net GHG changes based upon SOC enhancement need to consider both SOC sequestration and N_2O emissions. Bottom line is that the only practicable way to address this issue might be making projects that increase the use of nitrogen fertilizers ineligible for crediting under this protocol. In addition to the inherent problems a project-based system would have with providing confidence to civil society that emission reductions have actually happened, the SEP lacks transparency as records of required measurements and modeling results would not be made publicly available. Transparency would also provide critical data to help improve the understanding of soil C and N dynamics and the quality of models. **(EDF)**

    RESPONSE: Thank you for your comments, and follow up discussions. The protocol facilitates the use of peer-reviewed biogeochemical models for this purpose, reflecting consensus amongst the modelling experts on our workgroup, as well as consensus amongst the scientific community. With respect to the claim regarding lack of transparency, we would be happy to consider making available redacted copies of modelling results, upon request.

5 Quantification

49. The SEP has developed specialized quantification equations for many of the carbon pools. Rather than developing using the Reserve developed equations, I strongly encourage the Reserve to review and use the applicable equations developed by the US Department of Agriculture (USDA) in *Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory*, Technical Bulletin 1939. This guidance was developed by scientists who specialize in quantifying GHG emissions from Cropland and Grazing Land Systems. Chapter 3, Quantifying Greenhouse Gas Sources and Sinks in Cropland and Grazing Land Systems, is particularly applicable to the SEP and was developed by fourteen highly respected scientists from USDA, the University of California at Davis, Michigan State University, and Colorado State University. **(SVC)**

RESPONSE: Thank you for your comments, and follow up discussions. The default equations and the majority of emission factors used were taken from the USDA Blue Book, so we are moving to update references accordingly.

50. Projects can select their own models to calculate the number of credits earned under the [protocol], subject to a set of ambiguous quality control criteria. What constitutes "peer-reviewed model" under these criteria would allow a model to [qualify] based on an ad hoc or financially-conflicted review process, rather than its well-established use and acceptance in the scientific literature. Perhaps more problematically, there is not requirement that projects disclose sufficient methods and data such that the number of credits generated by projects can be independently replicated. Because the protocol does not require verifiers to have the technical expertise to be able to [replicate] or evaluate model calculations, the model selection process appears to create a situation where no one-other than the modelling team paid by the project developer to calculate the credits earned under the protocol – would have the necessary information to verify these calculations. **(CarbonPlan)**

    RESPONSE: Thank you for your comments, and follow up discussions. With respect to choice of models, we certainly would look to utilize just those very characteristics you mention when assessing the suitability of any proposed model. Please note, based on feedback received, we have now included two concrete examples of models we are *likely* to accept, namely DNDC and COMET-Farm. During the development of this protocol we have indicated that we intend to accept the use of DNDC, and would likely also accept the use of other models such as COMET-Farm, and Daycent, but that we would not accept any model for which there is not a similar level of peer-review and broad acceptance within the relevant expert scientific community.

    Please note that any given model would also need to pass the model validation, calibration and verification requirements. This guidance has been updated, following extensive further expert feedback, to include a requirement to publish a validation report, and have such report approved by an external expert. Thus an independent expert would need to approve the use of the model in question. In development of the Model Calibration, Verification and Validation guidance we received input from a range of world-renowned experts in the use of such models, as well as soil scientists and others, both within and external to the workgroup.

    With respect to the expertise of members of the verification team, please note that the protocol only allows for the verification team to not itself include an expert in the chosen model, should the Reserve approve the use of a third-party expert in their stead. Please note that during development of the protocol the Reserve clearly and transparently advised all stakeholders that there was a specific expert model operator that we had in mind, when creating this particular flexible option, namely Dagan Inc. This particular entity has staff that are world-renowned experts in the use of the DNDC model, who hold licensing rights to use of the model, and who have been used extensively for this purpose over the years. We think it entirely appropriate for project developers to consider hiring a world-renowned expert to assist them in operating such biogeochemical models.

51. I encourage the Reserve to develop a biogeochemical model that project developers can use for this project. Previous agricultural offset protocols have been developed which allow for the use of applicable peer-reviewed models. Unfortunately, for those protocols, no projects have been developed because the cost to calibrate and validate a model for a given crop, geography and practice has been prohibitive. To maximize the uptake of this

protocol, tools are necessary to allow project developers to efficiently create projects. **(SVC)**

RESPONSE: Thank you for your comments, and follow up discussions. The Reserve looked very closely at the idea of building default emission factors using a biogeochemical model, as we have successfully employed such an approach in the past. Ultimately, we concluded we had insufficient resources to search for requisite data to build such an approach. Having done this type of exercise several times, we also surmised that the results of any such exercise would likely be the eligibility of a very limited subset of the types of conservation practices we are hoping to promote with this protocol. Based on these factors, we concluded it not appropriate to pursue this approach. Nonetheless, we will continue to explore this option, and hope to be able to gather further data to enable this type of approach for future protocol versions.

52. Default emission factors have evolved over time and this protocol should reflect this. Using soil texture, cropping and rainfall as the primary factors for N_2O emissions would be straightforward to do and would better reflect actual emissions. **(Brown)**

    RESPONSE: Thank you for your comment, and follow up discussions. The default equations and underlying emission factors used in this protocol are from the USDA Blue Book, and as such represent best practice in terms of quantifying such emissions in the United States. The intent with allowing for the optional use of such equations is that they are likely to facilitate a simple, robust, and conservative assessment of emission reductions, and thus could serve as a useful option for any project that chooses not to use modelling for the given period and/or field in question. Where sufficient data is available, we expect projects to use modelling instead of these equations and default emission factors.

53. Measuring soil carbon and N_2O emissions are difficult and expensive to do correctly and there is substantial debate in the scientific community about how to correctly measure SOC. **(EDF)**

    RESPONSE: Thank you for your comments, and follow up discussions. There is no question that sampling techniques and soil carbon measurements are complex challenges, but that does not mean that they are intractable. In development of this protocol we have reviewed the literature which makes the uncertainty relating to specific approaches clear. We have then crafted uncertainty requirements to address bias, and that directly accounts for such uncertainty. Further, our workgroup members included several esteemed soil scientists who provided input throughout the development process as to the most reasonable way to address these concerns.

54. Current models lack sufficient validation to accurately predict SOC and N_2O dynamics at the field level and may only achieve sufficient certainty when applied over large numbers of acres. The size of anticipated annual SOC enhancement levels are small relative to the existing SOC stock and the literature suggests achieving statistically significant measurable enhancements will require continuous application of conservation practices for a decade or more. Furthermore, SOC sequestration should be compared to a baseline established by validated soil measurements (not modeling.) **(EDF)**

    RESPONSE: Thank you for your comments, and follow up discussions. The draft protocol has been supported by many experts that helped inform development of our model validation guidance. Models will only be accepted if they have been peer reviewed, and if an

independent expert accepts the validation approach developed by the project. The protocol requires that each time a new version of a model is released, the project is required to move to use of that new version. The protocol also requires a robust accounting for the uncertainty, including structural uncertainty of the model. In this protocol we adopt a hybrid approach to quantification which balances the use of models with the requirement to periodically directly sample SOC. At least every 5 years the project must come back and directly sample SOC again, meaning that there will be a true-up of modelling results. The protocol also employs default equations and emission reductions as contained in the USDA's Blue Book. We believe that taken as a whole, this combination ensures the risk of over-crediting emission reductions is reasonable. Please note that the baseline is established using soil measurements.

55. It is not clear whether the protocol requires measurement of bulk density. It is also likely that field measures with limited and different groups may give high variability. **(Brown)**

    RESPONSE: Thank you for your comment, and follow up discussions. The protocol does require the measurement of bulk density (as set out in the minimum data requirements summarized in Table 6.2). The quantification of soil carbon changes will be done using direct measurement and/or modelling, both of which will require the assessment of bulk density. These requirements were not immediately obvious as bulk density measurements are a constituent component by which SOC itself must always be calculated. We have updated protocol guidance to make such requirements more explicit (including via updated guidance in Section 6.4 Soil Sampling and Testing Guidance, as well as Table 6.1 Minimum Standards for Sampling SOC).

56. For a range of practices, it seems that use of default factors would be much less cumbersome and equally effective. **(Brown)**

    RESPONSE: Thank you for your comment, and follow up discussions. As set out in the summary of acceptable quantification approaches by source and gas in Table 5.2, the protocol does allow for the use of default factors for measuring a range of GHG sources and gasses.

57. Transparency in quantification and verification. The SEP is not sufficiently transparent in the areas of quantification and verification. First, the SEP and the modeling guidance should make clear that the models used are able to accurately quantify and are validated for the combination of practices adopted by a farm operation as well as for individual practices, since many of the 40+ practices likely interact both positively and negatively in terms of GHG emissions over a full calendar year at a specific operation. A positive list of models that are sufficiently validated for practices by crop and region and the supporting validation studies could serve this purpose. This list could be added to over time.

    Secondly, when regional averages are used for baselines, in lieu of historical data from a farm operation, the criteria for applicability of this data to the project sites/operations should be specified as well as how the data is averaged, and confidence intervals applied to ensure baseline conservatism.

    Finally, the SEP does not require re-running of biogeochemical models by a verifier. It will be difficult to render a verification opinion / statement that with reasonable assurance X number of emissions reductions have occurred, without a careful model review. In our experience with projects that rely on biogeochemical models, even small unintentional

errors, especially if replicated across many input files or via a batch processing of output files can result in significant errors (both under estimations and over estimations) that may not be found until a third party goes through the process of replicating the results. Review of the modelling exercise and the extent to which results are reproduced should be at the discretion of the verifier to reach a reasonable level of assurance. Or alternatively, the SEP could prescribe the components that must be replicated thus standardizing verifications across projects. **(ACR)**

RESPONSE: Thank you for your comment. We feel the extensive guidance in the Model Calibration, Validation and Verification document does make it clear that any chosen model, as well as the activities undertaken to validate the model, must meet rigorous standards. These standards were developed working closely with a large and diverse group of persons expert in the use of such models. We have now also added further guidance to point out specific models that will be accepted (namely DNDC and COMET-Farm). The Model Calibration, Validation and Verification document now also requires a validation report by made public and that it must be approved by an independent expert.

With respect to the use of regional baseline data, we will look to build in such further guidance. We envisage such data to have already been averaged by the source, and will require as spatially finite data as possible, along with geographical nexus to the project area. I.e. where data from the given county is available, that must be used, otherwise data from the given Land Resource Region may be acceptable etc. Thank you for that feedback. With respect to using confidence intervals when considering such regional data, given the dearth of publicly available datasets, and differing methodologies underlying such datasets, we are likely to only be presented with a single data point for each relevant parameter. Therefore, considerations of confidence intervals are unlikely to be useful, in our decision-making with respect to whether we accept such methodology/data. We will continue to consider this issue further though, nonetheless.

With respect to the re-running of models by verifiers, we're not aware of any specific requirement to do this in any program or protocol, rather that tends to be a decision left to verifiers, following their assessment of project-specific risk, and after applying their own professional judgment. In any regard, we carefully articulate specific circumstances when a verifier may consider re-running the model unnecessary, namely when a third-party expert has been employed to run the model, when the sanctity of the model results can be demonstrated (e.g. via the use of digital signatures), and when the independent model expert has provided the verifier a sensitivity analysis regarding model inputs. In such circumstances we feel it would be far more efficient for verifiers to focus on the veracity of model inputs, than spend inordinate amounts of time re-running models, under conditions where there is low risk the models have been run improperly. We are very often asked to reduce transition costs, and we feel this is a safe and appropriate means to introduce potential significant reductions in transaction cost, whilst maintaining integrity of the results.

58. The requirement for peer reviewed research supporting a practice is not clearly stated in the protocol. The most significant reference to using peer reviewed research is found in the Model Validation & Verification Guidance. Multiple studies have stressed that both theoretical and empirical support for a given practice in a specific geographic location and cropping system is critical for environmental markets. Not only is this important for a given practice on a given crop in a specific geography, it is also important when multiple practices are applied to a crop. The effects of multiple practices on net GHG emissions cannot be evaluated through separate studies – studies must consider the synergistic effects of

multiple practices. **(SVC)**

RESPONSE: Thank you for your comments, and follow up discussions. As you note the requirements for peer reviewed research to support inclusion of any given practice is contained within the Model Validation & Verification Guidance. This guidance was drafted in close concert with multiple subject matter experts on the workgroup and several external experts. We believe these requirements are robust and represent industry best practice.

59. The protocol allows a retroactive grace period of roughly 24 months for the project start date, yet direct sampling is required to establish baseline estimates. How is one to handle this if the beneficial practices have been in place for 1 or 2 growing seasons already? Are those gains negated? Still, I think there might be some temporal alignment issues with this requirement as the 'baseline' could account for higher SOC than was there a few years prior. Maybe I'm missing something. **(DU)**

    RESPONSE: Thank you for your comments, and follow up discussions. Activities that have been in place for over 24 months prior to the field being included in a project, and being submitted to the Reserve, will have to be accounted for as part of the baseline for that given field if sampling takes place as of the project start date. Only changes in activity from that starting point will be considered additional. If projects have sufficient data available prior to the implementation of those practices, that data can be used to inform the baseline. The availability of data will likely be a challenge for many fields as they are brought into a project, and henceforth robust data gathering mechanisms will be put in place.

60. Section 5.1 – Modeling of Baseline - Appears not to consider current fertilizer practices (ie, synthetic versus organic) and thus cannot give credit when a switch is made to biosolids or other organic fertilizer. **(CASA)**

    RESPONSE: Thank you for your comments and follow up discussions. The protocol does require thorough accounting for fertilizer usage in the historical baseline period, so would be able to capture any GHG impacts associated with the displacement in the historical use of such fertilizers and replacement with biosolids or other organic fertilizers.

61. Table 5.1 identifies Global Warming Potentials for Non-CO_2 Greenhouse Gases that are to be used for all soil enrichment projects (See footnote 18). These values are from the IPCC Fourth Assessment. Suggest that the SEP use updated GWP Values set forth in more recent IPCC Fifth Assessment (the values for methane and nitrous oxide are different between AR4 and AR5). In addition, it would be helpful to identify recommended soil emissions models for purposes of measuring baseline SOC and other required submissions. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. Implementation of IPCC Assessment GWP Values is a choice we make at a programmatic level. Please see Section 2.6.1 of our Reserve Offset Program Manual for more information. Additionally, we will consider the use of a positive list of accepted models, as described in the response to comment 57.

62. Irrigation efficiency should be included in required quantitative data and we encourage the addition of Irrigation Efficiency to column 3 - Quantitative Data in Table 3.1. This is also shown in the SEP Model Cal_Val_Ver Guidance - table 2.1 (practice category). The use of drip irrigation as compared to field flooding to surface water spraying may consume (and

recharge to aquifers) is quite different from one another . Irrigation efficiency is more telling as the amount of water used by the crop/amount of water consumed in irrigation.

Further to irrigation efficiency, field or boundary level Evapotranspiration should be included. Water foot-printing of project fields, as mitigated by the new practices, are critically important. **(Evergreen Carbon)**

RESPONSE: Thank you for your comments, and follow up discussions. Following this feedback we have updated the protocol to provide further guidance with respect to irrigation, including with respect to water source, and evapotranspiration.

5.2 Uncertainty Deduction

63. This process (including Appendix D) seems overly complex. In working with biogeochemical models, it can be extremely challenging to determine true uncertainty given all the parameters used. Some estimates of moderately stable pre- post- scenarios generated uncertainly estimates upwards of 60%. I recommend that this section be thoroughly reviewed by soil scientists and biogeochemical model engineers prior to publication to see if this data can even be generated. Past experience working with protocols and uncertainly conditions highlighted a general lack of dialogue to which the protocol requirements were not even feasible. **(DU)**

    RESPONSE: Thank you for your comments, and follow up discussions. We acknowledge that the uncertainty calculations are indeed complex. Yet we believe it is feasible for project owners to comply with the calculation requirements, thus providing an important element of conservativeness for credit quantification. To that end we will be providing a freely available tool that will aid project owners in the calculation of the uncertainty deduction.

64. What is the basis for the selection of the 15% margin of error threshold? Is there a scientific paper or concept that can be cited? **(SVC)**

    RESPONSE: The 15% threshold is not set based on literature or scientific principle, as such guidance is lacking, but instead was a policy decision taken by the Reserve. We believe this threshold is reasonable given uncertainty is typically provided in terms of a range, and given the general robustness of the requirements for informing total uncertainty, relative to approaches used elsewhere.

5.3.1 Contributions to the Buffer Pool

65. The treatment of drought on the sequestration of soil carbon is not adequately addressed in the protocol. Drought can have a significant impact on soil carbon concentrations. A 2017 paper by Canarini, Kaier, and Dijstra states that “C-rich soils (>2% organic carbon) increase CO_2 release into the atmosphere after intense droughts.”[1] At a minimum, the impact of drought needs to be included in the calculations of buffer pool contributions in Section 5.3.1. **(SVC)**

[1] Canarini, A., Kiær, L.P., Dijkstra, F.A. Soil carbon loss regulated by drought intensity and available substrate: A meta-analysis. (2017). *Soil Biology and Biochemistry*. doi: 10.1016/j.soilbio.2017.04.020

RESPONSE: Thank you for your comments, and follow up discussions. We feel the remodeling of the baseline and reporting period emissions each year would capture such impacts. Essentially projects themselves would be responsible for any changes year on year that result in reductions in SOC relative to the previous year, and relative to baseline trajectory. It would only be in the case of catastrophic single year losses that the buffer pool would be used. We now have additional buffer pool contributions in the case of geographically concentrated projects, which should help the buffer pool cope with any such instances.

66. Risk of financial failure - The protocol states this is a 10% buffer pool requirement that applies to all private companies, however the presentation/webinar suggested a scale of 0 to 9%? Can you clarify how this determination is made? **(CSG and CCSI)**

    RESPONSE: The buffer pool now has two contribution categories. One is $Risk_{default}$, which is either 5% or 7.5% depending on whether the project area is geographically dispersed (we assume more geographically-concentrated projects are at greater risk of being subjected to a single instance of a natural disturbance). Entities will also have a $Risk_{FF}$ value, or risk of financial failure, which varies depending on the entity type and whether they are employing any financial mechanisms like insurance or surety bonds. This risk is either 0% of 10%. However, the final risk rating is calculated using Equation 5.4, which is why the final contribution may not match either $Risk_{default}$ or $Risk_{FF}$, but rather their combined impacts. Thus, when combined with $Risk_{default}$, the effective contribution of $Risk_{FF}$ is actually 0-9.5%. The final values when both risk categories are combined range from a 5% contribution to a 16.8% contribution.

67. The transfer of a quantity of credits to the Reserve Buffer Pool at the time of credit issuance is an important factor in assessing overall monetary benefit for the Project Owner. Clearly, the more credits that are required to be deposited into the Buffer Pool, the less credits available for the credit market. While the Reserve notes that the risk of unavoidable reversals is not significantly differentiated by location or land management, the Reserve determined that the geographic concentration of field in any given project could exacerbate the GHG impacts of any catastrophic natural reversal event. The draft protocol therefore requires a higher default deduction for unavoidable reversal risk where more than 50% of a project's acreage is concentrated in a single county. This seems to contradict the earlier proposition that there is no significant differentiation by location for the risk of unavoidable reversal. This also results in a penalty (i.e., requirement to contribute more to the buffer pool) for small and medium-sized farms and projects that are located within a single county and are not aggregated. This buffer pool risk penalty provides a disincentive for the development of smaller scale projects. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. We were not able to locate any literature or empirical evidence to demonstrate a higher risk for projects that are geographically concentrated, however that was a concern raised by a preeminent scientific body in Australia, when reviewing their soil carbon method some time ago. We acknowledge that the buffer pool contribution, at any non-zero value, is more likely to impact viability for smaller projects. To help alleviate this situation, we have modified the protocol to allow projects comprising fewer than 100 fields to apply the lower default risk value to calculate their buffer pool contribution, recognizing that any risk inherent in geographically smaller projects, can be effectively mitigated through the inclusion of geographically dispersed larger projects, or larger projects that apply a higher buffer pool deduction.

5.3.2.1 Compensating for Avoidable Reversals

68. It is not clear why soil enrichment CRTs are preferred. Soil enrichment CRTs used for compensation may themselves be reversed in the future. The Reserve should, instead, consider a preference for CRT's from project types without reversal risk. **(NCP)**

    RESPONSE: Thank you for your comments, and follow up discussions. For each of the Reserve's protocols where there is a risk of reversal, our preference is to compensate like with like, where possible. If the replacement CRTs are reversed, then those would also have to be compensated for. This is consistent with our policy for managing the buffer pool as well, as detailed in Section 2.8.1 of the Reserve Offset Program Manual. The intent behind this is to encourage the use of replacement CRTs that represent similar co-benefits, in addition to the climate benefit each of our CRTs represents.

5.5 Emissions from Leakage

69. This Section assumes that where yield of a given crop drops on project fields as a result of project activities, it is considered market-shifting "leakage", which would result in a proportionate increase in yield elsewhere along with a shifting of associated GHG impacts. This is not always the case and is highly dependent on the project activity. For example, a change in land management practice that results in diminished or eliminated application of synthetic inputs (e.g., a project that converts from conventional to organic), may have a slightly reduced yield at the outset but would not necessarily result in increased yield elsewhere. In that circumstance, a consumer preference for organic over conventional would not yield GHG leakage outside of the project, in spite of any immediate yield impacts. **(Patagonia)**

    RESPONSE: Thank you for your comments, and follow up discussions. We believe the risk of leakage is low, but where it does occur, we mandate a robust approach to accounting for such impacts, as this represents industry best practice.

70. Section 5.5.1 Livestock Leakage: While I admittingly don't follow what is laid out entirely in this section, additional conditions around enteric fermentation and livestock leakage when it comes to soil enrichment projects seems completely off-base. These projects—even those at large scales—are not influencing how many calves hit the ground each year. That is determined by global markets, mother nature, and host of other factors other than these projects. It must be recognized that feedlots have the ability to raise calves. Yes, cover crops could provide a new feed for cattle. Reality is that this typically doesn't directly result in more cattle in this world, it simply replaces days in a backgrounding operation/feedlot and/or supplemental haying. I fear methane emissions associated with cattle are highly inaccurate given these dynamics and most models do a poor job estimating the positive contributions ruminants make, and 'livestock leakage' would even more so. Consider removing entirely. **(DU)**

    RESPONSE: Thank you for your comments, and follow up discussions. We believe the risk of leakage is low, but where it does occur, we mandate a robust approach to accounting for such impacts, as this represents industry best practice. The provisions addressing potential leakage of emissions associated with livestock displacement is intended to address situations in which amount of livestock grazing a site prior to the project (and hence producing emissions incorporated into the baseline) is reduced as a part of project activities,

with such livestock production simply being moved outside of the project area and hence beyond the project's accounting boundaries. As your comment mentions, while cover crops may provide a new feed source for cattle, it won't increase the global cattle population. However, if planting cover crops is somehow affiliated with a reduction in cattle grazing the project area, those cattle (or a replacement population) likely will simply be grazing elsewhere. Thus, the leakage provision in the protocol is included as a conservative way to ensure that any lowering of grazing activity within the project area will not result in the project being awarded credits for lowering their CH_4 and N_2O emissions relative to the baseline simply by causing grazing to occur beyond the project's borders.

71. Uncertainty Regarding Leakage and Yields: The guidance document cites a meta-study claiming that a long-term credit system would "erase [any] short-term potential yield declines." However, a study from SYSTEMIQ, which cites a 2015 paper by the same author (Pittelkow) finds that no-till results in yields of 86%-101% relative to baseline (i.e., a range of yield decline to slight yield gain). The 2014 paper from Pittelkow that is cited in the SEP guidance document reached the conclusion that "the potential contribution of no-till to the sustainable intensification of agriculture is more limited than often assumed," and "overall, [their] results show that no-till reduces yields, yet this response is variable and under certain conditions no-till can produce equivalent or greater yields than conventional tillage." We find that, given the uncertainty and highly circumstantial nature of yield benefits as determined in Pittelkow, 2014, and the mixed yield effects found in other studies summarized in Table 8 of the linked SYSTEMIQ paper, assuming no loss in yields and thus not accounting for leakage (i.e., carbon losses elsewhere to replace foregone food production where yields fall) is inconsistent with the evidence in the literature.

    Along those lines, we also find that the concept of monitoring livestock leakages through "animal-grazing days" should be supplemented with a consideration for the change in beef or dairy produced per hectare. Animal production is not just a function of grazing days, but also population and feed quality (which affects amount of weight gain per day). Thus, feed quality and product output should also be monitored in addition to feed consumed through grazing.

    We feel that "you can't manage what you don't measure." By that logic, if the goal is to encourage efficient agricultural production, accounting for leakage due to yield changes would do just that. **(Food Program at WRI)**

    RESPONSE: Thank you for your comments, and follow up discussions. We believe the risk of leakage is low, but where it does occur, we mandate a robust approach to accounting for such impacts, as this represents industry best practice. While Appendix C does state that the length of time fields are likely to be engaged with a project for crediting purposes provides sufficient time for yields to recover. Nevertheless, the protocol does require leakage associated with yield declines to be quantified. Furthermore, based on stakeholder and workgroup feedback, the protocol is being modified to make it clearer that this assessment is performed on a field-by-field basis, relative to baseline yield levels, with field-level leakage results then aggregated across the entire project. As for leakage related to livestock production, we have chosen to focus on animal grazing days owing to the simplicity associated with the measuring and monitoring of such activities, as opposed to monitoring changes in forage quality. Furthermore, we anticipate project activities will tend to improve feed quality.

72. Incomplete Carbon Accounting: We recently published a blog based on the findings of the World Resources Report, which focused on the need for more strict carbon accounting of the indirect impacts of soil amendments. Manure is filled with the carbon and nutrients absorbed originally by plants and eaten by animals. For that reason, adding manure to a field increases soil carbon where it is applied. But because there is a limited supply of manure in the world, using it in one place almost always means taking it from elsewhere, so no additional carbon is added to the world's soils overall (and there is no additional climate benefit). The global supply of crop residues is also limited. For example, if residues were previously used as animal feed and are now used to increase soil carbon on a farm, farmers may need to expand cropland into forests or grasslands to replace the animal feed, releasing carbon stored in these natural ecosystems' soils and plants.

    Converting cropland to grazing can build soil carbon, and might be advisable where cropping is marginal. But if the crops replaced by grazing are ultimately grown elsewhere by cutting down forests or grasslands, it can result in a net increase in greenhouse gas emissions or at least reduce the climate benefits of the conversion from cropland to grazing. The failure to count these off-farm effects especially matters if soil carbon benefits are claimed as carbon offsets. **(Food Program at WRI)**

    RESPONSE: Thank you for your comments, and follow up discussions. With respect to land-use change risks, we believe the risk that intensively managed crop lands would be converted to grasslands is minimal, aside from marginal lands, the retirement of which likely presents multiple environmental benefits. With respect to accounting for manure and stubble, we do not think it reasonable to prescribe unspecified and likely complex accounting for downstream effects of using manure and stubble on project lands. We believe project related offset revenues are unlikely to drive significant increase in long-distance movement of manure or stubble, as transport costs would be cost-prohibitive. Therefore, changes in how stubble and manures are used, are likely to be localized. If stubble and manures are already been put to beneficial uses, this is likely to further increase the costs inherent in moving such inputs onto a project farm, making such changes further unlikely. Therefore, it's more likely such inputs will come from within the given farm itself, or travel short distances, and likely only in scenarios where such materials are not already being put to as beneficial a use. In circumstances where the given risk is minimal, and where accounting for it is likely to be complex, best practice dictates it reasonable to exclude accounting for such risks.

6 Project Monitoring

73. "...remote sensing (e.g., satellite imagery, manned aerial vehicle footage, drone imagery), where requisite information on agricultural management practices can be reliably determined with these methods (e.g., tillage status, crop type, irrigation)."

    We request more guidance on what metrics can be used to decide if remote sensing can reliably determine the information? It will be too late to discover that a remote sensing wasn't applied properly, or could have been reliably used as an alternative during the verification. Please expand on how requirements for use of remote sensing in describing historical management will be determined.

    Right now, we don't see remote sensing as developed as bankable data. It still needs to be developed further with grower testing. Although technology is currently available for

measuring and detecting reflectance, it is still difficult to differentiate between crop and cover crops. **(Evergreen Carbon)**

RESPONSE: Thank you for your comments, and follow up discussions. We are not in a position to provide prescriptive guidance on whether remote sensing can successfully be used for MRV activities, and instead we suggest you seek the guidance of someone developing such applications. We can refer you to experts who are confident such technology is readily applicable today, for these specific purposes. Instead of prescriptive guidance in the protocol itself, we prefer to engage readily in dialogue with parties, to discuss whether any specific proposal they develop will be considered reasonable in the circumstances. It is worth noting that we have updated guidance in the protocol to make it clear that when we talk about monitoring technologies, such as remote sensing, we envisage their use for detecting practice change, not quantifying underlying GHG impacts of such changes.

6.4.1 Sample Design and Soil Collection

74. There is growing evidence in the literature that [SOC] down to a meter responds to changing land-use practices, often in the opposite direction of surface soil trends, indicating that the 30 cm depth requirement of the SEP will inadequately reflect net atmospheric changes. The SEP seems to assume that the change in carbon stocks of deeper soils are independent of surface soil processes and if there is a change it will be an increase in carbon. This assumption seems non-robust and as such has profound impacts on the determination of net changes in soil carbon storage. **(EDF)**

RESPONSE: Thank you for your comments, and follow up discussions. In this protocol we prescribe a minimum sampling depth of 30cm. While we would prefer that soil sampling occur at greater depths, current models are not capable of modeling below 30 cm, thus preventing adequate baseline development for such depths. We will encourage deeper sampling depth, such that when modelling can model down below 30cm, projects will have the requisite data to do so. We have also adopted restrictions with respect to no-till, in order to account for concerns regarding possible migration of SOC within the soil profile. We will exclude from eligibility to generate credits associated with SOC gains, any field that adopts no-till having moved from historically using either of two conventional tillage practices that typically go down to deeper than 30cm. These restrictions are described in Section 6.5.1, and the underlying rationale described in Appendix B.1.

Having liaised extensively with soil science experts on the workgroup, and having reviewed additional literature, we will continue to mandate a minimum soil sample depth of 30cm. We do encourage deeper sampling, and hope to be able to also model to deeper depths in future, but currently modelling is only available to a depth of 30cm. We reviewed several meta-analysis that included studies of no-till practices. A recommendation in one of the cited meta-analysis is that sampling depth be set at historical plow depth. This notion appears to be supported by another meta-analysis, which included studies that sampled 10-20cm below historical plow depth. We have conducted further research to identify typical depths of conventional tillage practices. We have identified that the majority of conventional tillage practices go down to depths of 10cm, several to 20cm and two go to depths at or deeper than 30cm.

Based on this information, we will exclude from eligibility to generate credits associated with SOC gains, any field that adopts no-till having moved from historically using either of the two conventional tillage practices that typically go down to 30cm or deeper. Requiring a minimum of 30cm sampling for remaining fields will capture impacts some 10-20cm below historical plow depth, which should capture the vast majority of any migration of SOC within the soil profile. We believe this approach should reasonably account for the majority of risk identified in the various reports studied. We are also considering removing no-till from being eligible at all under this protocol at all. At present we will not remove no-till altogether, given extensive feedback we have received that the adoption of no-till is likely to be one of, if not the, most important practice change that can help farmers safely migrate towards the adoption of new sustainable farming systems. We will continue to consider options with respect to this issue, and will be seeking further expert feedback from both workgroup members and beyond.

75. On page 67, change "Sample depth- Minimum of 30cm" to "*Sample depth- Minimum of 30 cm but up to 200 cm.*" **(CalRecycle)**

    RESPONSE: Thank you for your comments, and follow up discussions. Following extensive expert feedback, and literature reviews, we will mandate soil sampling minimum depth of 30cm. We do encourage deeper sampling, and hope to be able to also model to deeper depths in future. See the response to comment 74 for further discussion.

76. Uncertainty of No-Till: We feel that a discussion on the impermanence of benefits of no-till is necessary. No-till farming, along with many other practices mentioned in this document, undoubtedly has benefits with regards to soil health. However, researchers have found that in many areas where no-till is practiced, farmers also plow up their soils at least every few years, reversing most, if not all, of any short-term carbon storage benefit. While we recognize that your guidance document deals with permanence and monitors for reversals, more emphasis on ground-truthing with physical samples to a depth of 1 meter rather than remote and modeled monitoring of the top 30 cm would greatly improve the validity of any results, and would better capture long-term trends. **(Food Program at WRI)**

    RESPONSE: Thank you for your comment, and further discussions. Any practices that result in a reversal of previously sequestered carbon, such as via plowing fields where no-till was previously initiated under the project, would be captured during project quantification for each reporting period. We believe physical sampling at least every 5 years provides sufficient opportunities to ground-truth and true-up modeled results. While we would prefer that soil sampling occur at greater depths, current models are not capable of modeling below 30 cm, thus preventing adequate baseline development for such depths. We will encourage deeper sampling depth, such that when modelling can model down below 30cm, projects will have the requisite data to do so. We have also adopted restrictions with respect to no-till, in order to account for concerns regarding possible migration of SOC within the soil profile.

    Following extensive further research and discussions with experts, we have determined to restrict the eligibility of no-till practices, as a means to ensure sampling to 30cm is sufficiently below historical plow depth to be able to effective capture the vast majority of any such soil migration from deeper depths. See the response to comment 74 for further discussion.

77. To provide an accurate baseline for each reporting period, and improve utility of the soil organic carbon data for future modeling, I expected a more detailed list of the number of samples required per land area for soil organic carbon measurements. I think that we need to require the farmers sample as deep as possible, perhaps for feasibility set a bottom limit (1.0 m), because new research shows that many practices, such as no-till or perennial crops can have major consequences for soil C deeper in the profile. We need to account for those changes, whether it is crediting the producer or negating the surface effects. Even if the models will not run now on deeper soil C, this will be a critical component in the future, and the only way to truly account for soil C sequestration. I also think that bulk density should be a required measurement for each reporting period, and as far as I read it is an optional measurement. We cannot simply use changes in concentration when assessing global impacts of the program, we need the change in stock. This is the best way we can account for changes over time is to start with sound measurement via a specific protocol. This may be set up as a flow chart for farmers, for example the amount of stones in the field will then dictate which protocol should be used for bulk density. **(Foster)**

    RESPONSE: Thank you for your comments. Based on the feedback received we have made several changes to the guidance regarding soil sampling, including prescribing a minimum of 3 samples per strata. Bulk density is certainly a requirement for both modelling and direct sampling of SOC, so we have made that clearer. In this protocol we prescribe a minimum sampling depth of 30cm. While we would prefer that soil sampling occur at greater depths, current models are not capable of modeling below 30 cm, thus preventing adequate baseline development for such depths. We will encourage deeper sampling depth, such that when modelling can model down below 30cm, projects will have the requisite data to do so. We have also adopted restrictions with respect to no-till, in order to account for concerns regarding possible migration of SOC within the soil profile. See the response to comment 74 for further discussion.

78. When fixed, permanent plots are remeasured every five years, it would be simple for a project owner to dump an extra application of manure or other organic material (even humic material from histosols) on specific plot locations. The hired soil technician, who only visits the sample plots, will be unlikely to detect this, because he/she would only be visiting doctored plots and have no idea what the soils in the rest of the field are like.

    This was considered a problem in Australia and a sampling method was created to deal with it. (See the attached de Gruijter article) I have not used this method, but it seems reasonable.

    Another possibility to guard against this is to have a qualified verifier or consultant to the verifier look at the soil profiles of a few random plots and some profiles from non-plot areas and see if there are differences in A horizon thickness, or other evidence of added materials.

    The reality is that fixed soil plots are an easy cheat in a protocol like this. As a verifier and soil scientist, this makes me uncomfortable. **(Scharf)**

    RESPONSE: Thank you for your comments. Based on the feedback received we have included further guidance with respect to use of permanent plots and resampling. In Table 6.2 we have included new guidance that remeasurement of previously sampled points during subsequent reporting periods is allowed, though remeasured sample points may comprise no more than 50% of the total number of sample plots. Furthermore, either the selection of sample points to be remeasured or the selection of sample units in the stage

directly above the sample point stage and containing the potential sample points for remeasurement must occur on a randomized basis. We have also included further guidance in Section 8.3.2 to ensure verifier re-sampling is done by either the verifier themselves or suitably qualified parties that are independent from the project developer.

6.5 Modeling Guidance

79. Staff of the Reserve may encounter models with which they are unfamiliar. This will make oversight difficult, thus undermining the degree to which offset buyers can trust the quantification of emissions reductions. The Reserve should specify which models are acceptable. **(NCP)**

    RESPONSE: Thank you for your comments, and follow up discussions. We have updated protocol guidance to make it clear that models need to be peer-reviewed, and that DNDC and COMET-Farm will be acceptable. The Model Calibration, Verification and Validation guidance now contains a requirement that validation reports be approved by an independent expert, and that either the verifier will need to re-run models themselves, retain an model expert, or the project needs to employ a third-party expert to run the models, and ensure integrity of model outputs. Thus, there are several safeguards built into the protocol to require that independent expert guidance be employed to ensure models are appropriately chosen, validated and used.

7.3 Reporting Period and Verification Cycle

80. Projects can verify 5 reporting periods at a time for this Project type. For COI purposes, this means that if two five-year reporting periods are verified, the Project Developer will need to hire two separate VBs. Each VB will be required to train two individuals. The Reserve should either consider foregoing the direct training costs or adjust the timing of COI so that a verification body can assess COI based on number of verifications and not number of reporting periods. Otherwise, the training costs will inflate the verification costs. **(RCE)**

    RESPONSE: Thank you for your comment. We would note that the current Verification Program Manual requires VB rotation following six consecutive years of verification services, which may include any number of reporting periods (Section 3.7 of the Verification Program Manual). However, your point regarding training costs is well taken. We will attempt to address this in our next Verification Program Manual update, and would encourage you to resubmit any comments regarding verification body training during the next public comment period for the Verification Program Manual.

7 Verification Guidance

81. Section 8.4.1 - As a VB, we would likely perform a site visit to an area of concentrated fields. If the random selection includes fields that are hundreds of miles from a cluster, we will likely always choose the option for a remote site visit to those fields based on cost and the fact that ICT is readily available now. **(RCE)**

    RESPONSE: Thank you for your comment.
    Verifiers must use their professional judgment, based on factors including a risk assessment that they themselves perform, to determine appropriate verification activities that meet

protocol requirements. We understand the potential logistical difficulties that project area configurations registering under this protocol pose. As recognized by your comment, we have included flexibility in the protocol to allow for verifiers to seek approval to forgo site visits in favor of alternative means of performing the verification tasks normally achieved when visiting portions of the project area in person, as long as such means still provide reasonable assurances concerning the detailed verification requirements in the protocol, and the specific items the verifier wished to have verified. Please note the final guidance in Section 8.4.1 regarding the process for verifiers seeking approval to forgo physically visiting fields identified for site visits.

82. Soil carbon varies widely both within and across project sites and over time. Despite a potential role for remote sensing in the future, reliable measurement and calibration currently requires in situ samples conducted from site visits. Nevertheless, the protocol does not specify random sampling methods to ensure accurate measurement of individual project sites, nor does it require independent measurement of soil carbon in the verification process. When it comes to large aggregators, the draft protocol proposes that fewer than 1% of large project aggregators' sites be verified, without justifying that rate with respect to known data on soil quantification and sampling. Numerous loopholes would allow Project Owners to avoid all physical site visits in the verification process, with the Reserve able to replace verifier visits with information from third-party experts paid by the Project Owner, attestations from the Project Owner or remote sensing technologies that are not yet established in the scientific literature. Recommendation: The Reserve should require projects to rigorously sample soils at baseline and every 5 year intervals, ensuring that the sampling is adequate to encompass inherent within-site variation and randomized to ensure samples are representative of the site as a whole. The Reserve should also revise its verification process to require independent soil carbon measurement and increase the rate of sampling of individual project sites for large aggregators, or provide evidence for its choice of minimal sampling with respect to published soil analyses. Verification sampling must be done on-site and should not be replaced with self-reporting or remote sensing techniques that are not widely accepted in the scientific literature. **(CarbonPlan)**

    RESPONSE: Thank you for your comments, and follow up discussions. Please note that the protocol does explicitly require direct measurement of soil carbon at the outset of the project, and at least every 5 years henceforth (Section 5). Following the feedback received we have made changes with respect to guidance in Section 8.3.2 and Table 6.2, including the verification frequency requirements in the protocol, and we now require a minimum of 2.5% of all farms by subjected to desktop or site visit requirements in each reporting period. Based on the feedback received we have made several changes to the guidance regarding soil sampling, including prescribing a minimum of 3 samples per strata, additional guidance with respect to sampling method, additional guidance with respect to randomized vs fixed sampling, and added clarify with respect to bulk density requirements.

83. Tables 8.1 and 8.2 - The following items are listed as NOT being able to apply professional judgment: 2.2, 3.4.1, first 5 items in table 8.2. These items will likely involve *some* professional judgement. We believe it is unreasonable to have *no* professional judgement with these. **(RCE)**

    RESPONSE: Thank you for your comment. We have made several changes to Table 8.2 as a result. Additionally, these tables are intended to help guide verifiers in developing their

sampling plans, but are not intended to be exhaustive.

8.3.1 Verifying Proper Use of Models

84. The centrality of modeling to offset quantification necessitates that the verification team include an expert in the use of the model. While it is not necessary for the verifier to repeat the entire modeling exercise, the verifier must have the ability to independently test model sensitivity to different types of variables. Only then can the verifier credibly confirm that the model results appear reasonable. Oversight and verification activities should nowhere have a "black box." A situation in which neither the verifier nor Reserve staff can operate the model invites concerns about offset integrity. **(NCP)**

    RESPONSE: Thank you for your comments, and follow up discussions. Verifiers will always have the ability to rerun models, and hire experts to better enable them to do so. In very specific circumstances we envisage this not be strictly necessary, though we would still defer to verifiers professional judgment as to whether they still want to employ such steps in a given verification. Please note that no private for-profit party will be able to use the DNDC model, for use in relation to carbon offset projects, due to licensing restrictions. It's in this specific context that we envisage a verification team may not need their own expertise, and may not need to themselves run DNDC, provided they meet the further safeguards we have stipulated. Having liaised extensively with parties that are expert in such matters, we feel the current approach is robust;

8.4.1 Verification Site Visit Requirements

85. Fields representing a minimum of one-half the square root of the total number of fields in the project must be visited. Is it intentional that this guidance does not speak to you the number of different farms, just different fields? I could imagine that the verifiers' risk-based sampling process would bring this element into consideration, but regardless, the variability of data quality etc. that is likely going to lead to errors in assertions might be more to do with record-keeping/data collection processes from farm to farm rather than field to field. As written, a verifier could in theory (though most unlikely – unless the highest risk category represented, in effect, one farm) satisfy this requirement by visiting one farm only, could they not? **(CSG and CCSI)**

    RESPONSE: Thank you for your comments. We agree with your assessment, and have thus modified verification frequency requirements in this section to instead by applied at the farm level, not field level. Please note we have also made further edits to requirements here, as noted in our response to comment 82.

86. Once fields have been selected for site visits, verifiers may seek Reserve approval to forgo an actual site visit, if sufficient proxy data exists such that a verifier considers it unnecessary for a member of the verification team to specific set foot at the relevant field. This is a welcome inclusion to open an avenue for lower verification costs – we would ask that successful requests and the CAR response be made public through the reporting and verification documents, so that standard for allowing this feature becomes a transparent and consistent practice/process. **(CSG and CCSI)**

RESPONSE: Thank you for your comments. Regarding the notion of making public any requests from verifiers to use proxy data for any given site visit, and results thereof, a summary of any such request and Reserve decision will need to be in the verification report, which will be made public. We will continue to study if and how we can safely make this type of request public, as it foreseeably may contain sensitive farmer information.

9 Glossary of Terms

87. On page 91, compost is included within the definition of organic nitrogen fertilizer. This definition is overly broad and may lead to missed opportunities to improve SOC and decrease GHG emissions. Fertilizer regulators do not typically classify compost as a fertilizer, and farmers do not use compost for its relatively minor nitrogen content. **(CalRecycle)**

    RESPONSE: Thank you for your comment, and follow up discussions. We have made edits to the glossary to improve the content with respect to compost and biosolids, and make it clearer that such organic amendments are eligible. We have also made further similar edits elsewhere, as noted elsewhere in this summary.

88. Replace ‘sewage sludge’ with ‘biosolids’ in the definition drafted for Organic nitrogen fertilizer. **(CASA)**

    RESPONSE: Thank you for your comment, and follow up discussions. We have made this change.

Appendix A Development of the Performance Standard

89. On page 98, we suggest adding a second paragraph to A.3:

    In California, there has been growing interest in soil health following the publication peer-reviewed research from UC Berkeley, funded by the Marin Carbon Project, outlining the effect of compost application to increase the Soil Organic Carbon storage and net primary productivity of rangelands. This was followed by the implementation of a State Healthy Soils Program, which offers grant funding for activities that build soil health, reduce GHG emissions and adapt for a changing climate. Results from those grants are pending and include replicates of the Marin Carbon work. In 2019, researchers at the University of California, Davis published new information from a long-term agricultural research project showing that a combination of compost use and cover cropping was the only strategy studied which resulted in consistent, long-term carbon sequestration in a 200-cm deep soil profile. The results showed SOC increases of .66% annually, exceeding the goals of the ‘4-per-1000' initiative. California’s draft Natural and Working Lands Implementation Plan calls for compost application on hundreds of thousands of acres of rangelands. **(CalRecycle)**

    RESPONSE: Thank you for your comment, and follow up discussions. That appendix studies barriers to adoption of practice, in the context of additionality, whereas your suggested additional content focusses on the impacts of a specific practice. Therefore, we don’t think it’s an appropriate place to include such information. We will continue to consider where it might be appropriate to include such content.

Appendix B Illustrative List of Soil Enrichment Practices

90. On page 100, the following changes are suggested for Table B.1.

    - Under Use of Cover Crops, add: *Cover cropping in tandem with compost application*
    - Under Fertilizer management, add *Apply Compost*
    (CalRecycle)

    RESPONSE: Thank you for your comment, and follow up discussions. We have made multiple edits throughout the protocol to better articulate that composting is a potentially eligible practice, as noted elsewhere in this summary.

91. Table B.1 is an illustrative list of soil enrichment project activities which could be eligible to define a soil enrichment project. While the list is not comprehensive, it will still be relied upon by project owners to assess the range of management practice changes that are optimal for a prospective project. Consider adding to the illustrative list: agroforestry, silvopasture, cropland border conservation, and biochar as among the regenerative practices associated with a positive impact on Soil Organic Carbon. **(Patagonia)**

    RESPONSE: Thank you for your comment, and follow up discussions. Please note that we are not likely to be able to credit for increased woody biomass with this first version of the protocol, but we hope to do so in future versions. See our response to comment 8 for further discussion. With respect to biochar, we have made an amendment to the table, advising that impacts of biochar on SOC will likely be accounted for during direct measurement of SOC, but models are unlikely to currently be able to model such impacts.

Model Calibration, Validation, and Verification Guidance for Soil Enrichment Projects

92. This guidance is predicated on the modeling meeting the test of acceptability of peer review that the model at worse case was deployed correctly according to protocols. There is no guidance on how verifiers are to confirm the accuracy of the model, the precision of the estimates against baseline, being able to predict test subdata sets, or predict future conditions. The challenge with this framework is many published peer reviewed models and publications routinely have r-squared values (prediction of testing using split calibration/test data subsets, once calibrated) that can be in the single digits. What is acceptable for marketplace peer review and performance is not addressed adequately in this guidance. **(Apfelbaum)**

    RESPONSE: Thank you for your comments. We assert that the quantifiable impact of model performance is, by requirement, accounted for in the calculation of model prediction error. Thus, a verifier is not required to assess model performance beyond the bias calculation. We also believe it is not possible to set performance benchmarks (e.g. coefficient of determination) that would meaningfully apply to all possible model applications. Model validation should be expected to be model-specific and site-specific, and in the case of peer-review (detailed in Section 4), should be judged within the relevant context by an expert. Please note, based on your feedback, and extensive further review by model experts, we have made multiple change to this guidance. To help emphasize the mathematical accounting of model performance in the calculation of model prediction error, we have

added the following statement to the end of Section 3 in the Guidance document: "Thus in addition to demonstrating lack of bias or conservative bias, these guidelines require that both model accuracy and precision be quantitatively accounted for in the calculation of credits." Further, we added the language: "In the model validation report, the measured versus model predictions should be reported with model prediction error per practice effect and crop type each for changes in SOC, N2O and CH4 separately across ranges in clay, soil textures, and LRRs validated in the analysis." and described best practices for model validation across the project domain to support critical review.

We have also rewritten the guidance in Section 4 "Satisfying the Model Validation Requirements: Reporting and Peer-Review" to better clarify the use of peer-review in approving model validation and to require a third party review of any unpublished model validation reports. Specific changes that address the commenter's concern regarding peer-review include:
1. a requirement that a model validation report to be submitted to CAR that has been reviewed and approved by an independent expert entity, with CAR approving that entity;
2. that validation published in a peer-reviewed journal must be done so in a pre-approved journal (list of such journals now included),
3. a requirement that if published in a journal, the purpose of the article must be clearly stated: i.e. the purpose of the paper is to validate a model used in generating verifiable carbon credits.

Table 2.1

93. Row 1: N from irrigation water, Phosphorus sourcing against background for both N and P already in the soil.
Row 2: Water source (carbonate rich ground water, nitrogen rich surface water, pumping or gravity feed, irrigation mode and timing (night, day, seasonality). **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have added "irrigation-based" sources of N fertilizer in Table 2.1, and have added water source to Table 6.1 which sets out minimum data requirements. With respect to P, indirect effects of soil phosphorus status or phosphorus fertilizer/manure application on GHG emissions are not sufficient for model validation in the N fertilizer practice category. Biogeochemical cycling of P is fundamentally different than N, and its linkages to N are largely uncoupled in agricultural systems with high fertilizer rates.

94. Row 3: Soil disturbance from trash rakes, tillage, compaction from planting, harvesting, and conditions under which tillage and residue management, harvest, planting occurred. **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have changed the name of the practice category "Tillage and/or residue management" to "Soil disturbance and/or residue management". We have revised the corresponding Practice Effect for this category to be "Soil disturbance including tillage and compaction, residue management encompassing soil exposure after harvest."

95. Row 4: Cropping practices, prior year soil preparations, mulches, smother crops. **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have changed the name of the practice category "Crop, planting and harvesting" to "Cropping practices, planting and harvesting". We have revised the corresponding Practice Effect to be "Variety of crops grown, increasing crop rooting depth, which may include cover crops and preparations changing soil pH such as lime". We added an organic amendments application' practice effect, listed to be "Magnitude, form, method or variation in C:N ratio for organic amendments applied. Forms include and are not limited to biochar, mulch, compost, and manure, and methods encompass surface, subsurface, or irrigation-based application "

96. Row 5: Species of grazers, mixed or single species herds, loading weight, grazing time, rest/recovery period time/seasonality. **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have added "species of grazers, mixed or single species herds, loading weight, grazing time, and rest/recovery periods" to the Grazing category's Practice Effects.

2.2 Define the Project Domain

97. Far to general definition of project domain for accurate model development and calibration. Land resource region mapping is far too vague to be useful in most modeling. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Land resource regions represent distinct combinations of important biophysical features relevant to carbon credit modeling, including climate, geography, and land use. By requiring multiple LRRs in the specific requirements for validation, the model is tested under a wide range of such features in addition to variable soil textures, clay contents, and cropping systems. In response to your feedback, and based on extensive further consultation with model experts, we have made several changes to this guidance. We have added a sentence to Section 2.2.2 to highlight the utility of using LRRs: "LRRs represent distinct combinations of climate, land resource use, and geographic features." We have also added an allowance for non-US-studies to be included in validation if all criteria are met, and as long as two IPCC climate zones can be subsituted per required LRR. Section 2.2.2 now includes: "For regions outside the US, IPCC climate zones must be declared for each practice effect." Requirement 3 now lists among its requirements: "At least three declared LRRs (or two IPCC climate zones per each required LRR when drawing from studies outside of the US)

2.2.3 Declare Project Soils

98. Wide ranges of variation are embedded in these project soil descriptions. And, most descriptions date from the 1920-1940's and do not take into account the present condition and what an updated classification of the soil would identify as the existing texture class... **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have attempted to include the multiple highly relevant soil features known to influence modeled soil carbon biogeochemistry: soil textural class and clay content. Additionally, the protocol contains specific soil sampling requirements that help to fully characterize soil carbon status and responsiveness to practices over time.

2.3 Gather Validation Data that Meet the Following Requirements

99. Requirement 1: Five-year interim will be applicable to SE USA and Midwest USA. But, most other areas of the US, especially seasonal moisture regions, and regions dependent on irrigation water allocations should consider a 7-10 yr period. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Statistically detecting a change (or lack of change) in SOC or trace gases will be required of any experimental study used in validation. Further, there are new SOC monitoring techniques becoming available that may provide valuable datasets for model validation. Text modified to clarify more extended time frames may be necessary to observe statistically robust SOC changes. It now reads "In the case of SOC stocks, repeat measurements of SOC stock changes must be statistically robust to capture multi-year changes, as practice effects on SOC may combine short and long-term changes in soil biogeochemical processes. Statistically robust measurements from paired fields leveraging space-for-time analysis methods that approximate multi-year changes may also be used for SOC validation. Newer methods for SOC stock monitoring are becoming available that can observe changes with greater precision at shorter time intervals. These methods will be acceptable if there is peer-reviewed support for their use in SOC monitoring and demonstrate statistically robust evaluation of multi-year impacts on SOC stock changes."

100. Requirement 1: In land with moderate to high relief, error from CO_2 drainage and non-laminar or air mass mixing must be accounted for in calibration. Also., highly permeable, ditch, and tile drained soils underlying histic soils, and soils with highly organic embedded soil strata should account for dissolved, nitrogen and carbon losses that would not be measurable with chambers or flux towers. **(Apfelbaum)**

RESPONSE: Thank you for your comments. It would be beyond the scope of the protocol to require validation of fluxes beyond N2O, CH4, and CO2 from soil. It may be true that a certain model may need to be specially calibrated to capture dissolved C or N fluxes or other components of the C and N cycles in certain regions, but the guidance does not make requirements for calibration, only validation of the three primary gases. The model must show the fate of these through direct comparison. Other fluxes may also be irrelevant for empirical models that do not represent whole cycles or specific processes.

101. Requirement 2: The same confirmed soil textural and microsite conditions (e.g., slope, aspect, slope position, clay %, etc.) to match site conditions closely with the model calibration. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Validation data is expected to come exclusively from the peer-reviewed literature, and matching microsite conditions including slope, aspect, and slope position would be prohibitively burdensome (they are often not included at all in publications). We agree however that these can be important biophysical traits affecting carbon dynamics, so we will consider including some aspect of slope in future versions of this document.

102. Requirement 3: Fully annual cycle GHG flux measurements. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Seasonal scale measurements are allowed for the case when N2O or CH4 has been monitored on event or seasonal timescales. These are more difficult to model, and if successful provides confidence in the model's ability to

capture annual scale fluxes used in crediting.

3 Linking Validation Data to Model Prediction Error

103. Error should be shown to penalize for fewer points, fewer deeper-1 m depth soil samples -- and variances greater than 15% in estimation of mean SOC stock changes should also be penalized at a higher level. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Fewer and more variable data points now require penalization in credits, per the following new text: "The model prediction error calculation should be shown to penalize fewer data points (e.g., by using a weakly informative prior, Fig 1.B) and account for data variability (i.e. with a wider posterior when data are more variable; see Equations D.4, D.5), such that the uncertainty deduction in credits is higher when fewer or more variable data are available. Thus, in addition to demonstrating lack of bias or conservative bias, these guidelines require that both model accuracy and precision be quantitatively accounted for in the calculation of credits." Because most biogeochemical models are not yet designed to simulate to 1m depth, it cannot be calibrated for or thus included in error calculations.

4 Satisfying the Model Validation Requirements via Peer-Review

104. The stated purpose for the use of the modeling exercise should be included in the peer review process for transparency. A model created for creating high trust-level carbon and GHG offsets/emission reduction credits must be reviewed at a higher level than a typical academic peer reviewed model. **(Apfelbaum)**

RESPONSE: Thank you for your comments. We have added a new requirement to Section 4 stating: "Lastly, as a means of enhancing transparency with the peer reviewers, the authors must clearly state the purpose of the paper as being to validate the model for use in generating verifiable carbon credits."

A further requirement has also been included for an independent expert review of the non-peer-reviewed validation report, with pre-approval of the expert entity by CAR to ensure no conflict of interest. Lastly, model validation reports will be public documents.

5.1 Guidance on Model Calibration using Frequentist Approaches

105. Modeling should follow a standard process of
a) initial model runs incorporate best available data for each parameter intending to be evaluated during calibration.
b) Sequential calibration test run with individual parameter changes to an apriori test/activity level with results documented and reviewable.
c) Random split of data set into calibration and predictive test sub-data sets
d) reporting on the predictive accuracy of the calibrated model at estimating the "test" data subset using high "n" randomized monte carlo model simulation runs or equivalent so that no control over the sequencing of the modeling is allowed once calibrated. Proper use of a model without an accurate demonstration in predicting a test subdata set is discouraged. peer review that a model has been used appropriately based on peer review is not a customary acceptable way to demonstrate model validity. **(Apfelbaum)**

RESPONSE: Thank you for your comments. We believe it is too limiting to apply to a single standardized calibration procedure to all possible models employed by this protocol. The cited reference (Wallach et al.) lists a number of valid calibration approaches and special considerations to make depending on the model and the context of its application. Further, a standardized approach as suggested by the commenter may preclude the use of more advanced statistical techniques. We note that randomization is implicit in the process of k-folding referenced for Bayesian calibration approaches.
To help increase transparency into the selection and use of validation datasets, we have added new language to Section 2.3 Req 1: "Project developers must describe the methods, selection process, and data manipulations used to create the dataset applied in the model validation process. This includes describing search terms and databases used to identify available datasets, criteria used to select dataset sources, origin of extracted data (e.g. figures, tables, databases with DOI), original units of data, and data manipulations used to convert original units into the units described above. The project developer should report the number of validation data measurements of each data type (SOC, N2O and CH4) for each project domain combination of practice effect and crop type. The project developer should also report how the project area is distributed across the project domain in each of these project domain combinations. In the case where validation data are unevenly distributed compared to how the project area is distributed, the method used to link validation data to model structural error (described in more detail in Section 3 below) should demonstrate that it addresses the discrepancy."

5.2 Guidance on Bayesian Methods for Calibration, Validation, and Error

106. Yes, however, this is exactly what should be required to be able where there is reliance on modeling for making marketplace claims.

Another very important need is to not accept a modeled generated under baseline sampling as adequate for confirmation, acceptance or approval of results at some future date without confirmation sampling of the changes in carbon stocks. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Both frequentist and Bayesian methods represent important and viable approaches to calibration. The former has a well-established legacy in the literature, and the latter employs a more modern, advanced approach. We feel both deserve inclusion in the protocol.

RESPONSE: Calibration and validation guidance ensure that the model is specific for project quantifications of GHG fluxes (i.e., for what cropping system and biophysical conditions). Once this is established the model is used in the baseline (and optionally for the first 4 years of the project scenario), initialized by a measurement of SOC at t = 0. Please refer to section 5.1 for a detailed description of baseline modeling. Changes in SOC carbon stocks are required to be established via soil sampling at least every 5 years.

107. Page 6: Measured data (not observed data) must be used prior to modeled results becoming the basis for final transactions, marketplace claims. Baysian methods, multivariate, deep learning and AI methods are useful but should only provide a predictive framework that must be confirmed with repeat sampling over time. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Measured and observed are one in the same.

Please see section 5 of the protocol for a description of the requirement for repeat measurement, "Soil organic carbon levels must be directly measured in relation to the initiation of the project, as well as at least every five years thereafter".

108. Page 7: Biophysical models that account for dozens of landscape variables is often much more powerful and predictive of changes in time than biogeochemical models alone. **(Apfelbaum)**

RESPONSE: Thank you for your comments. Biophysical models commonly have biogeochemical models underlying estimates of soil carbon dynamics (Century is a sub-model of many DGVM's such as MC1, see https://consbio.org/products/tools/mc1-dynamic-vegetation-model). The protocol does not preclude the use of biophysical models containing biogeochemical sub-models.