SUMMARY OF COMMENTS & RESPONSES
DRAFT NITROGEN MANAGEMENT PROJECT PROTOCOL VERSION 1.0

17 sets of comments were received during the public comment period for the Climate Action Reserve (Reserve) draft Nitrogen Management Project Protocol Version 1.0. Staff from the Reserve summarize and provide responses to these comments below.

The comment letters can be viewed in their entirety on Reserve's website at http://www.climateactionreserve.org/how/protocols/agriculture/nitrogen-management/

COMMENTS RECEIVED BY:

1. Ag Carbon Market Working Group **(Ag Working Group)**
2. California Compost Coalition **(CCC)**
3. Camco **(Camco)**
4. Chris Gambino, Washington State University **(Gambino)**
5. Environmental Defense Fund **(EDF)**
6. Garrison Sposito, University of California at Berkeley **(Sposito)**
7. Lowell Gentry, University of Illinois **(Gentry)**
8. G. Philip Robertson, Michigan State University, Neville Millar, Michigan State University, and Adam Diamant, Electric Power Research Institute **(MSU-EPRI)**
9. National Wildlife Federation, Natural Resources Defense Council, Union of Concerned Scientists, Meredith Niles, Christina Tonitto **(NWF et al.)**
10. SES, Inc. **(SES)**
11. Sieglinde Snapp, Michigan State University **(Snapp)**
12. The Climate Trust **(TCT)**
13. Union of Concerned Scientists **(UCS)**
14. Union of Concerned Scientists, Meredith Niles, Christina Tonitto **(UCS et al.)**
15. WaterBalance LLC **(WaterBalance)**
16. Weyerhaeuser Company **(Weyerhaeuser)**
17. Willamette Partnership **(WP)**

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General Comments

1. CAR is to be commended for assembling a comprehensive nitrogen management offsets protocol that in general is robust, verifiable, conservative, and based on the best-available peer reviewed science. The method's flexibility is a strength, as is its clarity in most places. Specifically, we support several key design approaches of the protocol, including:

   • Inclusion of nitrogen rate reductions as a management practice to reduce N_2O emissions in crop production and for potential crediting as GHG emissions offsets;
   • Inclusion of the MSU-EPRI "Tier 2" quantification approach to quantifying N_2O emissions reductions associated with reducing nitrogen fertilizer application in corn production in the 12 state North Central Region;
   • Inclusion of the potential to accept additional management practices that may also qualify to be credited with N_2O emissions reductions in the future once additional scientific information can be developed and evaluated.
   • The intent to consider additional Tier 2 and Tier 3 quantification approaches (e.g., biogeochemical modeling) in the future once they can be further developed, calibrated and validated for specific regions and cropping systems.
   • The intent to consider the circumstances under which N_2O emissions reductions may be "stacked" along with credits for nitrogen management practices that may be creditable under evolving water quality credit trading programs.
   • Consideration of the need for offset aggregation in order to scale up emission reductions and reduce transactions and verification costs. We support the decision to incorporate aggregation guidelines within the NMPP v1.0 methodology itself. We also appreciate the flexibility provided by allowing single field as well as multi-field projects to participate in an N_2O project. **(MSU-EPRI)**

   RESPONSE: Thank you for your comment.

2. The Climate Trust supports the Reserve's development of this protocol, particularly its efforts to standardize project eligibility and accounting procedures. The Reserve's emphasis on standardized eligibility and accounting standards is a welcome contribution to help streamline and increase transparency in the approval and verification of emissions reductions achieved by these projects. Continued efforts in this direction are vital to ensure more cost-effective projects can be developed by reducing transaction costs without compromising the high quality credits the Reserve has built a reputation on.

   We support the Reserve's sustained attention to aggregation in this protocol, as these policies will play an indispensable role in delivering a meaningful level of emissions reductions through nitrogen management projects.

   In addition, The Climate Trust supports the Reserve in continuing to expand the eligible range of offset project types and activities, including to additional nutrient management practices. In this methodology, the Reserve rightfully acknowledges the uncertainty in our current scientific understanding of the N_2O emissions corresponding to various nutrient management practices. In practical terms, however, limiting an offset methodology solely to N-rate reductions is also likely to constrain the accessibility of the methodology to farmers for whom N-rate is one of a variety of management considerations whose costs and benefits are likely to significantly outweigh any funding that ultimately derives from offset crediting. The Climate Trust fully

supports the Reserve's emphasis on scientific rigor and intent to consider and adopt scientifically robust quantification methodologies for additional nutrient management practices beyond N-rate reductions. We look forward to reviewing those additions to the NMPP in the future. **(TCT)**

RESPONSE: Thank you for your comment.

3. This protocol will be a challenge to implement at scale. A number of factors make it difficult to drive down emissions from corn production with this type of approach including:
   • Fertilizer is the most important variable farmers can control to ensure high yields at harvest. Asking a grower to reduce N application rate raises real concerns that the overall yield may be reduced.
   • Midwestern fields can produce 170 or more bushels of corn per acre, but most farms will generate less than 1 carbon credit per acre. Offsets cannot compete with cash payments for crops, especially when corn prices are near record highs. A methodology that covers a wider range of practice change based on the 4Rs of nutrient management and that emphasized increasing nitrogen use efficiency would be more readily adopted.
   • The potential credit value generated by the NMPP is modest. Driving behavior change with such a small financial incentive is very difficult.
   • Individual farms are unlikely to be able to take advantage of the NMPP. The transaction costs are too high for individual farms and the protocol requires aggregation to reduce uncertainty. **(Camco)**

RESPONSE: The Reserve agrees that nitrogen management, and particularly fertilizer N rate, is one of the most important tools a grower has at his disposal to ensure that he is optimizing yield. However, studies show that many growers could reduce N rate somewhat (by up to 12-20%), without affecting yield.[1] According to a USDA report on nitrogen in US agricultural systems, 35% of corn-growing acres nationwide (38% in the Corn Belt) were determined to not meet best management practice for N-application rate.[2] So there will very likely be some farms where significant N rate reductions are possible. Furthermore, although the carbon incentive is small in comparison to cash payments for crops, it may nevertheless be sufficient to address the marginal *risk* of yield loss associated with reducing N rate where over-application is occurring. To help address uncertainties related to that risk, project participants are given a grace period for passing the performance standard. Further, because we recognize that any grower experiencing significant yield loss while enrolled in the program will not likely stay enrolled, we have added language to the protocol that encourages adoption of a number of enabling practices, to help growers reduce their N while maintaining or increasing yield (see comment response #10).

In addition, the Reserve has made a number of significant changes to the protocol based on the public comments received, in an effort to simplify a number of requirements, streamline verification, and reduce transaction costs. Record-keeping requirements have been reduced, clarified, and streamlined. Site-visit requirements have been reduced, while guidance for verifiers on how to verify N rate reductions have been

[1] According to the T-AGG Literature Review (2012), Smith et al. (2008) estimated up to a 20% reductions in N fertilizer application rates may be feasible, while Millar et al. (2010) estimated potentially 12% to 15% reductions without impacting yield.
[2] Ribaudo, Marc, Jorge Delgado, LeRoy Hansen, Michael Livingston, Roberto Mosheim, and James Williamson. *Nitrogen In Agricultural Systems :Implications For Conservation Policy. ERR-127*. U.S. Dept. of Agriculture, Econ. Res. Serv. September 2011.

expanded. See comments 101 through 115 for additional information on the revisions to Sections 7 and 8 of the protocol.

4. At a time when international best practice is moving towards ever-simplified, easily-monitored and easily-verified climate protocols, this protocol clearly goes against the trend. As, for example, the UNFCCC's Clean Development Mechanism (CDM) Executive Board moves towards simplified methodologies, standardised baselines, and significant reduction of transaction costs for aggregating, generating reductions, monitoring and verifying those reductions from small-scale activities, this protocol would impose far more time-consuming, far more onerous procedures. (**Camco)**

   RESPONSE: The Reserve recognizes the value of simplified methodologies with standardized baselines and additionality assessments. In fact, as a program, the Reserve is committed to standardized methodologies, to every extent possible, as discussed in our Program Manual. In this protocol, we have attempted to incorporate standardized eligibility determinations, simplified monitoring and quantification requirements (e.g., those that do not rely on complex modeling), and streamlined aggregation procedures to the extent possible while maintaining sufficient rigor to generate credible carbon offsets. However, as many of the comments submitted note, agricultural systems are also known for their site-specific conditions and management practices chosen to address them, making a standardized methodology challenging (to date, CDM methodologies have not addressed these kinds of systems). In response to comments, we have made a number of final revisions to the protocol to reduce site-specific inputs and streamline verification (see comments relevant to Sections 5 and 8). With these revisions, we hope we have struck an appropriate balance between streamlined accounting (most notably with the Tier 2 emission factor) and site-specific monitoring and evaluation, where necessary.

5. The NMPP does not provide enough incentive to overcome natural obstacles to its adoption. Changing fertilizer management practices is a big "ask" of farmers and requires sufficient incentive to risk lowering yields. The combination of strict performance standard, short crediting period (in some cases less than 5 years), transaction costs (data collection, baseline development, monitoring), and high verification costs will discourage adoption.

   It is Camco's opinion that practically, realistically, this version of the protocol will not be successfully adopted by corn growers and their aggregators; very few farmers will utilize this protocol to obtain emission reduction credits for improving their nitrogen use and management. A key test to any protocol must be its relative ease of application and utilization by the target participants. The more complex and difficult a protocol is to apply, the less it will be utilized and the less relevant it is to its target audience. This protocol, in its current format, fails on these counts. **(Camco)**

   RESPONSE: These concerns are duly noted, and we have made a number of revisions to the protocol to increase its ease of use, as well as reduce site visit verification requirements and other transaction costs associated with the protocol. (See comment responses for Section 5, 6, 7, 8). Further, as with all protocols, the Reserve will monitor protocol adoption and continue to solicit stakeholder feedback on how the protocol can continue to be improved.

2.1.1 Potential Nitrogen Management Practices and N_2O Quantification in this Protocol

6. Initially, CAR considered a much broader suite of management activities (Table 2.1, p. 5) but did not include any of them in this draft protocol. We encourage continued efforts to compile data sufficient to create appropriate N_2O flux functional relationships across varied cropping systems. **(UCS et al.)**

   RESPONSE: Thank you for your comment. The Reserve plans to continue efforts to expand this protocol, as new N_2O emissions data becomes available for additional management practices, cropping systems, and regions.

7. As you look to further develop this protocol, we suggest you consider putting in place a process for updating the protocol to incorporate new data, methods, and approaches as they become available. We know that you intend to expand the protocol, but we further suggest that you outline a process for adopting improvements to the protocol to allow for additions and further developments where sufficient data exists to:
   - Add activities, crops and regions;
   - Further update the methodology to reflect the latest data and methods; and
   - Add verification tools and approaches. **(EDF)**

   RESPONSE: The Reserve does have a process already in place for updating our protocols to incorporate new data, project types, methodologies, etc. As outlined in our Program Manual, approval by the Reserve's Board of Directors is needed for more substantial revisions, such as revisions to eligibility criteria and inclusion of new project types. That said, the Reserve has expanded language in Appendix D of the protocol, in an effort to clarify further how we will prioritize additional project activities, crops, and regions specifically for the NMPP. Further, the Reserve will work to put a transparent process in place for identifying further additions and keeping our stakeholders informed of ongoing updates.

8. Since the criteria is already laid out in the protocol, we recommend there be a process to bring new management practices and/or locations for consideration a eligible projects *without having to wait for a future version of the protocol*. **[See Weyerhaeuser public comment submission, General Comments, for further detail.] (Weyerhaeuser)**

   RESPONSE: The Reserve does intend to establish a process for including new management practices, crops, and geographic areas in the protocol over time. At this time, however, we believe that such additions – since they may entail elaborations of the methodologies prescribed in the protocol – should be made following our standard procedures for protocol updates. As we gain experience evaluating and incorporating new additions, we will look for ways to expedite updates where possible.

9. At current, the protocol only applies to reduced nitrogen application for corn in twelve states. We were glad to see that more activities, crops and locations could be added as the data becomes available. Selection criteria for additional crops could include: (a) crops that already have baseline N_2O emission measurements through research; (b) crops with significant total acreage and more intense use of nitrogen fertilizer; (c) crops for which management practices that reduce N_2O emission are economically and technically feasible. We recognize the significant future potential for this protocol and look forward to working with you to expand the range and

applicability. **(EDF)**

RESPONSE: The Reserve agrees that criteria a, b, c are important to consider, as we scope additional management practices, crops, and regions to be included in later protocol versions. In fact, such considerations did contribute to the decision to focus on corn in the North Central Region in this protocol. We have added language to Appendix D of the protocol to highlight these three selection criteria in the list of criteria that will be considered as we make determinations about additional protocol expansions.

10. The NMPP is wisely designed to evolve over time to incorporate new quantification approaches as they mature. This current version only applies to corn fields where a majority of N_2O emissions from soils occur. In addition, the current methodology only quantifies reductions related to a decrease in the total rate of N application. However, we know that good nitrogen management involves all of the 4R's of nutrient management; The Right Rate, at the Right Time, in the Right Place, and from the Right Source of N. Other N management practices based on the rest of the 4Rs should be rapidly developed. **(Camco)**

    RESPONSE: We agree that methodologies addressing additional N management practices, including those involving each of the 4Rs, should be developed. In the meantime, the Reserve believes project participants are likely to implement practices based on the 4Rs, as well as other best N-management practices, to enable the N rate reduction credited under this protocol. Due to this and other comments received, the Reserve has added language to the protocol to encourage additional best management practices as a way to enable the N rate reductions, while maximizing yield. Additionally, language has been added to the monitoring and record-keeping sections of the protocol (Sections 6 and 7) to encourage additional monitoring of these "enabling practices," so that if any of these practices become eligible for additional crediting in the future, the proper records will have been kept by the project participant to enable their inclusion.

11. New methodologies should be allowed and fostered to establish a more complete basis for measuring N_2O reductions in Midwestern corn production. It is more important to get the corn belt methodology correct than it is to prioritize work on other crops and regions where the potential reductions are much lower. This must be a priority in order to drive adoption and acceptance of this Protocol. Experience has shown that growers are more willing to hear about approaches to enhanced N efficiency when a broader management approach is planned. A singular focus on rate reduction is unlikely to lead to broad participation, but rate reduction taken as part of a broader suite of activities will lead to better grower acceptance. **(Camco)**

    RESPONSE: The Reserve agrees that maximizing N_2O emission reductions in Midwestern corn production is important. In the case of the NMPP, ongoing improvements to the current methodology are expected, along with efforts to continue to expand the protocol to new regions, crops, and project activities. With respect to inclusion of a broader suite of activities, please see the response to comment #10.

12. This version of the NMPP is intended to establish not only the framework for future versions of the Nitrogen Management protocol, but perhaps to get interested parties thinking about additional activities that might pass muster with CAR. I applaud your work which so certainly plants the seed for north central growers, surely our largest nitrogen users, potential conservation of nitrogen fertilizer and unintended, detrimental consequences.

    There are certain other dimensions that could be considered. Firstly, the intimate relationships

between water management, soil microbiology, as well as other macro-nutrients relative to soil nitrogen and NUE. In irrigated agriculture, it is almost unheard of to consider nitrogen use efficiency without water management. Likewise, it is difficult to imagine water use efficiency without consideration of nitrogen and phosphorus nutrition.

If we could next focus upon the fertigation activity, we might begin to shape the realities of western growing conditions. Because we can nearly perfectly account for water movement through the rootzones of irrigated/fertigated crops, we can therefore directly improve yield while accounting for most of the nitrogen. Teasing apart which is the largest contributor to those yield metrics is only possible with prescription fertigation, with very formal mapping of rootzone monitoring. **(WaterBalance)**

RESPONSE: The Reserve recognizes that water management can significantly impact N_2O emissions. We also recognize that the project type of switching from other irrigation methods to fertigation may have significant N_2O emission reduction potential. Fertigation will be considered for inclusion in the next version of the protocol, along with the other practices prioritized for protocol development (listed in Table 2.1 in the protocol), depending on data availability for developing a performance standard and quantification methodology. Please see comments #7-11 for additional information on the Reserve's priorities for the next version of the protocol.

13. Version 2.0 of this protocol should consider provisions for quantification of nitrous oxide emission reductions when converting annual cropping systems to perennial grasses or other perennial crops that require less N inputs. **(SES)**

    RESPONSE: Thank you for your comment; this will be taken into consideration for future protocol development. The Reserve has taken a modular approach to the development of the Nitrogen Management Project Protocol, allowing for future expansion of the project definition and quantification methodology. In addition, the Reserve is currently exploring the development of a project protocol for the emission reductions associated with the avoided conversion of grasslands and the conversion of marginal cropland to grasslands. The issue paper addressing this potential project type is expected to be completed and made available to the public towards the end of 2012.

High-Level Methodology Comments: Tier 1 vs. 2 vs. 3

14. The quantification approach contained in the NMPP applies to the approved project activity of N rate reduction only. Additional practices that have been shown to reduce N_2O emissions include changing timing and form of N applied, based on the widely acknowledged 4R's of nutrient management. Work on a standardized quantification methodology that can address the other aspects of 4R management is urgently needed to allow for this protocol to incentivize broader emission reductions. CAR should continue working with the SAC to investigate Tier 2 approaches or the use of DNDC or similar biogeochemical models. **(Camco)**

    RESPONSE: Please see the response to comment #10. As we incorporate expanded methodologies over time, Tier 2 and Tier 3 approaches (including DNDC and other biogeochemical models) will be considered. The Reserve plans to continue to engage the Science Advisory Committee as part of this process.

15. Scoping reviews of the theoretical potential for reducing N_2O emissions have typically identified corn cropping and the reduction of nitrogen fertilizer application rates as the single largest opportunity for achieving N_2O emissions reductions in the United States. This NMPP justifiably prioritizes this single combination of crop and nitrogen fertilizer management practice, but unnecessarily limits its scope to corn in the North Central Region.

    The Climate Trust supports the immediate inclusion of an approach that would allow for a broader set of cropping systems and geographies. In particular, The Climate Trust encourages the Reserve to utilize the IPCC Tier 1 emissions factor for N_2O from fertilizer applications, derived from an even broader dataset covering more cropping systems and geographies, so that the methodology could be immediately applied beyond corn crops in the North Central Region. A similar approach has been included in the MSU-EPRI methodology currently undergoing validation for the Verified Carbon Standard, and could be easily adapted for the NMPP. **(TCT)**

    RESPONSE: The Reserve recognizes that the MSU-EPRI methodology, which was the basis for the Tier 2 emission factor used in the current NMPP, also includes an approach for quantifying N_2O emission reductions from non-corn crops using the IPCC Tier 1 emissions factor. However, the Reserve respectfully disagrees that this Tier 1 emission factor should be included to quantify a broader set of crops and regions. While the Reserve recognizes that there are many studies indicating that a Tier 1 approach is conservative in many areas and for many crops, other studies suggest there will be a significant number of situations where a Tier 1 emission factor is not conservative. For example, Burger and Horwath (2012) found that emission factors for lettuce and wheat in California are lower than 1% (i.e., lower than the Tier 1 emission factor).[3] In those cases, the Tier 1 approach would overestimate emissions reductions. However, the Reserve will continue to seek out the latest datasets and N_2O field studies in an effort to include additional Tier 2 emission factors and/or calibrate and validate the DNDC model for use in future versions of the NMPP.

16. We support CAR's proposed adoption of the MSU-EPRI Tier 2 quantification approach for corn grown in the NCR given the scientific validity of this approach. At the same time, we urge CAR to consider increasing the geographic breadth and range of crops included in the NMPP V1.0 by reconsidering use of an IPCC Tier 1 approach to quantify N_2O emissions reductions in other states and crops where a scientifically valid, peer-reviewed Tier 2 approach has not yet been developed.

    As noted in a recent CAR webcast, the use of a Tier 1 approach may reduce the number of N_2O emissions reductions offsets generated from a reduction in N fertilizer inputs, but it will nonetheless provide these farmers with an incentive to reduce their N application rate without threatening the environmental integrity of the resulting offsets. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: Please see the response to comment #15.

17. Research has flourished since the IPCC, 2006 Report and updated data should be the basis of current calculations. **(Gambino)**

[3] Burger, M. and Horwath, W.R. (2012). Assessment of Baseline Nitrous Oxide Emissions in California Cropping Systems. Final Report. California Air Resources Board, Contract No. 08-324.

RESPONSE: The Reserve acknowledges the considerable amount of research that has been conducted since 2006, the publication year of both the IPCC report and the authoritative Stehfest and Bouwman (2006) review study, upon which the Tier 1 emission factor was largely based. The Reserve has made every effort to incorporate the most up-to-date data and science in this protocol, and we convened a Science Advisory Committee to help interpret and apply this science and to point out new data sources where applicable. The Reserve is not aware of a comprehensive update to the Stehfest and Bouwman (2006) dataset on N_2O emissions and emission factors. Unfortunately, it was beyond the mission and the scope of the Reserve's effort in designing this protocol to provide a full and scientifically valid review study of the most recent literature on N_2O emissions. Therefore, the Reserve relied on the most recent comprehensive review studies, particularly the Technical Working Group on Agricultural Greenhouse Gases (T-AGG)'s extensive literature review and analysis, published in its Third edition in January 2012.[4] The Reserve will certainly continue to follow the literature closely and will revise the protocol appropriately if a new literature review or comprehensive datasets become available.

18. We recognize CAR's attempt to evaluate and use the most robust datasets and methodologies available. As you know, EDF has experience with using the De-Nitrification De-Composition (DNDC) model to project changes in GHG emissions, including working with CAR to develop a methodology for rice GHG offsets. We feel that DNDC is a good example of a model that can be used to accurately assess GHG emissions at the farm scale. Because of this, we are currently conducting research to calibrate and validate the DNDC model for corn in the Midwest. We feel that calibrated and validated process models (like the DNDC model) can provide a greater level of accuracy. While adding more factors increases complexity, it can also increase accuracy by incorporating differences in soil types and climate, which can have a large impact on actual N_2O emissions.

    The emissions factor approach used in the protocol does not take into account factors like weather, soil type or residual levels of nitrogen in the soil from crop residue. These factors play a significant role in the year-to-year and place-to-place variation in the level of nitrogen application, uptake and emission. Including these factors, whether using a model like DNDC or other approach, could provide a higher level of accuracy to the methodology. (EDF)

    RESPONSE: The Reserve agrees that factors such as weather, soil type, and residual nitrogen are crucial for N_2O emission calculations. The Reserve also agrees that DNDC is a good biogeochemical process model that can accurately assess GHG emissions when properly calibrated and validated. The Reserve's Rice Cultivation Project Protocol (adopted December 2011) relies on the DNDC model to quantify methane emission reductions in California rice fields. Members of the NMPP stakeholder workgroup (and the Science Advisory Committee) acknowledged the value of the DNDC model in general, but did not believe that sufficient calibration of the model had been done to support an offset protocol targeting N_2O emissions. However, we are aware that calibration efforts are underway. For example, we acknowledge the efforts of the Environmental Defense Fund and the California Air Resources Board to develop and compile datasets geared towards calibrating and validating DNDC for the quantification of N_2O emissions reductions from various agricultural management practices and cropping systems in the Corn Belt and California, respectively. The Reserve will continue to evaluate DNDC and

[4] Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States: A Synthesis of the Literature (Third Edition)

will consider including a quantification methodology based on DNDC in a future version of this protocol.

The Tier 2 emission factor the Reserve chose to use in the NMPP has been calibrated for use in a defined geographical area. The Reserve also conducted a sensitivity analysis on variables for soil clay content and soil organic carbon (SOC) content, to evaluate the robustness of the emission factor within the applicability region. Based on that sensitivity analysis, the Reserve further restricted the applicability conditions in Section 5.1, as is further elaborated in comment #82. Furthermore, there was consensus among members of the Science Advisory Committee that this emission factor could be used when appropriately discounted for uncertainty or variability due to the factors mentioned in the comment.

2.1.2 Project Aggregation

19. The concept of pooling uncertainty and cost is found at the beginning of the Protocol. But, then, it is cast away by the extremely detailed and extensive record keeping, data collection, data analyses, and data monitoring and verification such that it eliminates the benefit of aggregation. Likewise, it is difficult to believe that any single farmer would have the inclination to pursue this, as the costs and level of effort to qualify are so onerous. **(Camco)**

    RESPONSE: The Reserve has worked to develop monitoring, reporting, and verification guidelines that minimize burdens to the greatest extent possible while also maintaining a high degree of integrity. Based on this and other comments, we have made a number of important changes to the monitoring and verification requirements of the protocol to help reduce these burdens further. Please see the responses to comments #102-116 for additional details about the changes that have been made to the final protocol. The Reserve will continue to monitor how well the protocol works in practice and if necessary will seek ways to make it easier to use in future versions as long as the accuracy and integrity of GHG reduction calculations can be maintained.

20. The vast majority of offset protocols have been written for point source quantification – very few have been prepared to measure environmental benefits from a program of small scale activities enacted over broad geographic areas with multiple project participants. The fundamental principles of a point source approach are not very relevant to bundled or aggregated small-scale activities that each have multiple sources of emissions and each of which can only be viewed, from a protocol's perspective, as parts of a whole. Treating each field as a point source puts enormous burdens on both project participants and aggregators in terms of data requirements to set baselines and to monitor, report and verify any emission reductions against those baselines. **(Camco)**

    RESPONSE: While each field in a Nitrogen Management project does represent a unique source of GHG emissions, the Reserve agrees that it would be overly burdensome for each field within a project aggregate to be held to the same requirements as the project as a whole. That said, the credits that are generated by these projects must be held to an equally high level of integrity as credits from other project types. Thus, the protocol seeks to provide a methodology that maintains this integrity without being overly burdensome for the project developers and farmers. In light of various comments received, we have made a number of important changes to the monitoring and

verification requirements of the protocol. Please see the responses to comments #102-116 for additional details about the changes that have been made to the final protocol.

2.2 Project Definition

21. In the definition of approved project activities (Table 2.2), the Reserve describes the approved activity of Reducing N Rates as "reduction in the annual nitrogen application rate… *without going below N demand*" (emphasis added). The Climate Trust fully supports this addition to the project definition, which the NMPP attributes to a request from the Scientific Advisory Committee. In the current draft, this requirement is not mentioned or reflected anywhere else in the NMPP text. It is therefore unclear whether any changes to the NMPP have been made to ensure this critical addition to the definition of the project activity is being meaningfully integrated into the NMPP requirements.

    The Climate Trust would prefer to see a clearer articulation of how the Reserve intends to reflect the project activity definition that N rates not be reduced below crop demand elsewhere in the NMPP, especially in the discussion and calculation of Performance Thresholds. **(TCT)**

    RESPONSE: The need for this particular phrase in the project definition was discussed with both the stakeholder workgroup and Science Advisory Committee and there was general consensus that it was necessary to make it clear that projects should not generate GHG reductions at the expense of crop productivity. There are multiple mechanisms in the protocol that further support this intent. The performance standard test based on general measure of nitrogen use efficiency and designed to improve N-use efficiency, as opposed to focusing on just the reduction in N application rate. Further, the requirement to quantify GHG leakage effects (e.g. when yields decline) provides an incentive to avoid yield losses. The Reserve also believes that farmers are unlikely to deliberately risk substantial yield losses out of financial concerns. Language was added to the protocol to make these connections more clear.

22. This protocol uses a simple metric – reduction in emissions of N_2O per unit of land (acre) – for crediting. This is not the appropriate metric when dealing with ever increasing demands on farmers to supply food, fuel and fiber for an expanding population. In a situation where over thirty years of intensification of corn yields per unit of land in the targeted area (the US Midwest), a more appropriate unit of measuring emission reductions is N_2O reductions per unit of output (lb N_2O-N/bushel). GHGs attributable to land use cannot be dealt with in a point source manner. If rate of application is to be used, then, that rate should be measured against output, not against a unit of land to which it is applied. **(Camco)**

    RESPONSE: Thank you for your comment. However, the Reserve respectfully disagrees that measuring N_2O reductions per unit of output (lb N_2O-N/bushel), in which the focus is reducing the GHG emission intensity of N_2O per bushel of corn, is a more appropriate metric than N_2O per unit of land. The concern with a production intensity approach is that it would in principle allow farmers to receive credit for displacing more GHG-intensive production on other lands. This would result in the crediting of indirect emission reductions, which the Reserve generally seeks to avoid in accordance with best

practices for offset accounting.[5] The Reserve believes that the performance standard threshold, derived from a field's N rate and historic yields, effectively accounts for field-specific output in N rate targets. Further, allowing fields to use their site-specific baseline also accounts for output.

23. While farmers are interested in participating in offset markets, they must be assured that if significant changes in practice result in reductions in yield there are contingencies for insurance or aid in place. Farmers face serious financial challenges if they suffer significant yield losses and many will not risk their current yield levels if there is not come sort of safety net. **(Ag Working Group)**

    RESPONSE: The Reserve recognizes that real and perceived risk is a potential barrier to participation; however, the Reserve as an organization is unable to provide insurance for such risk. Our hope and expectation is that yield-loss risks will be effectively addressed by other participants in the carbon market, e.g., project developers/aggregators. That said, additional language has been added to the protocol to encourage the adoption of additional best management practices (e.g. "enabling practices" that allow an N rate reduction while maintaining or increasing yield). See the response to comment #10.

24. Nitrogen fertilizer, beyond its value to crops as a nutrient, is often considered as a risk mitigation strategy for farmers. Particularly when commodity crop prices are high, as they have been for corn recently, farmers may reasonably apply nitrogen fertilizer to a modest extent above the minimum level required to meet plant demand to ensure a profitable yield. The NMPP's current exclusive focus on N-rate reductions is justified through the discussion of the current state of science, but will nevertheless likely raise farmer concerns that this methodology does not adequately consider or reflect the farmer's fundamental need to sustain yields and remain profitable.

    The potential threat to yields from N-rate reductions, and in the extreme, the progressive depletion of soil nitrogen, should be a concern for policymakers generally, but should also be anticipated as a serious concern to any farmer considering participation in a nitrogen management project under this protocol. Even if the NMPP is revised in a way that ensures no economic or environmental risks would be introduced by following the NMPP guidelines, farmers considering participating in a nitrogen management project will be particularly sensitive to these issues, and the NMPP would benefit from a more explicit recognition and treatment of the expected concerns and risks farmers are likely to perceive.

    The Climate Trust encourages the Reserve to address these potential risks directly and prominently in the protocol to help assuage concerns that participating in a nitrogen management project following this protocol would make a farmer more likely to experience reduced yields or profitability. **(TCT)**

    RESPONSE: As noted in the response to comment #23, above, the Reserve recognizes that real and perceived risk is a potential barrier to participation. As recommended, we have made an attempt to address these perceived potential yield risks more directly, by adding language to the protocol encouraging the adoption of additional measures to mitigate this risk. We have reduced the stringency level of the performance standard

[5] See, for example, the Reserve Program Manual, p. 31, as well as Offset Quality Initiative, 2008. *Ensuring Offset Quality: Integrating High Quality Greenhouse Gas Offsets Into North American Cap-and-Trade Policy*. Available at: http://www.offsetqualityinitiative.org/.

somewhat, as well as clarified the limitations of the simplified RTA calculation, to address the possible misperception that the protocol encourages the progressive depletion of soil nitrogen. (Please see response to comment #44 for further information on the RTA)

25. The Climate Trust believes the sustainable production of food to meet the needs of a growing global population should not be discouraged by any offset policies being considered now or in the future. In practice, the management of nitrogen should be considered as one component of a comprehensive nutrient management strategy. The NMPP focuses narrowly on the management of nitrogen, which is intuitive given its focus on reducing N_2O emissions, but The Climate Trust would nevertheless encourage the Reserve to consult the Scientific Advisory Committee with a directed discussion on whether there are unintended environmental or economic consequences that may be likely based on the prescribed rules and guidelines in the NMPP, especially the Performance Standard and Thresholds and policies regarding manure use. **(TCT)**

    RESPONSE: We have consulted several stakeholders on these issues, including the Science Advisory Committee, and have found no indication that adherence to this protocol would, in any way, interfere with the ability to implement best management practices and/or sustainable production of food, nor do we expect it to have any unintended environmental consequences. As discussed in the responses to comments #68, #72, and #86, the protocol's approach to accounting for manure applications has changed significantly, in response to stakeholder comments.

26. It appears that the only N management method that meets protocol requirements is reducing the amount of N applied. Often growers are able to reduce N rates by applying a different type of fertilizer, such as the use of nitrification and urease inhibitors, which reduce N-losses to the atmosphere, and therefore reduce the amount of N-applied needed because more remains in the soil. Would such a practice (i.e. reducing the amount of N-applied because of switching fertilizer type) still be considered eligible?

    We recommend clarifying that the reduction in N-applied can be achieved through any means as long as the yield remains the same. **(Weyerhaeuser)**

    RESPONSE: The Reserve has revised the protocol to clarify how the reduction in N-applied can be achieved, in particular clarifying that the protocol allows for any number of enabling practices (changing timing, adding cover crops, changing application method). However, only emissions reductions associated with a reduction in N rate are able to be quantified and credited at this time. Accordingly, although the quantification methodology credits reductions in N rate due to switching fertilizer type, it does not allow quantification of any additional emissions reductions that occur due to different N_2O emission intensities of various fertilizer types.

27. We encourage you to consider ways to integrate novel approaches to improved crop N management. EDF has extensive experience with farm-level nutrient management through our work with adaptive management. Adaptive management is a process by which data on crop needs and N-response is used to inform better decisions about nutrient application. Adaptive nutrient management <u>using tools such as replicated strip trials, aerial imagery, cornstalk nitrate testing, and other tools has been shown to help farmers reduce nitrogen applications by 20% or more without reducing yields.</u> Use of these tools enables farmers to fine tune the initial recommendations in a nutrient management plan, tailoring them more effectively to the actual

conditions on a given field. The CAR protocol at current offers a way to credit more efficient nitrogen application, but it does not specify how a producer can achieve these improvements in nutrient efficiency (without affecting yield). The appropriate level of nitrogen application is based on a complex set of factors, including weather, soil type and previous cropping history. Tools like adaptive management can be used to improve decisions about nutrient application and could be integrated into the protocol. CAR should evaluate how these types of approaches can be used in coordination with the protocol to achieve more efficient nutrient application and wider adoption of the protocol by growers. **(EDF)**

RESPONSE: Thank you for your comment. The Reserve agrees that tools used in adaptive nutrient management can serve as enabling tools for a farmer to successfully reduce N rate and improve nitrogen use efficiency without affecting yields. Language has been added to the protocol to encourage the use of such enabling practices (such as strip trials, nitrate testing, variable rate technology, etc.) in section 2.2 of the protocol. Further, the protocol now requires Corn Stalk Nitrate Tests (CSNT) be performed for all fields, at the end of each reporting period, as a tool to supplement verification activities (please see the response to comment #107 for full discussion), and the Reserve believes such a tool can also be used by growers to continue to improve their N rates over the course of the project, as site-specific data accumulates.

2.2.1 Defining Field Boundaries

28. The footnote here is important and belongs in the body of the text. “This definition of field boundaries is not meant to exclude the implementation of variable rate technology; small variations in rates across a field are acceptable (within 15 percent of the average application rate for the entire field).” **(NWF et al.)**

    RESPONSE: The protocol has been revised to clarify in the body of the text, as opposed to a footnote, that variable rate technology (VRT) is actually encouraged in the protocol as a way for growers to implement the project activity (N rate reductions) without impacting yields (See responses to comments #10 and #27). Additionally, after further consultation with the Science Advisory Committee and precision agriculture experts, the Reserve decided to remove a limitation on VRT that would have only allowed small variations in rates, as we determined such a limitation would unnecessarily hinder the implementation of VRT by progressive farmers.

29. Field definition should not preclude strategies to reduce N_2O emissions within the field. The footnote allows for use of precision or variable rate technologies but as written would exclude other techniques used to target specific areas of the field where moisture and soil characteristics combine to create an emission “hot spot.” In the current draft this could include manually adjusting application rate on certain portions of a field and in future versions of this protocol, additional practices such as applying nitrification inhibitor products could/should be allowed within a field. Localized variances of application rate greater than +/- 15% may be justified as effective strategies to reduce N loss. CAR should increase the 15% limit on variations within field. **(Camco)**

    RESPONSE: As noted in comment #28, the Reserve agrees that the +/- 15% limit on N rate variability for a field was too restrictive. We recognize that adjustments to N rate within the field could be an important part of improved N-management. The field

boundary definition has been revised, removing language that requires a homogenous N rate across the field.

30. CAR should reconsider the definition of a field, recognizing that in most cases a field is defined in legal documents already as part or all of a parcel of land within a given Section or county. Any clearly referenced geographic area adequately defined and supported by aerial and satellite photography and used consistently across the baseline and crediting time period should satisfy the protocol's criteria. **(Camco)**

    RESPONSE: The Reserve agrees that a consistent definition of a field by a grower, across both the baseline and crediting time period, should generally satisfy the field boundary definition. The Reserve has expanded the field boundary definition to allow it to reflect the boundaries by which a field has been historically managed. Field boundaries as defined in legal documents may be helpful in determining appropriate boundaries as well. However, legal boundaries are not sufficient, as a grower could decide to plant a portion of a legally defined field with a different crop at any time. Aerial and satellite imagery, as well as legal documents referencing field boundaries, have been included as recommended data points for defining field boundaries in the verification section of the protocol.

2.4.2.2 Leaving an Aggregate

31. "Fields can switch their participation to another aggregate during a crediting period if and only if... 3. The aggregator breaches its contract with the project participant."

    Who determines if the contract has been breached? What if the Aggregator and project participant disagree? **(Camco)**

    RESPONSE: Language in the protocol has been clarified so that if a contract between the Aggregator and a project participant is *terminated* due to a breach of contract, then the project participant may change to a new aggregate. The Reserve will continue to evaluate how best to address movements of fields between aggregates and will consider changes to the protocol (such as requiring evidence of cause for termination) in a future version, if it seems like the methodology for a field to leave an aggregate is proving to be problematic.

3.2 Start Date

32. The start date seems unclear. June 27, 2010 is listed, but in Eligibility Rule 2, the start date can only be six months prior to submission. Given that submission is impossible before the protocol is approved, we do not see how this will be possible. **(NWF et al.)**

    RESPONSE: Language in the protocol, including in Section 3.2 and the Eligibility Rules Box, has been clarified. Submission of projects may commence as soon as the protocol is adopted by the Reserve Board. The Reserve's policy, as outlined in the Program Manual, is to "accommodate early actors for a period of time following the adoption of new protocols, but to otherwise restrict eligibility to new projects. For a period of 12

months following the adoption by the Reserve Board of any new protocol, the Reserve will accept projects for listing with start dates (as defined in the protocol) that are no more than 24 months earlier than the date of the Reserve protocol's adoption," which will be June 27, 2010, assuming the Reserve Board adopts the protocol at its June 27, 2012 meeting. "After the 12-month period following the date of the Reserve protocol's adoption, the Reserve will accept projects for listing with start dates (as defined in the protocol) that are no more than 6 months prior to the date on which they are submitted. A project submitted within 6 months of its start date is considered a 'new' project.'"

33. It is unclear whether the start date applies only to a specific field or whether it applies to a particular landowner. For example, if a landowner has tried a nitrogen management technique on part of the land prior to June 27, 2010, would the parts of land that had not yet been treated be eligible under this protocol?

    We recommend clarifying that it applies to site-specific fields and not across an ownership. **(Weyerhaeuser)**

    RESPONSE: Thank you for your comment. Language has been added to Section 3.2 to clarify that the start date applies only to the specific field upon which the project activity is implemented. Fields owned or managed by the same project participant may have different start dates within the same year and/or may have start dates in different years, depending on when the project activity is first implemented on the given field.

3.3 Crediting Period

34. Selection of the crediting period is an important element in the design of a protocol and can have a powerful impact on adoption. Too short of a crediting period may leave an insufficient incentive for real change in behaviour. Corn growers in the Midwest face increasing variability in weather, increasing volatility in prices and an ever changing global economy. Many farmers will phase in change slowly after running field test trials to determine if there are any yield impacts. A longer timeframe for crediting will better allow growers to evaluate results and confirm the gains in nitrogen use efficiency. **(Camco)**

    RESPONSE: Thank you for your comment. The Reserve agrees that selection of the proper crediting period length is an important part of protocol development and involves balancing the need to provide sufficient incentives to project developers with the need to ensure that credited GHG reductions continue to be additional. In the case of nitrogen management business-as-usual trends already show some improvement of nitrogen use efficiency over time and, generally speaking, implementation of a nitrogen management project will serve mainly to accelerate that BAU improvement. Furthermore, the Reserve believes that once project activities have been adopted, the project participant is likely to continue to implement those project activities, as long as yield is not impacted. For these reasons, the Reserve determined that a crediting period of 5 eligible crop years (which may be extended over a period of up to ten years in the case of multi-crop rotations), renewable one time, was most appropriate for this project type.

35. We feel the crediting period (5 crop years renewable 1 time) is unnecessarily short. As long as the project is continuing to generate robust offset credits, EDF encourages you to consider multiple renewal periods. **(EDF)**

RESPONSE: Please see the response to comment #34.

36. The crediting period should be extended beyond the 10-year timeframe to accommodate more complex rotations beyond corn-soybean. In addition, we recommend that the definition of cultivation cycle length and crediting period be compatible with crop rotations of diverse, multi-year cropping systems. **[See rationale in NWF et al. public comment submission.] (NWF et al.)**

    RESPONSE: The Reserve believes the current "cultivation cycle" definition is appropriate for Version 1.0 of the NMPP, as it was developed for corn, the only crop currently eligible. That said, the Reserve will continue to monitor the definition of cultivation cycle and expects to revise the definition, as needed, to accommodate additional crops and regions, in future protocol expansions.

    With regards to the recommendation to extend the flexible crediting period beyond the 10-years timeframe, the Reserve appreciates the commenters' desire to incentivize more complex, multi-crop rotations. However, as a general rule ten years is the maximum time horizon over which the Reserve is comfortable guaranteeing a performance standard or baseline. For example, if the Reserve were to allow for a crediting period of 20 years, and a project enrolls with a Fall 2012 start date, that project would be allowed to register CRTs as late as Fall 2032, based on a performance standard threshold, baseline, and quantification methodology established in 2012. Although limiting the crediting period may present difficulties for complex crop rotations, we believe this kind of scenario would be untenable from an offset crediting perspective.

3.4 Other Criteria

37. Section 3.4 addresses supplemental eligibility rules including unclear limitations on the farmer's ability to plant certain crops in a rotation. As currently written, "the frequency and sequencing of eligible crops grown in a rotation must not change significantly due to the project (e.g. a multi-crop rotation shall not be replaced during the project with a corn-corn rotation nor a rotation such as three years of corn, followed by one year of soy)."

    The Climate Trust believes any limitations on the ability of farmers to make production decisions should be carefully considered. Limiting the ability of farmers to introduce a new rotation would needlessly exclude farmers that desire to introduce new crops into a rotation with corn if they haven't done so in the historical look-back period and even though doing so may not negatively impact project emissions. For example, farmers need not be prohibited from shifting from corn-corn to corn-soy or other rotations.

    From the example given in the NMPP text excerpted above, it appears the Reserve intends to prevent participants from increasing the frequency of corn planting during the crediting period. If this is case, The Climate Trust encourages a more direct definition in this regard. **(TCT)**

    RESPONSE: The Reserve recognizes that limitations on farmers' abilities to make production decisions, especially to their rotations, are particularly sensitive and must be carefully considered. The Reserve attempted to strike a balance which allows for maximum flexibility for the farmer, particularly for ineligible crops, while preventing a

move towards monoculture. The protocol's intent is not to prohibit a farmer from shifting from a corn-corn to corn-soy rotation, but rather, explicitly allow for it, while a shift in the opposite direction is explicitly prohibited. Language as been added to Section 3.4 of the protocol to clarify this intent.

38. The protocol should not discourage a three-year rotation from being introduced in the middle of the crediting period **[See rationale in NWF et al. public comment submission.] (NWF et al.)**

    RESPONSE: Please see the response to comment #37. Language has been added to section 3.4 of the protocol to clarify that movement from corn-corn or corn-soy rotation to a more complex rotation is allowable.

39. We recommend, as in The Energy Investment and Security Act of 2007 (renewable fuel standard) and the Biomass Crop Assistance Program of the Food, Conservation, and Energy Act of 2008 (Farm Bill) that lands that are native ground (ie have no cropping history) prior to the enactment of the regulation be ineligible for participation. This policy reflects the consensus amongst policy makers that land suitable for agricultural production has already entered production, and further policies should at the very minimum do nothing to incent new lands entering agricultural production. Continued encroachment of agricultural lands on native sod poses a major threat to wildlife and causes a net increase in greenhouse gas emissions. . **[See NWF et al. public comment submission for further background and information.] (NWF et al.)**

    RESPONSE: Thank you for your comment. The Reserve agrees that the protocol should not encourage the conversion of land with no previous cropping history, and such a goal is consistent with the Reserve's "Do No Harm" Principle (see Program Manual). The Reserve initially believed that the protocol's Section 3.4 requirement of at least 5 years of management data would make land with no previous cropping history ineligible. However, after further consideration, we realize this is not the case. The protocol has been revised to include the recommendation of the Reviewers that land with no cropping history prior to the adoption of this protocol will not be eligible.

40. We also recommend, that to be eligible for program participation, land must meet basic 1985 conservation compliance standards traditionally required of farms receiving Farm Bill commodity payments. Conservation compliance requires farmers not farm wetlands and have a conservation plan to farm highly erodible land. If a farmer is found out of compliance they are given technical assistance and a year to return to compliance. This minimum requirement is a way of ensuring all land enrolled in the program meets minimum standards. **[See NWF et al. public comment submission for further background and information.] (NWF et al.)**

    RESPONSE: Thank you for your comment. After further consideration, the Reserve agrees that, to be consistent with the Reserve's "Do No Harm" Principle (see Program Manual), a project field should at least meet the minimum standards for conservation compliance in the 1985 Food Security Act (Farm Bill). The protocol has been amended to include the specific requirements for compliance with the Highly Erodible Land (sodbuster) and Wetland Conservation (swampbuster) provisions of the 1985 Farm Bill. Highly erodible land and lands classified as wetlands are not eligible for project activities.

3.5.1 The Performance Standard Test

Ex-Post Nature of the Performance Standard

41. The ex-post test evaluation seems inappropriate. Fertilizer is put onto crops at rates that are designed to anticipate a normal yield, not at rates based on actual yields. If, in a given year, the fertilizer rate is lowered as a project activity, at the end of the season less N_2O will have been released than if the project had not been in place – even if there is complete crop failure such that RTA is zero.

    Likewise, in Section 5.3, calculating the historic average RTA value, which will depend on historic yields subject to year-to-year climate variability, will unduly penalize producers in more variable climates. The important metric is historic fertilizer application rates – not historic yields. Again, fertilizer is applied in anticipation of yield – not because of yield.

    The protocol should reward N_2O reductions that result from intentional fertilizer reductions, irrespective of actual yields that will vary with weather and other factors out of the producer's control. N_2O reductions will occur if fertilizer is reduced regardless of yield. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: Based on this and other comments received, the Reserve has made changes to the protocol that allow for more upfront certainty in determining whether a field will meet the performance standard. Specifically, a field's RTA value will be calculated using an average of historical yields, rather than an *ex post* measurement of actual yields. Since farmers will know upfront the yield value used to calculate their field-specific RTA, they will know in advance how much N they can apply without exceeding the performance standard. The historical yield value will be fixed for the duration of the field's crediting period. This should give growers and aggregators much more certainty with regard to what they must do to meet or exceed the performance standard.

42. The performance standard test is conducted annually by comparing each field's RTA to the state threshold value established in the NMPP V1.0. Because this performance standard is based on future yield, there is no way to determine eligibility ex ante. Carbon markets have always informed investors and project participants in advance as to the eligibility of the project. The prospect of "in one year, out the next" will discourage investment and adoption. CAR should consider a single test for eligibility at the beginning of the crediting period instead of an annual test. **(Camco)**

    RESPONSE: Please see response to comment #41.

43. The post harvest calculation of state RTAs and offset payments represent a significant financial risk to farmers considering participation in the Protocol. This measurement method creates a scenario in which farmers could invest in the equipment and new management practices required, significantly reduce N application in their fields, but still fall above the state RTA at the end of the season and therefore not be eligible to receive offset payments. Without a projection of what the state RTAs will be or a goal to meet before participating, risk-averse farmers will not participate.

    It is our suggestion that at a side-dress time, a predicted RTA be developed to provide a measuring stick that farmers can use to determine their probability of falling below the state

RTA. This predicted RTA could then be compared with the actualized state RTA at the end of the season. If there is a significant difference in the predicted versus actualized RTA, fields that fall at or below a certain adjusted-for-error RTA would qualify for payments. By providing a predicted RTA, farmers will have a better understanding of their chances of qualifying for offset payments, before taking risks during side-dress. **(Ag Working Group)**

RESPONSE: RTA threshold values in Table A.9 provide the explicit goal for performance and because they do not change for the duration of crediting of projects under V1.0 of the NMPP, the Reserve believes they provide a clear target for participants. However, in response to public comments, the Reserve has decided to modify the performance standard to allow for more up-front certainty. See the response to comment #41 for further explanation of the revised performance standard.

Threshold Level

44. We are concerned that the proposed RTA Performance Thresholds and Default RTAs shown in Table A.9 are too stringent and will make it very difficult for most farmers to utilize the NMPP V1.0. In effect, the performance standard that has been proposed is likely to result in very few farmers using the protocol, as it appears that only those farmers who already have made significant strides to increase their N-use efficiency would be eligible to participate and receive credits for N rate reductions. This would be a very unfortunate outcome.

    We believe that it is important to incentivize farmers who legally use excessive amounts of N fertilizer to reduce their N fertilizer usage both to reduce GHG emissions and reduce nitrate losses. To this end, we encourage CAR to revisit the design of the RTA, and most importantly to reconsider use of the RTA and in particular the 75% RTA performance threshold that is proposed to be adopted.

    A better and more agronomically defensive approach is to require farmers to comply with Best Management Practices as adopted by state departments of agriculture or the USDA/NRCS. These practices include nutrient management requirements based on accepted 4R nitrogen management strategies: right rate, right place, right time, and right kind. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: The purpose of the performance standard test (PST) is to ensure the additionality of projects implemented under the protocol. To this end, the PST is designed to exclude what are likely to be "business as usual" improvements in nitrogen application rates. All fields, regardless of historic N-use efficiency or N-application rate trends are eligible to participate under the protocol, provided that they can increase their N-use efficiency to above the RTA performance standard threshold.

    As noted in the protocol and in response to comment #34, the national trend for the last several decades has been towards increasing nitrogen use efficiency. We therefore expect to see some "business as usual" improvements that should in principle be excluded from eligibility under the protocol. We expect these N-use efficiency improvements to be most easily achieved on fields with historically low RTA values (i.e., those with the most room to improve). We also assume that fields with the lowest historic RTA values represent a group that would most likely adopt nitrogen use efficiency improvements regardless of a carbon market. The NMPP includes a grace

period to allow more time for such fields to achieve the changes needed to reach the threshold level indicative of truly additional performance, recognizing the wider gap for this group.

Notwithstanding these general considerations, setting a performance threshold is always a balancing act. The need to exclude "business as usual" activities must be balanced against the risk of excluding truly additional activities. In light of numerous comments received regarding the stringency of the proposed performance standard (i.e., projects must exceed the 75th percentile RTA for the state in which they are located), the Reserve has decided that it erred on the side of being too exclusionary. To better accommodate truly additional projects, we have changed the performance threshold to the state average RTA (i.e, the mean, instead of the 75th percentile). Furthermore, emission reductions will be calculated in all cases against a historical baseline (as opposed to a 50th-percentile default baseline for low-RTA fields). We expect that these changes will allow crediting of more truly additional reductions, while still excluding the majority of "business as usual" activity.

Regarding use of additional BMPs, in our background research, we were unable to identify a standardized metric that describes all aspects of BMP implementation. We would need such a metric to evaluate business-as-usual trends in BMP implementation at broad scales and to determine what level of activity approximates better than business-as-usual implementation of BMPs. That said, language has been added to the protocol to encourage the adoption of additional BMPs as practices that can help enable N rate reductions while maintaining yields. (See response to comment #10 for more information).

45. Given these considerable shortcomings, we recommend CAR remove the RTA Performance Thresholds to improve the accuracy, transparency, and fairness of the protocol. As noted above, BMPs are the better alternative.

    If, however, the Performance Thresholds are maintained, we recommend at the very least taking the following steps: i) remove the ex-post test, and ii) make the threshold percentiles more realistic and achievable. With respect to the latter, we recommend using yield-goal approaches, i.e., N-to-yield-goal ratios, along with simple N management criterion and national and state (where available) survey data to generate realistic RTA performance thresholds and default values obtainable by a large proportion of farmers. **[Further evidence and rationale for this recommendation is available in the MSU-EPRI public comment submission, sections f, g, and h.] (MSU-EPRI)**

    RESPONSE: Please see responses to comments #41 and #44.

46. The performance standard used for the NMPP is based on the ratio of removed to applied N (RTA). Values for RTA were calculated at the state level and a performance threshold value was set to ensure that only the top 25% of fields will satisfy the performance standard test. This is unnecessarily restrictive and curtails potential reductions for high emitting fields. Some of the fields in the top quartile for nitrogen use efficiency will not be eligible for the NMPP due to early adoption of practices and an already lowered baseline. The threshold value for the performance standard should be set to allow for broad participation in the NMPP and should not exclude farms that are struggling to improve N-use efficiency and lower GHG emissions. CAR should consider allowing all farms that are reducing emissions relative to their field specific baseline(s) to participate in the protocol. **(Camco)**

RESPONSE: The RTA threshold value is chosen to represent better than average performance for individual fields, but it is not used to exclude fields from the program based on their pre-project RTA levels. Please see the response to comment #44.

47. Equation 3.1 creates a very high bar for existing good land stewards to be credited with N_2O emissions reductions, and excludes those who have been using greater quantities of nitrogen on their lands.

    For example, a corn farmer harvesting 150 bushels/acre (bu/ac) who conservatively applies 134 lbs N/ac (150 kg N/ha) has an RTA of 0.90, below the RTA threshold of 0.93 for Illinois corn and well below the threshold of 1.37 for Michigan. The same farmer fertilizing at a more liberal 200 lbs/a (224 kg/ha) has an RTA of 0.75, substantially below the threshold.

    Not only does this threshold inhibit the good steward from participating, but it will exclude the less efficient nitrogen users who should be targeted by the protocol if CAR's intent is to positively affect climate change by reducing N_2O emissions in crop production.This seems to be a perverse outcome. If the formula is kept it needs to be evaluated against current rates of N fertilizer applications based on actual and recommended rates used by most farmers (using, for example, the common yield-goal approach and rates recommended by farmers' main source of information – fertilizer and seed dealers).

    Part of the problem may be a units issue – Table A.2 reports N values in lbs/bu, not kg/bu as called for by the equation. But converting Table A.2 values to kg/bu makes the threshold even more difficult to achieve. Additionally the 0.8 lbs N/bu for corn grain is based on a 1.4% N content – a value itself too low; using more common values for corn grain (1.6-1.8% as reported in the literature depending on hybrid age) will further exacerbate the problem as it will raise the RTA. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: The performance standard threshold is technically what sets the bar for eligibility, rather than Equation 3.1. We believe the equation itself is in fact correct. In the example provided in the comments, the value calculated with Eq. 3.1 using the lower N rate scenario (134 lb N/ha) is quite close to meeting the threshold value of 0.93 whereas the value calculated with the higher N rate scenario (200 lb N/ha) is far from meeting the performance threshold. This is consistent with the intended function of the performance standard test. As noted in the response to comment #44, we recognize that a larger change in N rate is needed for initially lower performing fields to reach the threshold, which has been lowered to the state average RTA in the final NMPP. The protocol includes a grace period specifically to provide more time for such cases to reach the threshold.

    With regards to units used in Equation 3.1, the units are consistent and correctly applied in the RTA calculation. RTA itself is dimensionless. In the calculation, the N content (0.8 lbs/bu) was multiplied by yield obtained from USDA-NASS (in bu/acre) and divided by N applied obtained from USDA-ARMS (synthetic + manure N, in lbs/acre). N rates in Table A.8 are in lbs/acre. The default N contents used in the calculation of RTA are adopted from a recent USDA report,[6] and are considered robust in the context of RTA

[6] Ribaudo, Marc, Jorge Delgado, LeRoy Hansen, Michael Livingston, Roberto Mosheim, and James Williamson. *Nitrogen In Agricultural Systems :Implications For Conservation Policy. ERR-127*. U.S. Dept. of Agriculture, Econ. Res. Serv. September 2011.

calculations. More specifically, as the field RTA is compared to the threshold RTA, and the same N content is used in the calculation of both RTA values, uncertainty around the N content does not bias the performance standard test.

48. We recommend that if RTAs remain in the NMPP, a threshold at or around the 40th percentile might be reasonable. For Michigan, the 40th percentile value is 0.72 (Figure A.4). This is very similar to the RTA value derived from USDA nation-wide survey data (0.71; 35% of corn acres are below this) and Michigan survey data (0.73; 26% of farmers apply N at a rate below or equal to this). This percentile is more appropriate and represents a realistic and obtainable threshold for a large proportion of farmers across the NCR states. Raising the RTA percentile much above this risks excluding farmers that were they included, would be most likely to provide environmental benefit through N rate reduction on their land. However, the match of the 40th percentile value to actual fertilizer use in Michigan may be coincidental – even the 40th percentile may inappropriately exclude farmers in other states. The uneven quality of the data underlying the percentiles plus the other problems underlying RTA calculations argues for dropping the RTA approach entirely. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: Please see response to comment #44.

49. The Climate Trust is also concerned with the RTA values which have been set as Performance Thresholds in each state. We are specifically concerned with RTA Performance Thresholds that have been set above a value of 1.0, meaning more nitrogen must be removed from a field as crop biomass than was added to the field as synthetic or organic nitrogen amendments in order to have any emissions reductions credited each year.

    Although we recognize important N inputs such as crop residues or remnant N from earlier biological fixation have not been incorporated in these RTA values, The Climate Trust remains concerned that current RTA Performance Thresholds could still require soil mining. The progressive depletion of soil nitrogen would not only compromise yields and farm profitability, but also affect a host of other environmental aspects in farm management such as the conservation of soil organic matter.

    The Climate Trust would prefer to see a clearer articulation of how the Reserve intends to reflect the project definition that N rates not be reduced below crop demand in the discussion and calculation of these Performance Thresholds. We believe more direct consultation with the Scientific Advisory Committee on this issue is also advisable. **[See TCT public comment submission, comment 6, for further detail.] (TCT)**

    RESPONSE: The Reserve appreciates the concern that the NMPP not encourage mining of the soils. However, some qualifications are in order in interpreting the RTA values contained in the protocol. Since the RTA is an estimate of the ratio of N removed by harvest to N applied, an RTA larger than 1 appears to indicate soil N mining. However, the RTA used in the NMPP is a very simplistic proxy of nutrient use efficiency, and as such, RTA values larger than 1 do not necessarily indicate soil mining. Unaccounted for variables may include: uncertainty around the crop N content, N credit from leguminous cash crops or cover crops not accounted for, residual soil N also not accounted for, and uncertainty around the manure N content. Finally, as indicated in response to comment #44, the performance standard threshold for the protocol has been changed to the state average RTA. With this revised performance threshold, very few states have a performance standard RTA threshold above 1, so it is very unlikely that the NMPP would

encourage N rate applications that lead to soil mining.

50. We appreciate the attempt to develop a simple and easy-to-use threshold to ensure additionality. However, we are concerned that, as presented, the removed to available nitrogen (RTA) performance standard threshold may limit participation and thus potential emission reductions. In order to obtain credits, a producer would have to apply fertilizer at a rate more efficient than the state-level average RTA threshold (a measure of nitrogen efficiency) as well as below their own historic application rates. We are concerned about the potential for producers who will be unable to meet the RTA threshold due to site-specific variables despite being able to produce additional improvements in nitrogen efficiency against their own baseline. That is, a producer could increase nitrogen efficiency significantly as compared to their own historic baseline, but could still have a rate of application very different from the state average due to factors like soil type or weather that can vary significantly across a state (consider, for example, if your farm was located near a state border). Additionally, because the RTA is an average and not a range, it does not capture year-to-year variability. It is conceivable to imagine a year in which weather causes poor crop yields across an entire region; in that year, no farms in the region may meet the RTA threshold in that year despite some farms still being able to perform well against their own historic baseline. **[See EDF public comment submission for suggestions on how to improve a performance threshold.] (EDF)**

    RESPONSE: Changes have been made in the final NMPP that seek to address these concerns; please see the responses to comments #41 and #44. In particular, because historic yields will be used to set field-specific RTA values, performance will not be affected by yield impacts caused by unexpected adverse conditions during the growing season.

Grace Period

51. While we are concerned that the proposed RTA performance threshold and Default RTA's are unnecessary and too stringent, we do recognize and appreciate CAR's attempts to incentivize farmers to use the protocol who do not meet the performance threshold for the first two years of the implementation of an N rate reduction project. This additional flexibility afforded in the protocol for farmers to incrementally move toward reducing their N-use efficiency over three years to achieve the RTA performance threshold is important and we encourage CAR to maintain this flexibility in the final version of the NMPP. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

    RESPONSE: Thank you for your comment. The two-year "grace period" has been retained in the protocol.

52. We suggest that the Protocol eliminate the two-year grace period required to meet the RTA before a farmer can receive offset payments. If the farmer is unable to receive payments during these years, but it still required to make nitrogen reductions, there is no financial incentive, and potential risk in terms of reduced yield, for the farmer to continue making reductions.

    By eliminating the two-year grace period and providing payments to farmers for all reductions, even if over the state RTA threshold, the Protocol becomes more feasible for farmers. **(Ag Working Group)**

RESPONSE: Thank you for sharing your concerns. The Reserve agrees that a two-year delay in crediting at the beginning of a project could potentially hinder protocol uptake. However, as indicated in response to comment #44, meeting the RTA threshold is a critically important criterion for establishing additionality. Delaying CRT issuance for fields until the performance threshold is met ensures the additionality of those CRTs. The alternative would be to require subsequent cancelation of CRTs for fields that fail to meet the performance standard, or to require that fields meet the performance standard within one reporting cycle; for programmatic and practical reasons, the Reserve rejected these options. Although delaying CRT issuances may delay the financial reward for fields that make progress towards meeting the performance standard, we felt this was a better option than excluding their participation entirely. In addition, aggregators may in principle be able to play a role in sustaining individual fields until the performance criterion is met.

Performance Standard Effectiveness

53. While having confidence that the large majority of projects allowed to generate credits under a protocol will be additional is an appropriate requirement of a compliance offsets protocol, not enough analysis has been provided in the protocol and the background documents to support this assertion for this proposed protocol.

    By setting the performance standard at approximately the 75th percentile of RTAs for a given region and crop, around 25 percent of fields would already have RTAs above the performance standard. Table A.6 and Figure A.5 of the draft protocol (page 84) show that on average RTAs are already increasing in some states that are covered under the protocol. Figure A.5 also shows that RTAs vary quite a bit year-to-year in many states.

    To the extent that field-level level data are available in some regions, the amount of business-as-usual activity that could have been credited under the protocol if the protocol were implemented in the recent past could be assessed. For example, fields could be identified that, perhaps five years ago, increased their RTAs from past levels to levels above the 75th percentile performance standard named in the protocol for that region. Such fields would have been able to generate credits under the protocol for activities that were performed regardless of those credits if the protocol had been put in place five years earlier. Such an analysis could provide some insight into the quantity of non-additional credits that could be generated if the protocol were implemented today. **(UCS)**

    RESPONSE: We appreciate the suggestion and agree the outcomes of such an analysis would help inform decision-making in the protocol. During the protocol development process we sought, but were unable to readily acquire, the field-level data necessary to perform such an analysis. We will continue to look for relevant data and if we find it will perform an analysis. As noted in response to comment #44, the threshold RTA value in the final NMPP was modified to be based on state averages, rather than the 75th percentile.

54. It is certainly possible that when projects are bundled together to lower costs, that many farmers would choose to change their fertilizer use practices to reduce fertilizer costs and receive revenues from carbon credit sales that would not have done so otherwise. It seems equally possible that the incentives provided by the program are too weak to incentivize much change in

practice, and that farmers who are already changing their practices without carbon credits could list their fields under the program and generate a non-negligible amount of non-additional credits.

An analysis could be done to assess the costs associated with monitoring and verification and the revenues that would be received by projects of different sizes. Interviews and surveys could be conducted with farmers to understand how much revenue they would need to receive to change their practices. An assessment of the results of existing programs, meant to reduce fertilizer use on corn and other fields (see section 2.1.2 of the CAR background paper: *Nitrogen Management Project Protocol: A Background Paper on Quantification of N_2O Emission Reductions* for a list of existing programs), could also provide some understanding of the effects incentives have had in the past. Such an assessment should take into account the uncertainty associated with future offset credit prices, and any uncertainty in the benefits associated with these other programs. **(UCS)**

RESPONSE: The Reserve appreciates the suggestion for further analysis and agrees it could be helpful for understanding the feasibility of implementing projects under the protocol and for assessing outcomes with respect to additionality. The Reserve did conduct some analyses to assess the relative impact of carbon incentives compared to the cost savings of reduced fertilizer application and the perceived risk of yield impacts. However, there was not time or resources during protocol development to conduct farmer interviews or a more thorough cost-benefit analysis that included detailed and realistic assessments of monitoring and verification costs. Very broadly speaking, the potential value of carbon offset credits (at current prices) is small relative to avoided fertilizer costs and the expected value of crop yields. However, there is ample evidence to suggest that farmers are over-applying fertilizer in many specific situations (see response to comment #3). For a variety of reasons, it is also unlikely that these farmers will respond individually to offset price signals in their management decisions. The "theory of change" behind this protocol – i.e., the logic behind how the carbon market could drive changes in practice – is premised on the role of aggregators to not only reduce average monitoring and verification costs, but also to provide farmers with technical assistance and support they need to implement best management practices where they are not already doing so. It is in facilitating this kind of action at an aggregate level (providing assistance to farmers who may not otherwise respond efficiently to price signals) where there are likely to be cost-effective opportunities for the carbon market to make a real difference.

55. Has an analysis been performed assessing the credits that could be generated by business-as-usual activity compared to the expected effect of the protocol on farmer practice? If not, such an analysis should be performed before the protocol is used, and if necessary, the protocol should be changed so that there is a high level of confidence that the large majority of credits generated by the protocol will represent real, additional reductions.

    In addition, a process should be laid out for evaluating the results of the protocol over time. If there is not clear evidence over time of an increase in RTAs due to the protocol, further changes should be made to the protocol, or the protocol should be suspended, to prevent the generation of non-additional credits. **(UCS)**

    RESPONSE: In practice, it would be quite difficult to undertake this kind of analysis with a high degree of certainty. It would depend not only on expected offset credit prices and trends in agricultural commodity markets, but on numerous variables that are difficult to

predict with respect to how the protocol is picked up and implemented. As indicated in the responses to comments #44 and #54, we have carefully examined business-as-usual trends in nitrogen use efficiency, the likelihood of various actors improving nitrogen-use efficiency under these trends, and the potential role of the offset market in incentivizing change in nitrogen management practices. We have developed a performance standard that we believe adequately and conservatively addresses additionality in light of these considerations. The Reserve evaluates the results of all of our protocols over time, and protocols are regularly updated to include, among other things, revised performance standards and baselines, which may grow more stringent over time as conditions change.

Performance Standard Applicability

56. Additionality is an important issue for many offset types; however it is rarely relevant when considering nitrogen reductions in agriculture. This is true for two reasons. First, even though precision nitrogen systems or practices may already be in place for some farms, none of these systems focus on the interaction of weather in addition to targeted application. Changes in precipitation, in particular, have the ability to make a huge difference in terms of N_2O emissions. So while someone may be reducing their overall N amount,, if they are not coordinating that practice with weather impacts, it is impossible to say that they are reducing significant emissions because temperature and moisture play a large role in determining how N breaks down in the environment.

    Second, outside of regulation, it is rare that farmers take the risk to significantly reduce nitrogen application without incentive or insurance. We believe that if farmers in the Protocol and reducing nitrogen use, emission reductions are being created that would not have otherwise occurred and are therefore additional. The only instance in which additionality could be an issue would be if a farmer were utilizing advanced, precision nitrogen management tools that account for weather variability and stored nitrogen. It is our experience that few farmers practice this level of adaptive management, and thus any practices beyond regulatory efforts or nutrient management plans would be additional, making accounting for additionality in this protocol irrelevant.

    It is our suggestion that farms making efforts to reduce their nitrogen use outside of regulations or other incentives and utilizing models that factor in weather data to assess N_2O emissions, should be eligible to participate in the Protocol and provide offset credits. **(Ag Working Group)**

    RESPONSE: The Reserve is committed to developing rigorous protocols that ensure additionality of all types of offsets projects, as this is a fundamental requirement for the credibility of carbon offsets. To this end, for all types of offsets projects, the Reserve uses standardized approaches to ensure that GHG projects are achieving better than average performance in terms of GHG emission reductions. As noted in the protocol and in response to comment #3, there is an observed national trend towards greater N-use efficiency under business as usual in the United States. To be additional projects need to go beyond the anticipated baseline level of N-use efficiency improvements. We believe the performance standard, as specified in Version 1.0 of the protocol (please see responses to comments #41 and #44 for further elaboration), will be both sufficient and necessary to ensure that credited GHG reductions are truly additional.

57. We recognize the Protocol's desire to generate a simple system for offset calculation, but find it crucial that the Protocol be an evolving document as more information on nitrogen application becomes available. While removed-to-applied (RTA) nitrogen measurements, which measure the ratio of nitrogen removed by the crop to the amount of nitrogen applied to the field, might be the most feasible method with present data, many other factors affect nitrogen application rates and emissions.

    In order to obtain more precise measurements in the future, emissions calculations must include existing soil nitrogen from cover crops, residue, as well as previous and current soil conditions, and consider the significant impact of weather on the amount of plant available nitrogen.

    Climate can also be the cause of significant nitrogen demand variability between growing seasons. By measuring only RTA nitrogen, the protocol does not measure nitrogen levels already in the system and thus cannot account for true gains or losses in N_2O emissions. State RTAs also do not account for the significant regional variability within a state. For example, the conditions and soils in northern Iowa are different than the conditions and soils in southern Iowa.

    Finally, it is important to note that the relationship between nitrogen application and N_2O emissions is not linear. Decreasing variability by adopting additional factors that affect soil nitrogen will help generate a better estimate of actual emission reductions. It is our recommendation that the Protocol work to include additional variable aspects of nitrogen use and N_2O emissions to generate more precise and accurate calculations **(Ag Working Group)**

    RESPONSE: The comment raises a number of important points regarding the complexities and variability involved in quantifying GHG emissions from nitrogen applications. In developing a carbon offset protocol, the Reserve sought to adopt a quantification approach that is sufficiently accurate but also practical and not overly burdensome for project developers. We believe the approach used in the protocol strikes an appropriate balance between practicality, accuracy and conservativeness. The Reserve intends to regularly update the NMPP, including the quantification methodology, as new data becomes available. It is important to note project GHG emissions are not calculated using the RTA values. An empirical model derived from N_2O field trials in soils representative of the North Central Region is used to estimate GHG emissions, and the model assumes a nonlinear relationship between N rate and N_2O emissions.

Datasets Used

58. Using statewide averages for RTA Performance Thresholds (Table A.8) is an additional problem. RTAs are dependent not only on fertilizer inputs but also on soil fertility – in particular, on soil organic matter mineralization. Assuming that all farmers within a state share the same soil fertility (Table A.8) is a major limitation of the RTA threshold approach. Even relaxing the threshold to some arbitrary percentage value will penalize farmers who manage fields far from the mean fertility level.

    Moreover, the Agricultural Resource Management Survey (ARMS) data is self-reported and do not necessarily overlap with the NASS yield data, which are collected differently. Differences among states may largely be artifacts, and some differences make little sense – for example, that corn following corn receives 30% less fertilizer than corn following soybeans in Michigan

(Table A.7) is clearly wrong. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

RESPONSE: We recognize that the statewide RTA values are based on a range of soil fertility and climate conditions represented within the state. Furthermore, even with the final revisions to the performance standard (see responses to comments #41 and #44), some farmers may not be able to participate because they are farming on low fertility sites that would be difficult to bring up to the state average RTA threshold. We will continue to explore development of more disaggregated RTA values, e.g., by soil fertility, if appropriate data can be identified.

59. The Reserve's emphasis on utilizing standardized performance thresholds has helped accelerate the transparency and consistency of offset quantification, and The Climate Trust generally supports this approach as a practical improvement upon the more subjective project-specific additionality and eligibility tests that have been applied through recent history. A critical component for these standardized approaches, such as the development of performance standards, is the reliance upon accurate and transparent data. Despite statements to this effect in the NMPP however, The Climate Trust remains concerned that the chosen Performance Standard and Performance Thresholds have been quantified using several simplifications that raise substantial concerns over the accuracy and suitability of the derived values for use as a Performance Threshold.

    The NMPP (as described in Appendix A) attempts to "back in" to calculating a distribution for a nitrogen use efficiency metric, a ratio for Removed-to-Applied Nitrogen (RTA), using average N-rates and yields for each state along with assumed variances and correlations from an undisclosed source. An earlier Workgroup draft of this protocol suggested the assumed variances for both N rates and yields are based upon a single survey in one state from which such statistics were available

    The accuracy of the data used to determine performance standards is critical, especially if the threshold means the difference between being eligible to receive credits and losing an eligible crediting year due to underperformance. According to Figure A.3, which shows a range of considered coefficients of variation for yield data, the range considered at the 75th percentile may correspond to a difference in RTA values by nearly 0.1. In Figure A.4, which shows the calculated RTA values for various percentiles in Michigan, a difference in RTA of 0.1 would be enough to move a producer from below the 75th percentile to above the 80th percentile. A similar table for a different state which had been published in an earlier version of the Workgroup Draft also showed a difference in RTA of 0.1 would be enough to move a producer from below the 70th percentile to the 80th percentile for that state.

    Between the assumptions made for the coefficients of variation for yields, N-rates, and the correlation coefficient between the two, it seems highly likely that these assumptions upon which the current RTA Performance Standard is based may have introduced substantial inaccuracies with significant implications for potential project developers and participants.

    The Climate Trust urges the Reserve to re-calculate these distributions directly from ARMS or another suitable dataset where paired yield and N-rates are available at the field and/or farm level. **(TCT)**

    RESPONSE: The Reserve performed a comprehensive review of available data and found no studies or datasets with paired yield and N rates or distributions of N rates or RTA

values around the mean that were relevant for use in a national scale protocol. The Reserve agrees that the distribution data for the RTA would have been preferable to the approach used in the protocol to approximate the 75th percentile. Due to this comment and other stakeholder concerns about the way in which the Reserve approximated the RTA distribution, as well as comments received that the performance threshold was unnecessarily stringent (e.g., see comments #44-49, above), the Reserve has adjusted the performance standard threshold to the state average RTA. Since state average yield and N rate values were used to calculate the state average RTAs, approximation of the RTA distribution is no longer necessary, and that methodology and section have been removed from the protocol.

Consequences of Inconsistent Performance

60. In section 3.5.1.1, any field which fails to meet the RTA Performance Threshold in an eligible crop year would lose one of its five eligible crop years. In contrast, there appears to be no such penalty for fields which are found to be loading N in non-eligible years (i.e., the non-corn year(s) in a rotational cropping system). These N-loaded fields would forfeit eligibility for the subsequent eligible crop year, but are apparently not penalized with the removal of one of the field's five eligible crop years.

    Because failure to meet the RTA Performance Threshold in any given year may be due to factors outside the control of the farmer (e.g., lower yields due to bad weather), The Climate Trust encourages the Reserve to address non-compliance with the Performance Threshold in eligible and non-eligible crop years consistently and without rescinding one or more eligible crop years from the total allowed within a single crediting period. Projects that fail to meet the Performance Standard should not be allowed to claim credits in the current or, in the case of underperformance during non-eligible crop years, the subsequent eligible crop year, but in either case should not be penalized with the loss of any of the five eligible crediting years. The loss of potential credits in the year of non-compliance is itself a substantial loss for the project, and need not be compounded by a punitive measure such as revocation of an eligible crop year. **(TCT)**

    RESPONSE: The intent of the protocol is, in fact, to penalize the fields found to be N loading in non-eligible years, by forfeiting their eligibility in the subsequent eligible crop year. That forfeited eligible crop year will count toward that field's five total eligible crop years allowed per crediting period. This intent has been clarified in the protocol. Further, the Reserve believes that revisions made to the performance standard, allowing the *ex ante* determination of yield levels, make it more straightforward for a farmer to pass the performance standard (please see response to comment #41). In particular, yield impacts from an anomalous bad weather year should not impact the field's ability to pass the performance standard. Since no credits are issued for non-eligible crop years, the Reserve cannot deduct credits from non-eligible crop years, and therefore the Reserve believes that penalizing fields with a future lost year of eligibility is the best mechanism available to limit N-loading in the non-eligible crop year.

3.5.2 The Legal Requirement Test

61. "Attestations of Voluntary Implementation must be signed and submitted to the Reserve...each time the project or aggregate is verified."

    A single attestation at the beginning that 1) implementation is completely voluntary, and 2) that any future change in the voluntary nature of the practices will be promptly reported, should suffice without the need for resending the same letter every year. **(Camco)**

    RESPONSE: It is Reserve policy, as indicated in the Program Manual, that the Attestation of Voluntary Implementation "is signed and submitted after the conclusion of each reporting period/verification period (unless otherwise exempted by the protocol under which the project is registered)." Since it would be burdensome to require all project participants to submit this attestation annually, only the Aggregator is required to submit it. Because new fields may enter the Aggregate every year, previously signed attestations may not be applicable. The Reserve therefore feels it is important for the Aggregator to attest to the voluntary nature of project activities engaged in by all project participants enrolled in a given reporting period, at the close of each reporting period.

62. The NMPP states "...supporting documentation should be made available to the verifier..." to document that the project was undertaken voluntarily. It is not easy to document a negative – guidance to verifiers should acknowledge that the presence of laws, regulations, court orders etc is easier to document than their absence. **(Camco)**

    RESPONSE: The Reserve agrees that there may not always be direct documentation of the voluntary nature of a project activity. However, the intent of this policy is somewhat different. The Legal Requirement Test states that "Individual project participants who are part of an aggregate will not be required to attest to the voluntary nature of the project activities to the Reserve. However, supporting documentation should be made available to the verifier during verification, *if requested*" (emphasis added). The verifier's consideration of a project's legal additionality follows a risk-based approach. If, during a review of the relevant laws for a project, a verifier determines that a project activity may be legally mandated, it is not unreasonable to request that the project participant provide evidence to the contrary. This policy is not assuming that a verifier will be asking to see evidence that no mandate exists, but rather that they may ask for evidence that a particular mandate does not apply to the project activity.

3.5.3 Ecosystem Services Payment Stacking

63. We strongly support the provisions in Ecosystem Services Payment Stacking. CAR's approach is consistent with how Willamette Partnership treats stacking of credits and stacking of payments for its water quality, upland habitat, and aquatic habitat credits. It is also consistent with many water quality trading programs across the country, including new programs emerging in the Chesapeake and Ohio River Basins. Proposed Virginia statute on water quality trading is also consistent with CAR's proposed approach. **(WP)**

    RESPONSE: Thank you for your comment.

64. This methodology contains the Reserve's first effort to define policies allowing payment stacking in terms of project eligibility, but also limiting the scope of credits that could be awarded to projects based on these stacked payments. Although The Climate Trust can see the theoretical value for such a policy in terms of adding another additionality safeguard through a financial assessment, we believe that the policy currently articulated in this draft would establish an unnecessary and subjective financial additionality test with a convoluted set of procedures whose complexity are not fully anticipated or appropriately captured in the text. This is also a clear departure from the Reserve's stated desire to standardize offset quantification and, we contend, is unnecessary in light of the various other additionality and performance tests already included in the methodology.

    The Climate Trust recommends the proposed payment stacking rules be removed completely unless and until they are revised to ensure they could be objectively and transparently applied in a manner consistent with how government payments are awarded and how on-farm decision-making occurs. **[See TCT public comment submission, comment 7, for further detail.] (TCT)**

    RESPONSE: The Reserve believes this payment stacking policy is the best way to support farmers seeking financial assistance through both the NRCS and the carbon market to implement N rate reductions while ensuring the additionality of the carbon credits issued for such reductions. We do not consider the policy a financial additionality test, as it is not used to determine eligibility of the project and does not require an assessment of the farmer's individual financial records. Rather, the policy adjusts the number of credits earned by the project according to a government-established percentage payment rate that is consistent across the nation. This standardized deduction is applied at the field level, but should not lead to undue burden on the farmer or project developer.

    Finally, the Reserve feels it necessary to include a policy on payment stacking at this time because there is a high probability that projects submitted to our program will have received or be receiving NRCS payments. If we removed this policy from the protocol, a policy would nevertheless be needed once such a project is submitted. Please recognize our protocols are organic documents that will change over time and with use, and we expect this policy to be refined based on user feedback.

65. The NMPP currently prohibits any fields from stacking EQIP or other government payments if the contract for these payments was entered into at any time before the date the project is submitted to the Reserve. This policy fails to reflect the fact that project start dates may occur before the project's submission date, and significantly contrasts with a similar issue addressed in the Reserve's Forest Project Protocol. The Forest Project Protocol Version 3.2 allows forest projects to adopt binding Habitat Conservation Plans or conservation easements as much as one year prior to the project start date without affecting the project's eligibility, baseline, or other offset quantification steps. The justification offered in the Forest Project Protocol that these management restrictions may be enacted in support of the project activities is equally applicable to nitrogen management projects adopting nutrient management plans or other best management practices through a government conservation program, regardless of whether financial compensation or other benefits are anticipated.

    The Climate Trust encourages the Reserve to revise the NMPP to be consistent with the

timeline and consideration offered to forest projects for voluntarily-adopted management plans or restrictions. **(TCT)**

RESPONSE: The protocol has been modified to allow payment stacking for fields with start dates prior to the adoption of the protocol in line with the start date policy in Section 3.2. To be clear, the adoption of a nutrient management plan prior to the implementation of a project is allowed by the current policy as long as that nutrient management plan did not explicitly include reduced fertilizer application.

Beyond that, there are important differences between a forest project and a nitrogen management project that justify the difference in temporal considerations between the policies in the two protocols. For forest lands seeking GHG credits with an existing conservation easement that has been in place for one year or longer, the easement is modeled into the baseline so the landowner does not receive GHG credits for conservation actions created by the easement; in other words, payment stacking is not allowed. However, when a conservation easement is recorded in support of a forest project (within a year of the project start date), the conservation easement does not have to be modeled when calculating the baseline. In this case, payment stacking is allowed. Because of the significant logistical challenges in establishing conservation easements and developing forest projects, the Forest Project Protocol allows for supporting conservation easements to be recorded up to a year before a project's start date (although they are usually coincident). We do not anticipate similar logistical challenges for nitrogen management projects enrolling in government payment programs and registering carbon offsets.

It is also important to note that policies included in one protocol are not precedent-setting for the program as a whole; each protocol is developed through its own multi-stakeholder process that can result in different policies to address similar issues. This process ensures policy decisions reflect the Reserve's principles, but allows rules to be most appropriate for each project type.

66. The protocol states that because there are currently no active Water Quality Trading Programs, the protocol will not, at this time, address credit stacking. This uncertainty may be a detriment to nitrogen management projects as project developers may choose to wait to understand if early action will hinder the ability to enter other markets in the future.

    We recommend making a statement regarding credit stacking. If one activity impacts two different markets (GHG and water quality) that are distinct, there should be no reason why credit stacking is not acceptable. **(Weyerhaeuser)**

    RESPONSE: In this protocol, the Reserve has sought a credible way to promote credit stacking. We believe that allowing stacking could provide landowners with needed incentives to promote broader participation in markets for ecosystem services. At the same time, we must be sensitive to the risks associated with stacking, in particular the risk that stacking might undermine additionality. As suggested in the comment, if stacking is allowed, a landowner could implement a single project (e.g. reduced fertilizer application) and receive both carbon credits for the reduction in N_2O emissions and an additional payment for the water quality benefits of the project. The question is did the landowner need the incentive of both payments to initiate the project? If not, the project should not have been considered "additional" for both payments, as it did not provide additional environmental benefit compared to what would have happened if only one

payment was available. This is the risk we are seeking to mitigate with the payment stacking policy included in protocol. We will continue to assess this risk as water quality and other ecosystem service programs are developed that dovetail with activities covered by the protocol.

4 The GHG Assessment Boundary

SSR 3 – GHG Emissions from Cultivation Equipment

67. Table 4.1: "GHG emissions from cultivation equipment." Consider excluding changes in diesel fuel use from the list of SSRs. These types of changes will be de minimis compared to total farm fuel use and inclusion only adds unnecessary complexity to the protocol with no real benefit to the environment. **(Camco)**

    RESPONSE: As in all Reserve protocols, any significant increases in secondary GHG emissions must be accounted for in the NMPP. The Reserve agrees that GHG emissions from cultivation may not change in all projects, as reducing N-application rate does not necessarily require changes to cultivation equipment. However, some of the enabling practices, implemented so that N rate can be reduced while maintaining yields, may actually increase GHG emissions from cultivation equipment (e.g. new cultivation equipment may be purchased or rented with more intensive fuel use, or a farmer may move to split application, increasing the number of field passes). If implementing the project activity does not result in a change in the type or use of cultivation equipment, GHG emissions from cultivation equipment need not be quantified for that field. Additional clarifying language has been added, to that effect, in Section 5.5.1. Further, additional improvements have been made to Equation 5.19 to simplify the quantification of this SSR, when required. (Please see response to comment #97)

SSR 5, 6, 8 – Application of Life Cycle Assessments

68. We recommend that CAR introduce a more consistent approach to the inclusion or exclusion of secondary emissions related to changes in fertilizer rates from organic and synthetic N sources. Either a complete Life Cycle Analysis with respect to CO_2 emissions should be conducted for both synthetic or organic fertilizers (production, storage, transport) or none at all. An inconsistent approach (e.g. decrementing credits for transport of manure but not for synthetic N) will introduce biases towards or against particular farm management practices. As a compromise, consider just including emissions from both synthetic and manure transport. The current approach in NMPP V1.0 seems likely to bias farmers against using or increasing their use of organic N fertilizer sources. Currently, the NMPP V1.0 considers increased CO_2 emissions associated with organic (manure) N transport and longer storage off site, but does not consider reduced emissions from decreased synthetic fertilizer production. **[Further rationale is outlined in the MSU-EPRI public comment submission, sections 3f-g.] (MSU-EPRI)**

    RESPONSE: Rather than require full life-cycle GHG accounting, the Reserve generally seeks to conservatively account for secondary effect emissions in its protocols. In many cases, this means conservatively ignoring secondary effects that result in a net *decrease*

in GHG emissions and attempting to quantify those that result in a net *increase*. While this may appear inconsistent from a life-cycle analysis perspective, it is done in order to ensure that the protocol's accounting requirements are not overly burdensome and result in a conservative estimate of overall GHG reductions, in accordance with best practices for project-level GHG accounting (see, for example, the WRI/WBCSD *GHG Protocol for Project Accounting,* Chapter 5). In addition, when GHG reductions occur at secondary sources whose emissions are regulated under a cap-and-trade system – such as nitric acid plants and/or power plants that provide the energy required in synthetic fertilizer production – those reductions must be excluded from crediting in order to avoid double counting. In part because GHG emissions associated with the production and transport of synthetic fertilizer will be covered under California's cap-and-trade system, reductions in these emissions are not included in the NMPP's GHG accounting boundary.

In the public comment draft of the NMPP it was assumed that emissions from manure transport and storage would *increase* as a result of the project activity and, to be conservative, it was necessary to account for the potential increase. However, in reassessing this assumption, the Reserve has decided to make no distinction between N_2O emissions from organic N versus synthetic N in quantifying direct N_2O emissions (please see response to comment #86). Similarly, no distinction between organic versus synthetic N is made for the calculation of N_2O emissions from leaching and runoff. For N_2O emissions from volatilization, the calculations (which are based on IPCC 2006 guidelines) lead to higher emissions from organic N inputs compared to synthetic N inputs. As a consequence of these changes, there will be little to no incentive for project participants to increase inputs of organic N as part of a project. Therefore, any increase in organic N inputs is not likely to be due to the project, and any increase in transportation emissions from transporting manure would likewise not be due to the project. Since any change in the amount of organic N applied is not likely to be causally related to the project activities, the increase in secondary emissions from manure transportation can be ignored, and this source is therefore excluded from the GHG boundary in the final version of the protocol.

69. As currently written, the N management protocol is an incomplete life cycle analysis (LCA) with respect to CO_2 emissions. A farmer does not receive additional credits for the reduction in CO_2 emissions that result from avoided production of synthetic N fertilizer. However, the draft protocol does consider CO_2 emissions associated with manure transport; if a farmer increases manure use as a consequence of switching from synthetic N to manure N, the farmer would incur a reduction in offset credits. Both of these CO_2 sources occur outside the farm gate. It is inconsistent to consider only some sources of CO_2 emissions resulting from farm management; an incomplete LCA results in a bias against particular agricultural practices, some of which deliver important societal and environmental benefits. If CO_2 emissions from farm management are to be considered, all of them need to be represented.

    We prefer that the Reserve do a complete LCA or none at all, to avoid biases towards or against particular practices. Alternatively, at a minimum, if emissions from manure transport are to be considered, then emissions from synthetic fertilizer transport should be similarly counted. **[See UCS et al. and NWF et al. public comment submissions for further detail.] (UCS et al., NWF et al.)**

    RESPONSE: Please see response to comment #68.

70. Farmers who want to use readily available manure, which costs less than synthetic nitrogen and avoids the additional emissions generated in that process, should not be penalized for manure storage and transportation emissions if indirect emissions for synthetic nitrogen are not also measured. This creates a bias towards synthetic nitrogen use, which could discourage the practice of recycling manure back into the land without any significant GHG reduction benefit. **(Ag Working Group)**

    RESPONSE: Please see response to comment #68.

71. A paradox does exist if manure transportation CO_2 is counted, but reductions in switching from synthetic N to organic N are not. However, I do believe a complete LCA should be completed rather than presenting no LCA at all. If calculations reflect no LCA then this report is merely reflective of reports of past, and serves little purpose to update carbon credit negotiations. **(Gambino)**

    RESPONSE: Please see response to comment #68.

SSR 5 – GHG Emissions from Off-Site Storage of Manure

72. The NMPP erroneously assumes that reducing the organic nitrogen (N) rate will increase off-site manure storage time thereby increasing secondary emissions, specifically methane emissions. Most manure storages at livestock operations, especially liquid manure storages such as deep pits, lagoons, slurry stores, etc. have a fixed manure storage capacity; therefore, these storages fill up at nearly the same rate every year and the livestock producer cannot "choose" to store the manure longer. When the manure storage is full, it must be pumped out to a land application field. The manure is not stored longer, it is just a matter of which fields receive manure in a given year. The secondary GHG emissions at the manure storage are the same from year to year and are simply being displaced from one field to another field in a given year.

    In addition, the manure generated at a given livestock operation may be managed by a different producer than who is managing the participating project field enrolled under this protocol, making the emissions from the manure storage outside of the assessment boundary. Also, including this off-site secondary source of GHG emissions is directly contradictory to excluding emission reductions from the decrease in synthesis of commercial fertilizer (SSR 8). It is recommended that the quantification of "GHG Emissions from Off-Site Storage of Manure (SSR5)" be excluded in this protocol. **(SES)**

    RESPONSE: In response to public comment, the Reserve has performed additional research with respect to the business-as-usual fate of manure N. It was concluded that reducing manure N application on one field does not necessarily lead to a net reduction in GHG emissions. As a waste product, manure supply is inelastic, and manure that is not applied on one field will eventually be land applied on another field; in some cases, the manure may also spend a longer time in storage at the manure's original source before land-application, resulting in additional GHG emissions elsewhere in the landscape. As such, even if a project participant is reducing manure N application, and reducing N_2O emissions onsite, no net GHG reductions are likely to occur. Furthermore, the Reserve does not necessarily wish to incentivize reductions in total organic N applied (manure, compost, and other organics), given the benefits of applying such N sources with respect to soil fertility and the recycling of nutrients. Consequently,

reductions in manure N application are allowed, but not credited in the NMPP. Because reductions in manure N are not credited, any change in manure waste management in the landscape will unlikely be due to the NMPP, and no secondary emissions from changes in manure waste management need to be accounted for.

73. By reducing the need to generate synthetic fertilizer and by reducing standing anaerobic manure waste mounds, manure amendments to farm fields as a source of N to promote crop growth generally reduces GHG emissions from the entire system. This provides a strong rationale for allowing growers to switch from synthetic to organic N sources.

    However, the draft protocol assumes that reductions in manure-N amendments will result in greater amounts of manure storage on the CAFO and therefore higher GHG emissions relative to maintaining baseline N amendment rate. It is unreasonable for the protocol to assert that all manure not used on a field will be stored on a CAFO and continue to produce emissions. In fact, since the CAR draft protocol allows for a farmer to switch from synthetic N to manure N, it is possible that manure reductions on one farm will be utilized by another, also participating in the protocol.

    We recommend that the protocol not attempt to address CAFO waste issues. Reducing the scale of excess nutrients at the CAFO requires a landscape-scale redesign of agriculture. Because the protocol is field-scale, the CAFO waste issue is beyond the scope of this work. **[See UCS et al. public comment submission for further detail.] (UCS et al., NWF et al.)**

    RESPONSE: As noted in response to comments #68, #72, and #86, the Reserve has revised the protocol such that reductions in manure N are no longer credited, and secondary emissions from manure storage and transport are no longer accounted for. The Reserve recognizes the complexity of manure waste management on a landscape scale, as noted by the reviewers, and agrees that attempting to address CAFO waste issues is outside the scope of the project type currently included in the protocol. The quantification methodology included for the project activity "reducing N-application rate" is not meant to quantify emissions reductions potentially associated with switch from synthetic N to manure N, and as such, it is not appropriate to allow the protocol to incentivize such a project type. The Reserve has removed from the protocol all provisions that might incentivize shifts in manure N application , while maintaining as much flexibility as possible for project participants to use manure N in the most appropriate agronomic and economic manner. Furthermore, the section on CAFO's in Appendix C has been removed, to reflect the fact that CAFO's that grow corn with their land applied manure will not be eligible for credits under this protocol.

74. A paradox occurs as highlighted by UCS, Niles, and Tonitto (UCS et al.) when reduced N inputs (a preferred practice) is subject to reduced credits because of the resulting estimated increase in manure storage emissions.

    • I agree that reducing inputs will lead to higher storage.
    • I disagree with the cropping farmer being penalized for using best NUE practices and reducing total N inputs.
    • I disagree with UCS et al.'s recommendation to avoid accounting for CAFO manure management because it is outside the cropping system farm gate.
    • Page 32, Equation 5.13: $Frac_{GASM}$ will depend on how manure or the organic fertilizer source was managed/handled prior to application. If organic material was composted prior to application, the majority of reactive Nitrogen would have been lost during that process, and the

Nitrogen present in the organic fertilizer material would be more stable and less likely to volatize as a result. Similarly, this single emission factor does not account for the application method. If this is slurry being applied in a 'big gun' spray method or a splatter plate design, NH_3 emissions will be much larger than if the slurry is directly injected into the soil.
• Therefore, if volatilization of NH_3 and NO_x from fertilization application are to be used as a portion of N_2O in accounting for credits, manure management practices must be included in the discussion.
• Manure management will similarly impact the reactive nitrogen available as leachate. **(Gambino)**

RESPONSE: The Reserve has thoroughly revised how manure N-application is credited in the protocol; please see responses to comments #68, #72, and #86. The Reserve acknowledges that manure management could affect how much manure N is leached or volatilized upon land application. However, no sufficient data is currently available to develop quantification approaches for indirect N_2O emissions that take into account differences due to manure management. The Reserve will continue to follow up with the newest scientific research and update the protocol as new data and quantification approaches become available.

SSR 6 – GHG Emissions from Fertilizer Transportation

75. Table 4.1: "GHG emissions from fertilizer transportation." Consider excluding indirect lifecycle calculations of transportation emissions. Changes in diesel fuel use will be de minimis compared to total farm fuel use and inclusion only adds unnecessary complexity to the protocol with no real benefit to the environment. **(Camco)**

RESPONSE: In response to public comments, the Reserve has performed additional analysis to assess the magnitude of changes in fertilizer transportation emissions, due to implementing the project activity. Reserve analysis shows that switching from synthetic N to manure N could result in a net GHG emissions increase, even taking into account reduced transportation emissions for synthetic N. This increase would not likely be *de minimis,* as suggested in the comment, if the manure is transported over a distance of more than 5 miles, due to the fact that a larger amount of manure (both in terms of mass and volume) is required to apply the same amount of N. However, please see responses to comments #68 and #86.

SSR 8 – GHG Emissions from Synthetic Fertilizer Production

76. CAR has been reluctant to give farmers credit for the reductions in CO_2 emissions that occur as a result of reduced synthetic fertilizer use on the farm field. The justification for excluding them is that: (1) as the farmer is not directly responsible for changes in production at the fertilizer factory, it is unclear to whom the credits would belong; (2) the fertilizer industry may be regulated at some point which would make it ineligible to generate offsets. To the first point, fertilizer factories produce fertilizer largely because of farmer demand. Less demand would mean less production. To the second point, we recognize that in California's cap and trade policy, set to begin in 2012, fertilizer production facilities are a capped industry. However, the scope of the draft protocol only encompasses Midwestern states that do not have legal requirements to reduce greenhouse gas emissions in fertilizer factories.

We recommend that the protocol should grant GHG credits for the reduced CO_2 emissions associated with a reduction in synthetic fertilizer production. **[See UCS, Niles, and Tonitto public comment submission for further detail.] (UCS et al.)**

RESPONSE: Please see the response to comment #68.

77. My understanding of the nitrogen cycle literature **[see Snapp public comment submission]** leads me to recommend that the protocol should grant GHG credits for the reduced CO_2 emissions associated with a reduction in synthetic fertilizer production. This is a vital point; it has both indirect and direct impacts on improving GHG management and profound implications for improving N management so as to reduce negative global impacts of reactive N and CO_2 emissions. **(Snapp)**

    RESPONSE: Please see the response to comment #68.

5 Quantifying GHG Emissions Reductions

78. The method in which the N_2O emissions reductions are calculated appears to penalize the progressive farmers or early adopters of good N management strategies because their historic baseline emissions calculated on a project-by-project basis or field-by-field basis will already be lower allowing for minimal opportunities for improvement. If the NMPP used the average N rates by state or average ratio of removed to applied N (RTA) or RTA performance threshold as shown in Tables A.7 and A.8 as “business as usual practices” this would allow (1) greater opportunities for quantifiable emission reductions; and (2) would minimize some of the historical data collection requirements for the project participant or aggregator. Both of these aspects would allow the NMPP to be adopted over a larger-scale area. **(SES)**

    RESPONSE: The Reserve understands the concerns expressed in this comment and generally supports the idea of finding ways to reward progressive farmers and early adopters. Unfortunately, we do not believe it is possible to reward early adopters with carbon offset credits and at the same time uphold requirements for additionality. Reductions achieved by early adopters are, by definition, reductions that have occurred in the absence of a carbon market, and are therefore not additional. We therefore do not think it is tenable to credit such reductions, and the baseline methodology in the NMPP is designed accordingly. Although our concern is with upholding the environmental integrity of offset credits, we nevertheless fully support the notion of rewarding and providing continued incentives for progressive farmers and early adopters through other mechanisms. In the context of a regulatory cap-and-trade program, for example, such support could come from allowance set-asides, allowance auction proceeds, or fees levied on the issuance of offset credits.

5.1 Applicability Conditions for N Rate Reduction Projects

Fertilizer Types

79. Compost is listed as an eligible organic fertilizer (Page 25); however, nearly every reference to organic sources in the document is to manure, with the word compost only mentioned three times. Composted materials, both plant material and manure, behave differently and have different impacts as soil amendments than raw manure.

    Compost, as a nitrogen source, is a slow release fertilizer, and much of the nitrogen content of compost may not be mineralized to a plant-available form. Nitrogen that is immobilized as organic nitrogen in the compost won't serve as a source of N_2O until it is mineralized, which is slow and incomplete. Therefore, the nitrogen application rate of organic fertilizer, particularly compost, isn't indicative of the amount of nitrogen available for volatilization as N_2O. The assumption that the N_2O emission rate of all organic nitrogen sources is 80% of synthetic sources seems to be an overestimation for some sources, particularly compost. **(CCC)**

    RESPONSE: The Reserve greatly appreciates concerns and comments about the role of compost with respect to nitrogen management and N_2O emissions from cropland. The term "organic N" in the NMPP is intended to include compost and language has been clarified in the protocol to this effect.

    The Reserve acknowledges that compost is not well represented in the current version of protocol. However, literature research and consultation with scientific experts, including members of the Workgroup and the Science Advisory Committee, indicated that there are currently insufficient data available to quantify the different effects of compost amendments, as well as other organic N sources, versus synthetic N on N_2O emissions in corn cropping systems in the North Central Region. As a result, the Reserve decided to remove all correction factors from equations 5.11 and 5.12. In the revised protocol, synthetic N and organic N (both manure N and compost N) are treated equally for the calculation of direct N_2O emissions, which is considered conservative. (Please see the response to comment #86 for further explanation). While important differences between effects of manure and compost on direct and indirect (leaching and volatilization) N_2O emissions likely exist, treating compost and manure equally is conservative and robust in the context of the NMPP, since N_2O emission reductions from reduced organic N inputs are not credited (please see response to comment #72). Furthermore, treating manure and organic N equally is consistent with the IPCC (2006) guidelines. It is important to note, however, that compost use is relatively low in the region eligible under this protocol. USDA/ARMS data indicated that only 0.3% of planted corn acres receive compost amendments across survey states nationally.[7] Within the North Central Region, Iowa was the only state for which disaggregated data on compost application was available, with only 0.02% of corn acres receiving compost. As more data on N_2O emissions related to compost additions become available, the Reserve will continue to investigate added benefits of compost amendments with respect to GHG emissions, and

[7] Survey states included: Colorado, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Pennsylvania, South Carolina, South Dakota, Texas, and Wisconsin.

update the protocol as appropriate, especially for crops and regions where compost application has great potential.

80. The use of organic materials, particularly compost, in conjunction with synthetic fertilizers can alter the pattern of nitrogen availability from the synthetic fertilizer. The increase in microbial activity resulting from the increase in soil carbon from the organic amendments immobilizes plant-available mineral nitrogen into organic nitrogen in microbial cell mass. As a result of microbial uptake, some fraction of the mineral form of nitrogen from the synthetic fertilizer becomes a slow-release fertilizer, reducing N_2O emissions. **(CCC)**

    RESPONSE: The Reserve agrees that amendments of organic material in conjunction with synthetic N have potential to increase N retention through increased N immobilization, and hence reduce N_2O emissions. However, no data of sufficient geographic scope are available to adjust quantification in a standardized manner. The Reserve will continue to investigate this important potential project activity and hopes to be able to distinguish this option to reduce N_2O emissions in a future revision of the protocol.

81. In the case of raw manure, the amount of nitrogen in the soil-applied material is strongly related to the manure management practices at the livestock facility; i.e. as-received and as-generated manure nitrogen content may be much different.

    This also bears on the emissions from an increase in organic material storage resulting from a decrease in organic fertilization. Volatilization from organic material storage is a function of the material handling practices. **(CCC)**

    RESPONSE: In the protocol, differences in manure N content due to manure source are accommodated as much as possible (see tables below). The NMPP provides default values for manure N contents by animal group. The default values provided in the NMPP are consistent with default values in the US EPA Greenhouse Gas Inventory[8] and adopted from Edmonds et al. (2003)[9]. The Reserve agrees that variations in N contents of manure within each animal group may exist, based on how the manure was processed. Nevertheless, further distinguishing N contents based on manure management system would require project participants to track and verify how the manure was managed. This is especially burdensome because N_2O emission reductions from decreased organic N inputs are no longer credited in the NMPP and secondary emissions related to manure storage and transportation are no longer included in the protocol (please see response to comments #68, #72, #86). The Reserve strives to create standardized protocols that impose minimal data burdens on project participants. Requiring a more robust measurement of the nitrogen content of raw manure would likely exclude a significant portion of potential project participants, due to the cost of such measurements. Therefore, it was concluded that standard N contents for different types of manure are sufficient within the context of the protocol.

[8] U.S. EPA. 2011. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009.* EPA 430-R-11-005. Washington, D.C.: U.S. Environmental Protection Agency. http://www.epa.gov/climatechange/emissions/usgginv_archive.html

[9] Edmonds et al. 2003. Costs Associated with Development and Implementation of Comprehensive Nutrient Management Plans. Part I—Nutrient Management, Land Treatment, Manure and Wastewater Handling and Storage, and Recordkeeping.

Manure type	N content (lbs N ton^{-1})
Beef cattle	8.52
Dairy cattle	6.06
Hogs	11.3
Poultry	26.93

Geographic Applicability

82. The 12 state region represented in the draft protocol varies significantly from the five Michigan field sites where the regression equation was developed. As a result, we do not believe the regression equation used to quantify N_2O emission reductions should be extrapolated that far from the conditions under which it was developed. Doing so misrepresents the potential N_2O emission reductions that can actually be achieved.

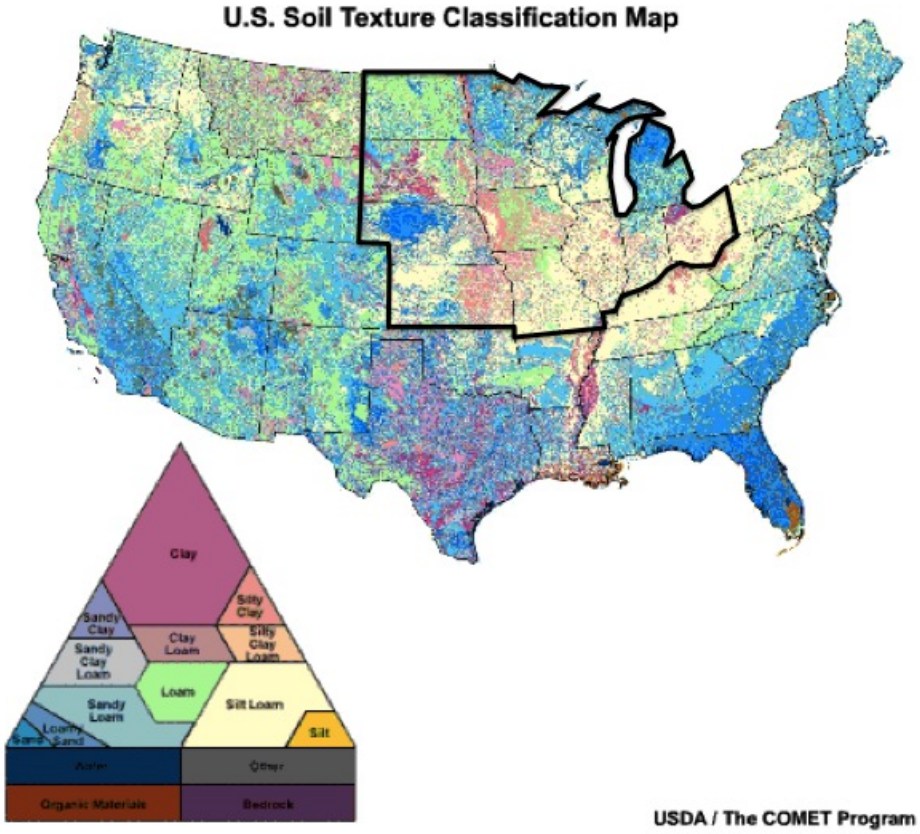
    Until further field observations are available, the relationship currently used in the CAR draft protocol should be limited to soils within 5-10% of clay content of field sites, to sites that have a 10-year average annual growing season precipitation within 1 standard deviation of the 10-year precipitation average at the study sites, to sites that do not have tile-drainage or irrigation, and to sites where the USDA plant-hardiness index falls within 1 unit of the study sites. In doing so, we aim to ensure that N_2O emission calculations based on this MSU EPRI study are conservative and that they do not overestimate N_2O emission reductions. **[See UCS, Niles, and Tonitto public comment submission for further detail.] (UCS et al., Gambino, NWF et al.)**

    RESPONSE: The 12-state region is consistent with the applicability region proposed by the developers of the emission factor used in the NMPP. The developers noted that the emission factor would be applicable in corn systems in the NCR, given the uniformity in agronomic practices in the region, and the robustness of the exponential response of N_2O to N rate across multiple cropping systems and regions. Nevertheless, the Reserve acknowledges that factors such as climate and soil texture can have a great impact on N_2O emissions.

    In response to public comments, DNDC sensitivity runs were executed to test the robustness of the quantification approach within the applicability region. In addition, maps showing variability in climate, soil properties and corn yield were consulted to assist with redefining the geographic applicability region. As a result of the sensitivity analysis, which is summarized below, consultation with experts, and further literature review,[10] the Reserve decided to revise Section 5.1 of the protocol to limit eligibility to areas within the twelve-state North Central Region to those with mean annual precipitation in the range of 600-1200mm.

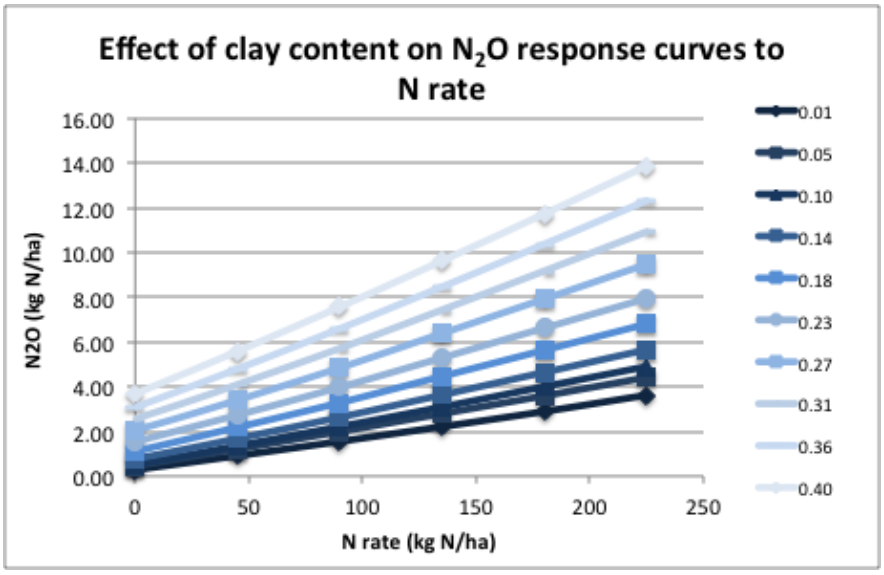
    In the 12-state region, the soil textures loam, silt loam, clay loam and silty clay loam predominate. In contrast, the field sites used for the development of the MSU-EPRI emission factors were on sandy loam and loam soils. Hence, the field sites generally had a similar or coarser soil texture compared to most soils in the 12-state region.

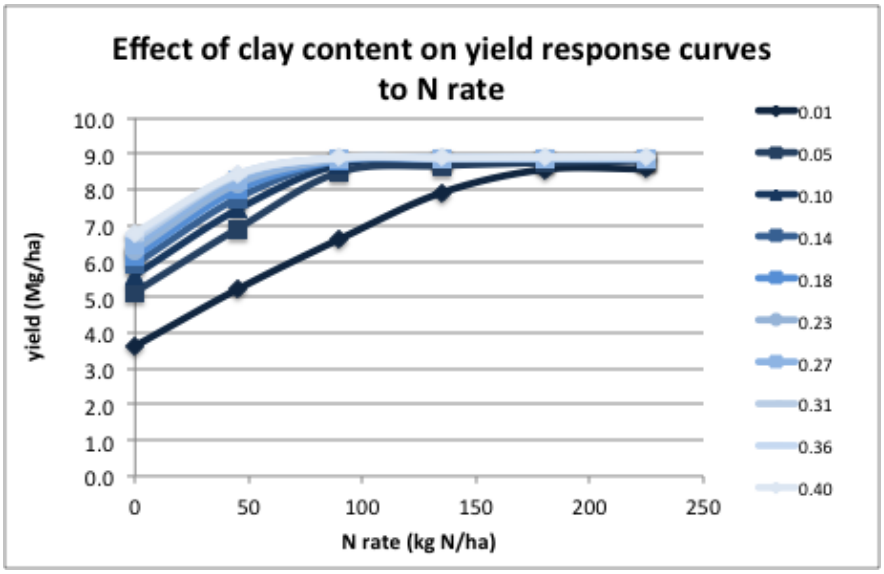
[10] Fischer G, Van Velthuizen HT, Nachtergaele FO (2001).Global agro-ecological zones assessment for agriculture in the 21st century. Vienna, Austria and FAO, Rome.



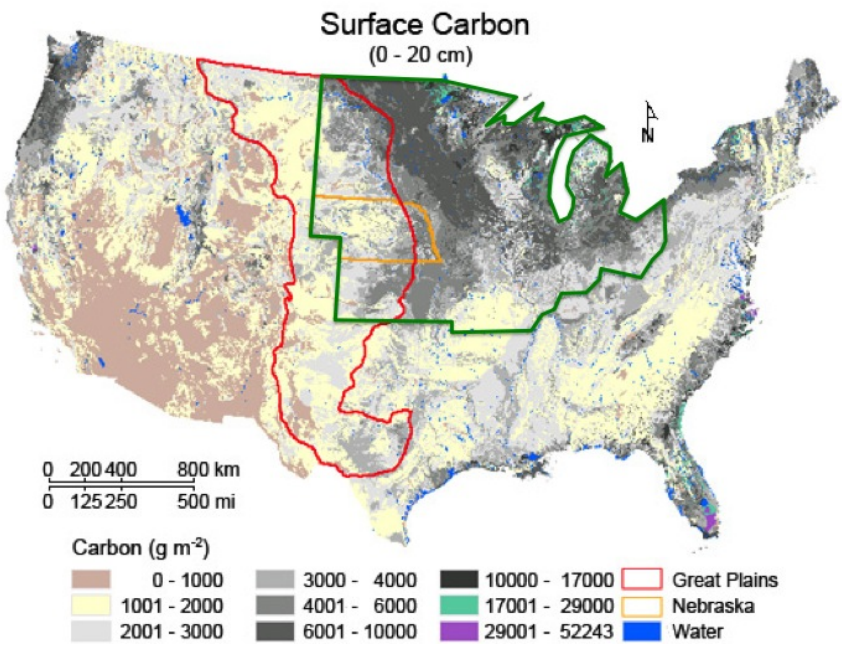
Source: http://www.meted.ucar.edu/hydro/basic/Runoff/print_version/04-soilproperties.htm

DNDC simulations with varying clay contents encompassing a range of clay contents found in the 12-state region (1-40% clay) were performed to assess the effect of finer soil textures on N_2O emissions reduction estimates. With increasing clay content, the model predicts a stronger response of N_2O to N addition. Yield response to N addition was less strong in soils with higher clay content compared to coarser textured soils. This is likely because more clayey soils (within the range considered in this exercise) have better nutrient retention and are more fertile. As crop response to N addition is less strong when clay contents are higher, more of the added N at higher N rates is not taken up by the plant. In addition, soils with higher clay contents generally have better water retention, more anaerobic microhabitats due to smaller soil pores and more available carbon, all of which are conducive to high N_2O emissions. This explains the trend of stronger responses of N_2O emissions to N additions as clay content increases. Since soils used to develop the MSU-EPRI emission factor are generally similar or coarser textured compared to the predominant soil textures found in the 12-state region, and finer textured soils show a stronger response of N_2O to N addition, it is most likely conservative to use the MSU-EPRI emission factor to calculate N_2O emission reductions from N rate reductions in the 12-state region. In other words, the MSU-EPRI emission factor will not over-estimate emission reductions when applied in the 12-state region, due to soil texture variability, and therefore, the Reserve did not implement restrictions with respect to soil texture.



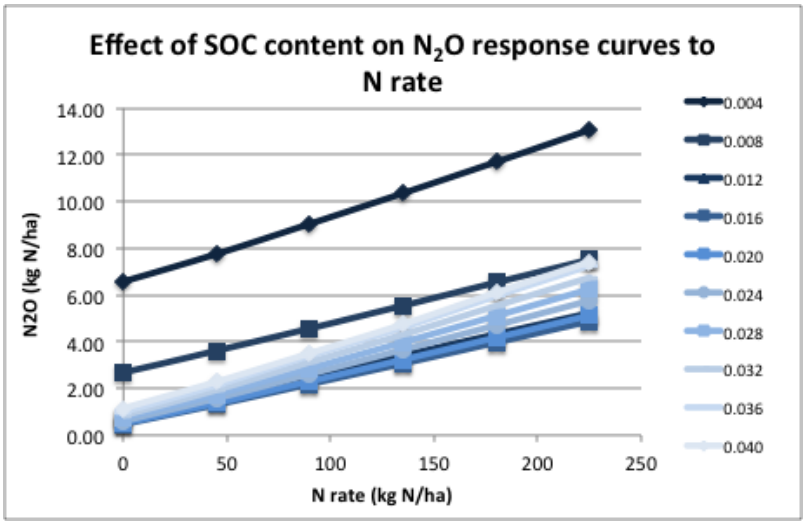


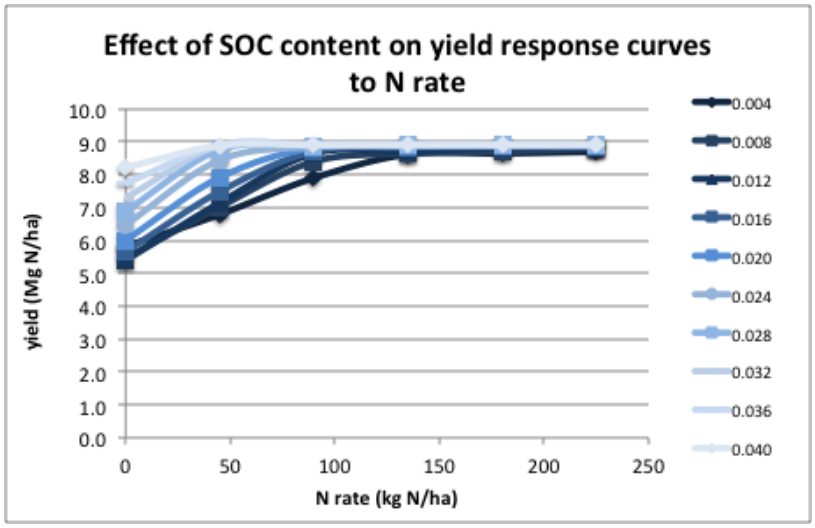
Similar to the assessment of effects of clay content on N_2O and yield response curves to N addition, effects of SOC content were tested. The range of SOC contents for the field sites used to develop the MSU-EPRI emission factor (~ 0.6 – 2%) was smaller than the range of SOC contents found in the 12-state region (~0.4 - 4%).



Source: http://csp.unl.edu/Public/C_background.htm

As SOC increases, the yield response to N addition becomes smaller. This is expected, as increasing SOC is associated with increasing soil fertility. In the higher range of SOC contents (1.6 - 4%), DNDC predicted a stronger response of N_2O to N addition as SOC content increases. This is associated with an increasing amount of excess N and available carbon as the SOC content increases, which can fuel N_2O production. In the lower range of SOC contents, DNDC predicts unrealistically high N_2O emissions. This is likely because DNDC is not well calibrated for predicting N_2O emissions in such regions. Nevertheless, the lack of predictive power to estimate N_2O emissions for soils with a very low SOC content (smaller or equal to 0.8% carbon, yellow areas in SOC map) based on the current DNDC calibration suggests that mechanisms underlying N_2O emissions at such low SOC contents are likely different compared to soils with a higher organic carbon content. In the field sites used to develop the MSU-EPRI emission factor, the lowest SOC content was ~0.6%. Though N_2O emissions estimated for fields with SOC below ~0.6% will be associated with slightly higher uncertainty, soil texture and precipitation are likely to be much more critical than variability around lower SOCs. As the Reserve determined to restrict according to precipitation (see below), and the restricted regions include much of the regions with SOCs below 0.6%, no lower bound restrictions were added for SOC. It should be noted, however, that soils with high SOC (e.g. organic soils or histosols) are still excluded from eligibility, as noted in Section 5.1 of the NMPP.





In the 12-state NCR region, there is an important precipitation gradient, with western states facing much drier conditions compared to the states to the east of the region. Because yield responses to N addition can become very different under irrigated conditions and in rain-fed systems in regions with low precipitation compared to systems where precipitation is abundant, N_2O response curves to N addition will likely also differ. Furthermore, soil moisture conditions and dry-wet cycles in irrigated and dryland corn cropping systems will be very different from those in rain-fed systems, once again potentially affecting the N_2O response curve to N addition. Therefore, the applicability region has been restricted to parts in the 12-state region where the mean annual precipitation is above the irrigation cut-off (i.e. 600 mm).

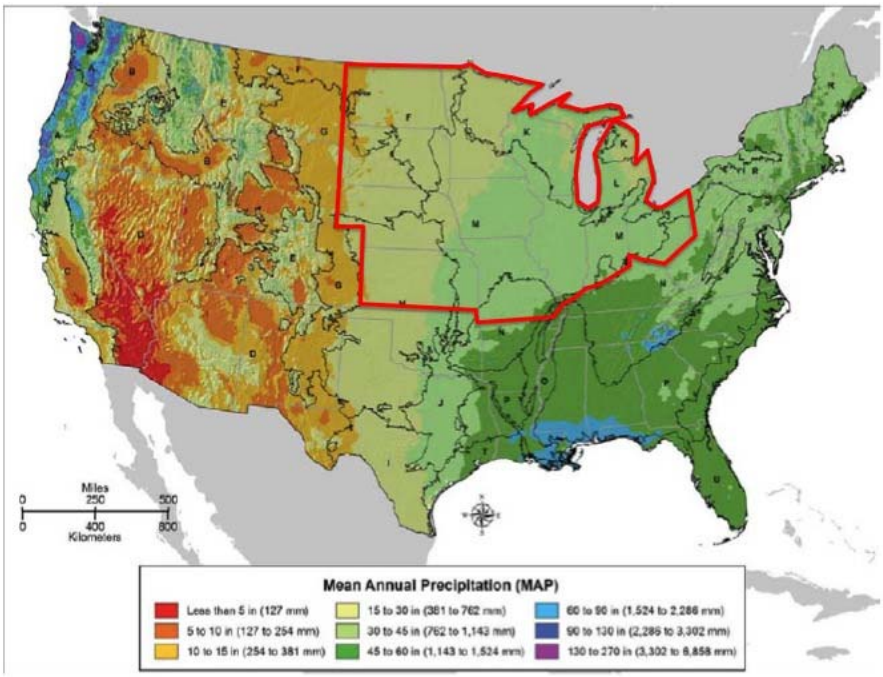


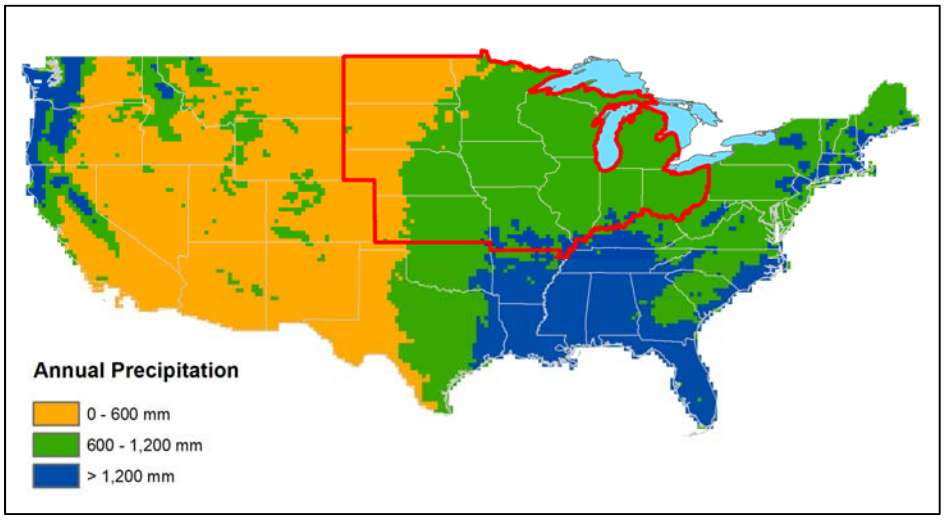
Figure 1: Mean annual precipitation (MAP) for the conterminous United States based on the period 1961-1990.

Source: http://soils.usda.gov/survey/geography/mlra/index.html

Further, these graphs indicate that yield is limited by moisture rather than N up to about 658 mm MAP. As MAP increases from 740 to 1233 mm MAP, yields at a given N rate decrease. Likely, the soil becomes too wet and retards plant growth and less N is available to the plant due to leaching of N. The yield responds linearly to N until a specific N rate above which there is no more yield increase. This point, i.e., the N rate above which there is no more yield increase, increases with higher rainfall, suggesting that less N is available to the crop with high rainfall. This could be potentially due to loss of N due to leaching.

Below about 575 mm, the N_2O response curves to N addition are very different compared to the N_2O response curves in the range 575-1233 mm MAP. Likely, different mechanisms come into play at the lower MAP range compared to the 575-1233 range. In addition, it is unlikely that corn would be grown at such small rainfall without irrigation. Therefore, it is recommended not to include regions where MAP is below 600 mm in the applicability region for the NMPP. As MAP increases above 575 mm, the response of N_2O to N rate becomes stronger. This is expected, as soil moisture contents will increase with increasing N rate, providing sufficient anaerobic habitat for the production of N_2O when excess N is available.

As noted above, this analysis resulted in the Reserve adding a restriction to Section 5.1 that fields must be in regions with mean annual precipitation in the range of 600-1200mm. An approximation of this range is shaded green in the map below, and an updated final map will be included in the protocol.



Source: http://www.esrl.noaa.gov/psd/data/gridded/data.unified.html

83. The MSU-EPRI emissions model used in Equations 5.11 and 5.12 is a two-parameter nonlinear regression model based on a single study conducted for five rainfed field sites in Michigan. In the protocol it is being applied to all potential field sites in 12 states. This application represents a major extrapolation of a single study whose limitations are not indicated in the protocol document. These limitations are of two kinds: (1) The nonlinear regression model used in the study did not give a perfect fit to the observed field data—it is a statistical model whose two parameters each have a range of possible values termed a 95% Confidence Interval. Put another way, the estimate of N_2O emissions provided by the model is subject to statistical error that is not stated in the protocol document and, of course, not taken into account when the model results are interpreted and applied. (2) The Michigan field study was limited in several ways, most importantly, to a narrow range of climatic properties and soil types. For example, the soils studied were mostly of loam texture (one was a fine sandy loam), found under a narrow range of precipitation and temperature. Application of the model to soils that are not of loam texture or that exist under significantly different precipitation and temperature is not warranted without additional research to show that these properties are irrelevant to N_2O emissions. It is also possible that irrigated or drained soils would give different results that cannot be described by the MSU-EPRI model. **(Sposito)**

RESPONSE: The Reserve fully agrees that some uncertainty remains around the predictions from the non-linear regression model. The Reserve strives to develop protocols that are robust, widely applicable, and conservative. Therefore, quantification approaches need to be transparent and standardized, with verifiable input variables. The Tier 2 emission factor used in the NMPP adheres to these criteria, on the condition that the uncertainty deductions are applied to address the remaining uncertainty around the non-linear regression model. These deductions are based on uncertainty associated with the statistical model, using the raw N_2O emissions data. To account for any additional uncertainty that is not captured by the measured N_2O emissions data, we included a term that represents the remaining empirical uncertainty due to rainfall patterns, soil types, or SOC contents that have not been observed within the field measurements but that could be present within the 12-state region. In the public comment draft, the Reserve proposed a 25% additional uncertainty deduction. In the final draft, the Reserve proposes to reduce this uncertainty deduction to 15%, in light of the leave-one-out analysis performed by the

MSU methodology developers, as discussed in Comment #93). This term will likely be decreased or eliminated as more data become available to cross-check the used model for other sites within the NCR.

With respect to geographic applicability, the Reserve restricted the eligible geographic applicability region based on further sensitivity analysis performed the Reserve's technical contractors to test the robustness of the quantification approach within the applicability region (please see the response to comment #82), and we are confident that emission reductions calculated for corn cropping systems within the newly defined applicability region are conservative, given the additional 15% uncertainty term. The Reserve is appreciative of the comment with respect to irrigated and drained soils. Additional eligibility criteria were added to the protocol to address such concerns (please see the response to comment #85 and #92 for more details).

Crop Type

84. The equation for calculating direct baseline and project emissions (Equation 5.11 and 5.12) appear to be specific to corn crops and is based on the MSU-EPRI Tier 2 emissions factor in corn cropping systems in the NCR in the U.S. How are SSR 1 emissions calculated for non-corn cropping systems?

    Please clarify that this equation can be used for other crops or specify a generic way to calculate SSR 1 emissions for non-corn crops (e.g. IPCC default factors). **(Weyerhaeuser)**

    RESPONSE: Only corn crops in the NCR are eligible under this version of the protocol, and as such, there is no quantification methodology included in the protocol for other crops. Multi-crop corn rotations in the NCR are eligible, but only the years when corn is grown will be eligible to quantify and receive credits for their emission reductions. Projects must continue to report on their management practices in non-eligible crop years.

Other

85. It is not apparent in the protocol if irrigated corn grain or corn silage is eligible. This will have a significant impact on the western Corn Belt, especially for Nebraska and Kansas. **(SES)**

    RESPONSE: Corn silage is eligible. The text in the NMPP has been edited to clarify the eligibility of corn silage.

    Concerning the eligibility of *irrigated* corn, the Reserve conducted additional research on potential effects of N rate on N_2O emissions in irrigated corn cropping system. Given considerable uncertainties and lack of directional certainty in the scientific literature associated with the response of N_2O to N rate in irrigated cropping systems,[11,12] the

[11] Liebig, M., Morgan, J., Reeder, J., Ellert, B., Gollany, H., Schuman, G. (2005). Greenhouse gas contributions and mitigation potential of agricultural practices in northwestern USA and western Canada. *Soil and Tillage Research* 83, 25-52.
[12] Hao, X., Chang, C., Carefoot, J., Janzen, H., Ellert, B. (2001). Nitrous oxide emissions from an irrigated soil as affected by fertilizer and straw management. *Nutrient Cycling in Agroecosystems* 60, 1-8.

Reserve decided not to allow participation of irrigated corn cropping systems in the current version of the protocol. Irrigated systems will likely become eligible in future versions of the protocol as more data for development and calibration of quantification approaches for N_2O emissions and emission reductions in irrigated systems become available. However, emergency irrigation to prevent crop failure will be allowed in systems that do not typically irrigate. In addition, as indicated in response to comment #82, the Reserve has limited the geographic applicability of the protocol to regions where mean annual precipitation is in the range of 600-1200 mm, due to the fact that systems in areas where water is limited are presumed to have different N_2O response curves than observed at the study site.

5.4.1 Calculating Baseline and Project Direct N_2O Emissions from Soils (SSR 1)

86. We recommend that, until further field studies in the NCR and elsewhere in the US are identified that show large differences in the non-linear (or other) N_2O response to varying organic (typically manure) N inputs when compared to synthetic N inputs, N from organic sources should be treated equally to N from synthetic sources. **[Justification for this is provided in MSU-EPRI public comment submission, sections 3b-d.] (MSU-EPRI)**

RESPONSE: After further consideration and consultation with our Science Advisory Committee, the Reserve agrees with this recommendation. The correction factor of 0.8 for organic N applications was removed from the protocol. In the revised protocol, organic N (both manure and compost N) and synthetic N are treated equally for the calculation of direct N_2O emissions, which is considered conservative. Equal treatment of organic and synthetic N for the calculation of direct N_2O emissions is also consistent with the IPCC (2006) guidelines for quantifying GHG emissions from cropland. This is also consistent with literature findings where the N_2O response to increasing manure N rate was exponential, including the Jarecki et al. article cited by the commenter. [13]

Nevertheless, it should be noted that available data on the effect of manure N on N_2O emissions is associated with large uncertainty. For example, Gregorich et al. (2005) found an average EF for liquid manure of 1.7% with an error of 1%, while the same authors found an emission factor for solid manure of 0.3%.[14] **Furthermore, it has been found that there is an interaction between fertilizer type (i.e. liquid manure versus synthetic fertilizer) and soil type.**[15] **Namely, in a clayey soil the synthetic fertilizer has a larger EF than the liquid manure, but the opposite is observed in a loamy soil. Please also see the response to comment #79.**

Given the uncertainty around N_2O emission reductions from reducing organic N rates and other issues, the Reserve has decided to only credit N_2O emissions reductions from

[13] Jarecki, M.K., Parkin, T.B., Chan, A.S.K., Kaspar, T.C., Moorman, T.B., Singer, J.W., Kerr, B.J., Hatfield, J.L., Jones, R. (2009). Cover crop effects on nitrous oxide emission from a manure-treated Mollisol. *Agriculture, Ecosystems & Environment* 134, 29-35.
[14] Gregorich, E.G., Rochette, P., VandenBygaart, A.J., Angers, D.A. (2005). Greenhouse gas contributions of agricultural soils and potential mitigation practices in Eastern Canada. *Soil & Tillage Research* 83, 53-72.
[15] Chantigny, M.H., Rochette, P., Angers, D.A., Bittman, S., Buckley, K., Massé, D., Bélanger, G., Eriksen-Hamel, N., Gasser, M.O. (2010). Soil Nitrous Oxide Emissions Following Band-Incorporation of Fertilizer Nitrogen and Swine Manure. *Journal of Environmental Quality* 39.

reductions in synthetic N (while still allowing applications of both synthetic and organic N). Please see the response to public comment #68.

87. In Equation 5.11 used to calculate the MSU-EPRI Tier 2 emission factor, the denominator should not include the 0.8 manure correction factor. **(Camco)**

    RESPONSE: The Reserve agrees with the comment. As discussed in the response to comment #86, the Reserve decided to remove this correction factor.

88. Equations 5.11 and 5.12 would be clearer if extra parentheses were added around the term "$NR_{B,o,f}$ x 0.8" and the correction factor 0.8 was listed first. **(SES)**

    RESPONSE: Please see the response to comment #86.

89. There appears to be a discrepancy between the emissions factors cited in the NMPP in Equations 5.11 and 5.12 and the factor appearing in the article describing the results of the field study. According to the field study this factor equals 0.0064, but a factor of 0.0067 is given in Equation 5.11 and a factor of 1.00 is given in Equation 5.12. **(Sposito)**

    RESPONSE: The Reserve is aware of the different versions of the equation for calculating emission factors and is working with the original developers of the emission factor to resolve the discrepancy. The final NMPP will contain the most recent and correct version of the equation.

5.4.2 Calculating Baseline and Project N_2O Emissions from Leaching, Volatilization, and Run-Off (SSR 2)

90. Equation 5.13 assumes that the N_2O emissions from leaching, volatilization and run-off are twice as much for organic fertilizer as for synthetic. This would intuitively not seem to be the case for composted organics. **(CCC)**

    RESPONSE: The Reserve acknowledges the possible difference in magnitude of indirect emissions for compost versus manure. Unfortunately, data are lacking to precisely re-calibrate the equations and emission factors specifically for compost. The equation used to quantify LVRO emissions is adapted from the IPCC Tier 1 methodology, which similarly does not address the difference between compost and other organics. If sufficient data were to become available to account for such a difference, the Reserve will take this into consideration for future revisions. Please also see the response to comment #79.

91. The literature documenting how different farming practices can reduce N leaching – and hence downstream N_2O emissions is very clear. Operationally, the way to take these practices into account is to make a slight modification to Equation 5.13. We recommend modifying $FRAC_{leach}$ so that: For default conditions, $FRAC_{leach}$ = 30% of N applied. For fields with legume cover crops, $FRAC_{leach}$ = 18%. For fields with non-legume cover crops, $FRAC_{leach}$ = 9%. **[See UCS et al. and NWF et al. public comment submissions for further detail.] (UCS et al., Snapp, NWF et al.)**

    RESPONSE: The Reserve has seriously considered the implementation of adjusted

default factors for the fraction of leached N for systems with cover crops. While the suggestion for adjusted default factors for N leaching is based on peer-reviewed scientific research, little is known about the effect of cover crops on direct N_2O emissions. Some studies suggest that cover crops decrease or have no effect on N_2O emissions. However, other studies have found significant increases in N_2O emissions due to cover crops, especially where legume cover crops are used (e.g. Kallenbach et al. 2010,[16] Peterson et al. 2011, McSwiney et al. 2011[17]). Furthermore, the quantification approach for direct N_2O emissions included in the NMPP was developed for N rate reduction and not for the implementation of cover crops. In order to account for potential N_2O emissions reductions for implementing cover crops, more research is needed to develop and test quantification approaches for direct and indirect N_2O emissions, identify the geographic applicability region, and design performance standard tests and thresholds to ensure additionality. Therefore, the Reserve chose not to adopt adjusted default factors for N leaching under cover crops. The Reserve will continue to investigate effects of cover crops on direct N_2O emissions, and update future versions of the protocol if cover crops prove to reduce total N_2O emissions from cropping systems.

92. We recommended limiting application of the MSU-EPRI equations to non-tile-drained fields, which reflects the abiotic state of the sites where observations were acquired. Once N2O flux data for tile drained grain regions is available, and appropriate functional relationships are established to include tile drained lands into the draft protocol, extensive field work in Iowa by Kaspar et al. (2012, 2007), provides nitrate leaching data relevant to tile-drained fields common in the most productive regions of the Corn Belt. **[See UCS et al. and NWF et al. public comment submissions for further detail.] (UCS et al., and NWF et al.)**

    RESPONSE: After further consideration, the Reserve agrees that the protocol should be limited to non-tile-drained fields, due to the difference in soil moisture conditions and N leaching losses in tile-drained compared to non-tiled-drained systems, both of which can affect the N_2O response curve to N addition. Tile drained fields will not be eligible at this time, but the Reserve hopes to include tile drained fields in a future version of the protocol, once data become available.

5.4.4 Adjusting Primary Effect GHG Reductions for Uncertainty

93. We appreciate that CAR have included an uncertainty analysis based upon the original MSU-EPRI approach. However, we have concerns regarding the suitability of the structural uncertainty and the accuracy deduction equations used in the NMPP.

    Currently, the structural uncertainty Equation 5.17 is:

$$UNC_{PER,f} = \frac{1}{\sqrt{nrFields}}\left(100 - 63 \times e^{-40 \times 10^{-6} \times NR_{P,f}^{2}} + 25\right)$$

[16] Kallenbach, C.M., Rolston, D.E., Horwath, W.R. (2010). Cover cropping affects soil N_2O and CO_2 emissions differently depending on type of irrigation. *Agriculture, Ecosystems & Environment* 137, 251-260.
[17] McSwiney, C.P., Snapp, S.S., Gentry, L.E. (2010). Use of N immobilization to tighten the N cycle in conventional agroecosystems. *Ecological Applications* 20, 648-662.

We recommend this be revised to:

$$UNC = \left(100 - 61\, e^{-46\, 10^{-6}\, NR^2}\right)\left(1 + \sqrt{\frac{32}{nrFields}}\right)$$

In the new recommended equation, the expression in the first brackets represents the structural uncertainty of the model (i.e., the possible bias in the model). Here, the uncertainty procedure for the MSU-EPRI uncertainty equation was adapted to include a cross-validation based on a bootstrap or 'leave-one-out' algorithm. Depending on the fertilizer input level, the uncertainty increases by only 2 to 4% in the new equation when compared to the original MSU-EPRI equation.

In the expression in the second brackets (i.e., adjustment to the number of fields), the first term (1) represents the multiplier for the uncertainty of the model itself (structural uncertainty) and cannot be attenuated by increasing the number of fields in the study. The second term (√(32/nrFields)) represents the additional uncertainty from the finite number of fields that are in the study. Thirty two is used because the term in first brackets is the uncertainty of emission reductions for the mean of 32 fields (8 site years x 4 replicates) in the MSU-EPRI training dataset. We recommend removing the additional and arbitrary increase in the uncertainty (25%) in Equation 5.17. **[See MSU-EPRI public comment submission for further detail.] (MSU-EPRI)**

RESPONSE: The Reserve appreciates the leave-one-out bootstrap estimate provided by MSU-EPRI – the Tier 2 emission factor's original developers – in this comment. It is encouraging to see that the leave-one-out approach only increased uncertainty by 2-4%. The leave-on-out approach eliminates the concerns regarding using the same data for model development as for uncertainty analysis and sufficiently addresses the lack of independent data to validate the model and to calculate the uncertainty. The uncertainty equation will be revised to acknowledge this range of structural uncertainty for all projects. Further, in the new version of the protocol, the additional uncertainty of 25% is eliminated for projects located in Michigan due to the similarity of locations within Michigan to the project sites. However, the Reserve is still concerned about the implications of extrapolating the 5 study sites beyond the state of Michigan to the whole North Central Region, a concern shared by several of the reviewers who have provided public comment. Part of the rationale for the 25% adjustment factor was to address this concern. Therefore, for projects located outside of Michigan, an additional uncertainty term will still be applied, but the term has been reduced from 25% to 15% in light of the results of the leave-one-out approach. Whereas the DNDC sensitivity analysis, discussed in comment #82, clearly indicated that impacts of differences in rainfall, SOC and clay content across the 12-state NCR region were relatively minor, it is evident that a significant amount of uncertainty remains within the 12-state NCR region due to these factors. Deviations in emission reductions due to differences in rainfall, SOC, and clay content were, on average, smaller than 15%. As a consequence, the additional uncertainty term serves to conservatively capture the remaining uncertainty.

Finally, the Reserve recognizes that changing the formula within the square root to (1+32/nrFields) corrects a previous bias within the formula by expanding the statistical formula for prediction intervals (i.e., the interval bounding a single new prediction) to use for multiple new predictions, instead of confidence intervals (the interval bounding the

average of the model). This was modified in the new version of the protocol.

The actual uncertainty equation, therefore, becomes:

Step 1:
In case the project is located in Michigan:

$$\boldsymbol{UNC_{PER,f}} = \left(\mathbf{1} + \frac{\mathbf{32}}{\sqrt{\boldsymbol{nrFields}}}\right)\left(\mathbf{100} - \mathbf{63} \times \boldsymbol{e}^{-\mathbf{40} \times \mathbf{10}^{-\mathbf{6}} \times \boldsymbol{NR}_{P,f}{}^{\mathbf{2}}}\right)$$

In case the project is not located in Michigan:

$$\boldsymbol{UNC_{PER,f}} = \left(\mathbf{1} + \frac{\mathbf{32}}{\sqrt{\boldsymbol{nrFields}}}\right)\left(\mathbf{100} - \mathbf{63} \times \boldsymbol{e}^{-\mathbf{40} \times \mathbf{10}^{-\mathbf{6}} \times \boldsymbol{NR}_{P,f}{}^{\mathbf{2}}} + \mathbf{15}\right)$$

Step 2:

In case $\boldsymbol{UNC_{PER,f}} < 15$:

$$\boldsymbol{\mu_{struct,f}} = \mathbf{1}$$

In case $\boldsymbol{UNC_{PER,f}} \geq 15$:

$$\boldsymbol{\mu_{struct,f}} = \boldsymbol{e}^{-\boldsymbol{UNC_{PER,f}}/\mathbf{300}}$$

Where,			Units
$UNC_{PER,f}$	=	Uncertainty in N_2O emissions reductions associated with a reduction in N rate for field f relative to the average emission reduction value.	%
nrFields	=	Number of fields included in the project area (e.g. the number of fields in the aggregate, or equal to one for a single-field project)[18]	
$NR_{P,f}$	=	Project total N rate determined for field f	kg N/ha
15	=	Additional uncertainty factor to account for remaining uncertainty not captured by measurements.	%
$\mu_{struct,f}$	=	Accuracy deduction for structural uncertainty for field f	

94. Drop the term "nrFields" in Equation 5.17, because 1) It is negligible when participation in the program is widespread, and does not create large underestimations in uncertainty, and 2) It is a large deterrent to early adopters of the program. In the case of a small number of fields, the term √(32/nrFields) and overall uncertainty would be large. This potential overestimation of uncertainty for early adopters will be reduced when more fields are added to the program.

    If a term for the number of fields is allowed to stay, it should represent the total number of fields in the program and not the number of fields in a project or aggregate for the following reasons: 1) Aggregates are arbitrary entities unnecessary in uncertainty analysis, and 2) Using the total number of fields will reduce the added uncertainty and increase confirmed emission reductions

[18] The $\frac{\mathbf{1}}{\sqrt{\boldsymbol{nrFields}}}$ factor ensures that the uncertainty decreases with an increase in the number of fields in the aggregate. This factor accounts for the smoothing effect of having more fields in an aggregate on the emissions that are calculated by the quantification approach. Note that this factor was not included in the MSU-EPRI protocol.

for all participants. **(MSU-EPRI)**

RESPONSE: It cannot be assumed that project implementation is going to be widespread. Therefore, the Reserve explicitly desires to keep the impact of the "nrFields" within the formula for uncertainty deduction. The Reserve respectfully disagrees that leaving this factor in the formula represents an overestimation. Rather, not including this factor within the formula is regarded as a potential underestimate of the uncertainty.

The Reserve agrees with the suggestion that the number of fields should reflect the total number of fields in the program in any given cultivation cycle, and has revised the protocol accordingly.

95. The Structural Uncertainty Deduction in the current version of the NMPP unnecessarily continues applying discounts to every project into the future even if such a discount would be statistically unnecessary at the program-level.

    The Reserve could conservatively address structural uncertainty through alternative policies that could be applied at the program-level, consistent with the guidance from Statements 5 and 6 in the C-AGG white paper **[see TCT public comment submission for further detail]**. For example, the Reserve could implement a holding account on its registry which could be used to hold credits from projects based on a program-wide Structural Uncertainty Deduction at the time the credits were issued to each project. As the number of fields enrolled and receiving credits through the application of the NMPP increases over time, structural uncertainty would be progressively reduced and the credits held in this holding account could be periodically returned to their respective projects. A policy alternative like this would avoid the unnecessary and permanent discounting of credits for every project without compromising the conservativeness of the Structural Uncertainty Deduction. The Climate Trust, a contributor to the C-AGG white paper referenced by the NMPP, believes policy alternatives like this that avoid unnecessary transaction costs while ensuring uncertainty is appropriately accounted for should be preferred over the type of policy currently proposed in this version of the NMPP. **(TCT)**

    RESPONSE: Thank you for these suggestions. We agree that uncertainty should be evaluated at the program level. Please see the response to comment #94.

96. Currently, the accuracy deduction in Equation 5.17 is:

$$\mu_{struct,f} = 138 \times 10^{-7} \times \quad UNC_{PER,f}{}^{2} - 395 \times 10^{-5} \times \; UNC_{PER,f} \quad + 0.999$$

    While this quadratic function **[see Figure 1(b) in MSU-EPRI public comment submission]** is a conservative approximation of the stepwise function **[see Figure 1(a) in MSU-EPRI public comment submission]** it is not the simplest approximation of the original step-wise function.

    Recommendation: Use either (i) or (ii) below; preferably (i):

    i. $\mu_{struct,f} = (\exp^{(Unc\ /\ 330)})$

    a simple function with a small deviation (maximum of ~2 %) from the more complex quadratic function **[see Figure 1(c) in MSU-EPRI public comment submission]**.

    ii. $\mu_{struct,f} = (1 - 2.3 \times 10^{-3}\ Unc)$

a linear function, that has a slope derived from the integration of uncertainty approach **[see *Integration of the Uncertainty* attached to the MSU-EPRI public comment submission]**, again with a small deviation (maximum of ~ 4%) from the more complex quadratic function **[see Figure 1(b) in MSU-EPRI public comment submission]**. The linear approach is the only one that allows us to discard a constant proportion of the emission reductions we are uncertain of, without the need to relate it back to the relative % of total emission reduction it represents. **(MSU-EPRI)**

RESPONSE: The Reserve appreciates the suggestions by the emissions factor's original developers to simplify the formula to calculate the uncertainty. The protocol has been revised to include Option (i). However, the exponent was reduced to 300 instead of 330 to achieve a similar level of conservativeness as that contained in the original, quadratic, function. The response to comment #93 includes the new set of equations regarding uncertainty deductions.

5.5.1 Calculating GHG Emissions from Cultivation Equipment (SSR 3)

97. Equation 5.19: Growers often do not know their fuel use by field. It would be helpful to provide explicit guidance on how to allocate fuel use in the situation that 1) growers don't know their fuel use by field; and 2) growers don't know their fuel use by specific activity (so as only to include the fuel related to the project activity). **(NWF et al.)**

    RESPONSE: Thank you for this suggestion. The new version of the protocol has greatly simplified the required data for Equation 5.19, as well as clarified that GHG emissions from cultivation equipment must only be quantified when fuel use for cultivation increases due to the project. Specifically, if the same cultivation equipment is used both before and after the start of the project, and no significant management changes occur, other than a reduction in N applied, no fuel use data must be reported. However, if different cultivation equipment was used (e.g., a switch from conventional equipment to VRT equipment) or the number fertilization applications and/or field passes have increased (e.g., a switch to split application), some extra reporting is required. In light of feasibility concerns, the protocol has been modified to indicate that if no data or records on fuel use or fuel efficiency are available, project participants may use a standard default emission factor expressed as fossil fuel emissions per hectare and per fertilization application event. This conservative default factor will streamline both recordkeeping and verification requirements. Alternatively, project participants may opt to use their own fuel use to calculate the specific change in fossil fuel emissions from their own cultivation equipment.

98. "The project developer/aggregators should retain the following records...for each field...Onsite fossil fuel use records." [Recordkeeping section]

    Simple and accurate methodologies exist to quantify increases in on-farm fuel combustion GHG emissions by using estimates of additional time of operation (if any) and simple mpg data for relevant equipment. Verifying this calculation would not require access to all (or any) fossil fuel purchase records.

Using purchase records to calculate the amount of fossil fuel usage attributable to fertilizer application is unnecessary. Growers use fossil fuels for a variety of on-farm activities throughout the year including plowing, harvesting, soil preparation, irrigation or any other number of on-farm uses. The amount of fossil fuel use attributable to fertilizer applications and management is small. Fossil fuel purchase records should be totally excluded from the data collection, monitoring and verification. **(Camco)**

RESPONSE: Please see the response to comment #97.

5.5.3 Calculating GHG Emissions from Transport of Organic Fertilizer (SSR 6)

99. Equation 5.21, Page 38: The calculation of increased GHG emissions from transportation of organic-N (manure) substituting for synthetic N fertilizer does not appear to take into account baseline emissions for the transportation of the synthetic fertilizer. For example, what if the project participant under baseline conditions is using liquid urea ammonium nitrate (UAN) solution that he is hauling 20 miles one way to the field and under the project scenario, he is hauling an equivalent amount of N in the form of manure 0.5 mile to his field. How is the transportation distance for the synthetic fertilizer accounted for in Equation 5.21? **(SES)**

RESPONSE: Please see the responses to comments #68 and #72. Equation 5.21 has been removed from the protocol.

5.5.4 GHG Emissions from the Shift of Crop Production Outside of Project Boundaries (Leakage) (SSR 7)

100. In the event of a yield reduction from project activities, it is assumed that the production would be made up by crop production outside the project boundary resulting in leakage. It seems as if the entire baseline emissions would be attributed to the crops grown to make up the reduction in yield. It seems likely that a farmer that responds to an increase in corn prices would dedicate acreage to corn production that had previously been used to grow less lucrative crops that would have received fertilization themselves. The method in Section 5.5.4 seems to allocate the entire baseline N_2O emissions to the “leakage acreage”, accruing them to the project, which seems to be overly conservative since the baseline condition for the “leakage acreage” would likely have been fertilized in any case. **(CCC)**

RESPONSE: The Reserve recognizes that a farmer making up for yield declines at the aggregate level may respond by growing corn on acres that had previously been used to grow less lucrative crops, which also would receive fertilizer. These crops, however, are likely to have a lower N rate, and as such a different (likely lower) N_2O response curve. Further, it is equally possible (as noted in the response to comment #39) that if yield declines at the aggregate level, additional land may be put into production elsewhere to make up for that yield decline. As such, the protocol applies the most conservative approach for leakage, which is to assume that the baseline N_2O emissions (at the aggregate-level in Mg CO_2e/ha) would occur on that newly cropped land.

101. The draft protocol is concerned with the possibility that management changes will reduce yield and therefore cause increased planting elsewhere. The draft protocol only penalizes the case where management reduces yield, but does not credit the case where management improves yield relative to conventional practice (Equation 5.22, pg. 40). There are different ways to achieve reduction in N amendment to a field. For example, a farmer may choose to use cover crops, increasing N retention and resulting in mineralization of this N throughout the growing season. The net effect of using cover crops is expected to be no decline in yield (Tonitto et al. 2006), with increased yields in some years and decreased yields in others. Based on the current protocol, adding cover crops to a system would result in a penalty during years with lower yield than conventional systems, but no credits in years with improved yields.

    We recommend that if there has been no net yield decline over the course of the crediting period, no yield penalties should be applied to GHG credits awarded to the grower. **[See UCS et al. and NWF et al. public comment submissions for further detail.] (UCS et al., NWF et al.)**

    RESPONSE: Thank you for your recommendation. There may be valid reasons to consider leakage over the timeframe of an entire crediting period. However, since emission reductions are credited on an annual, reporting period basis, the Reserve believes it is important to ensure that leakage is accounted for over the same timeframe. Accounting for net leakage over an entire crediting period would require a mechanism to true up credits issued if, for example, yield increases in some years were not sufficient to compensate for yield decreases in other years. We will continue to consider ways to improve leakage accounting in future versions of the protocol.

7.3.1 Record Keeping for Single-Field Projects

102. "Time-stamped digital photographs of the fertilizer management activities" is referenced in Section 7.3.1 and 7.3.1.2. These photographs will not provide the necessary information to document or verify reductions in N rates. It is recommended these references be removed from the protocol. **(SES)**

    RESPONSE: Noted. The Reserve has removed the requirement that time-stamped digital photographs be used to demonstrate N rate reductions during verification. However, the Reserve believes that time-stamped photographs could supplement the verification process in some cases. For example, photographs may be used to demonstrate field boundaries and/or types of cultivation equipment. The Reserve has added a section on optional records/documentation that may be voluntarily provided by project participants to help demonstrate certain components of the project. Photographs have been added to this new section. (See also the response to comment #107).

7.3.2 Record Keeping for Aggregates

103. "Aggregators should retain the following records...for each field... Copies of air, water, and land use permits relevant to project activities."

    Farmers may have a variety of local ordinances, state regulations and federal standards to comply with. Some farms are diversified businesses; some operate dairy operations, raise hogs

and chickens, and operate small businesses on premise. There is no reason to require blanket collection of all permits and official permissions and communications that might be relevant to project activities to be reviewed for the NMPP. This open-ended requirement could easily spiral out of control if verifiers don't have clear standards for materiality, understand the purpose and use of this information, and have a usable definition for what constitutes "relevance" to project activities. **(Camco)**

RESPONSE: The Reserve has clarified the language with regards to this requirement. The Reserve no longer requires aggregators to retain copies of *all* air, water, and land use permits from every project participant, so long as the aggregator reviews any permits relevant to the project activity and/or project site (defined as the fields on which a project activity is being implemented). As such, permits have been removed from the list of records required to be retained by the aggregator in Sections 7.3.1.1 and 7.3.1.2. The Reserve has added clarifying language to Section 7.3.1.1 that: 1) requires aggregators to include a review of relevant permits in the Aggregate Monitoring Plan; 2) stipulates that project participants must retain relevant permits and be prepared to provide any documentation requested by the aggregator or a verification body; and 3) clarifies the types of permits that would be relevant to project activities.

104. Project Activity Data: It is not at all clear why this statement is included in the Protocol for record-keeping for verification: "Farm management records, particularly pertaining to nitrogen management" (page 52). What is the relevance to a nitrogen management protocol of farm management records that have nothing to do with nitrogen management? **(Camco)**

RESPONSE: This requirement has been clarified. The protocol now reads "Farm management records pertaining to nitrogen management and crop yields, by field."

105. "The project developer/aggregators should retain the following records...for each field...All maintenance records relevant to the farm equipment and monitoring equipment."

What reason would justify the expense of requiring verifiers to review maintenance records of farm equipment? Given the extensive use of farm machinery on a variety of farm practices, other than fertilizer application, it is not at all obvious the incremental value of this information would be, or how any verifier could conclusively use that information except with reference to the most specialized pieces of equipment used for fertilizer applications. Clear standards for materiality and relevancy should be provided to verifiers to minimize cost and burden to growers. **(Camco)**

RESPONSE: The Reserve believes that examination of cultivation equipment, monitoring equipment, and the associated maintenance records can help inform verification activities, particularly when significant management changes (e.g. "enabling practices") have taken place to help implement N rate reductions. However, the commenter is correct that examination of cultivation equipment and maintenance records may not be necessary for all project sites. As such, this requirement has been clarified. It now reads "All records relevant to the equipment used for N-application and/or N-monitoring (e.g. chlorophyll meter, variable rate technologies, etc.)." Maintenance records are no longer required. The Reserve has also added language in Section 7.3.1.2 (see comment #97) requiring project participants to retain all records that demonstrate any material changes in equipment type and/or usage, if they intend to use the project-specific quantification methodology for Equation 5.19. If the standard default is used, no such maintenance

records are required.

7.4 Reporting Period and Verification Cycle

106. Alongside a review to make sure the terminology for project timeframes (e.g., eligible cropping years, reporting periods, crediting periods, etc.) are used consistently throughout the NMPP and are defined in the glossary, The Climate Trust suggests revising the verification timelines specified in *Sections 7.4.1.1 – 7.4.1.4* and *8.2.1 – 8.2.3* such that verification and site visit timing is based upon the occurrence of eligible crop years as opposed to calendar years. For example, *Section 7.4.1.3 Option 2: Twelve-Month Verification Period with Desktop Verification* could be revised such that site visit verifications occur following the conclusion of every other eligible cropping year rather than every two years. This revision would prevent unnecessary site visits in non-eligible crop years for projects employing rotational cropping. Similarly, *Section 7.4.1.2 Option 1: Twelve-Month Maximum Verification Period* could be revised such that the verification period covers one eligible crop year plus any non-eligible crop years for projects with a rotational cropping system. **(TCT)**

RESPONSE: Noted. The protocol has been clarified to indicate (in Section 7.4.1) that, although project participants must continue reporting on N rate during non-eligible crop years, non-eligible crop years do not require verification. Further, language has been clarified to specify how the verification options for single-field projects work to accommodate projects with a rotational cropping system. Option 2 has been clarified to allow desktop verifications to occur every other corn-cropping year (alternating with site visits), following the initial site visit verification, with a maximum of three non-eligible crop years between corn crops. Option 3 now allows 24-month verification periods that consist of two non-consecutive corn crop years with a maximum of one non-eligible crop year in between (e.g. verification could cover 24 months of data within a 36-month timeframe).

8 Verification Guidance

Verifying the Project Activity

107. At current, the protocol relies on only a few verification tools. This could be expanded to include readily available tools like geospatial modeling, to verify things like soil type or land use at the landscape-level, and farm-level tools like pre-side dress soil nitrate test (PSNT) or corn stalk nitrate tests (CSNT) to evaluate nitrogen levels. Some flexibility (for example, use one or a few of a list of approved verification options) could be most effective as some verification tools are more expensive or readily available for some than others. See Appendix A for more ideas on additional tools for verification. Using more of these types of tools could also allow you to reduce uncertainty and thus put to rest the case for an uncertainty deduction. **(EDF)**

RESPONSE: Thank you for your comment and the provided information. The Reserve has revised Section 8 of the protocol to include a list of mandatory verification items, as well as a list of additional, supplemental verification tools that may be used. These supplemental verification tools must be used "according to manufacturer's guidance,

industry best practice, or the equivalent standard." Further, the Reserve anticipates that additional verification tools may be included in future versions of the protocol.

In addition, the Reserve has added a requirement that all fields implement a corn stalk nitrate test (CSNT), one of the tests recommended by the commenter, to evaluate nitrogen levels in the corn stalk at the end of the cultivation cycle. A CSNT is a low cost method to provide greater assurance of N rate reductions in the absence of site visits and to aid in adaptive N-management strategies for participants across aggregates. Guidance on how a farmer takes cornstalk segment samples has been added to the protocol, and samples shall be analyzed by local land-grant universities and/or extension services, which the Reserve estimates will cost $11-20 per field. CSNT results will help inform a risk based approach to site visit sampling for verifications. Verifiers must review the results of the CSNTs for all fields, sampling from the fields indicating "excessive" N-use (e.g. greater than 2000 ppm nitrate-N) or other anomalous results for site-verification by sampling. (Please see response to comment #110.)

Language has been clarified that an agronomist must be part of verification site visit teams. The agronomist shall ask questions of interview the farmer to assess N-management practices, confirm statements about historic and project N-application rates, and confirm proper sampling of the cornstalk for CSNTs. In the case of excessive CSNT results, which itself may often lead to a site visit, the agronomist and verifier will examine any additional project data needed to confirm that the "excessive" results were anomalous.

108. The protocol lacks a rigorous method to verify the quantity of fertilizer applied. It relies heavily on record keeping, but there is no assurance that the records are accurate.

For synthetic fertilizer purchasing records can be used. But there are two problems with this. First, a farmer may purchase fertilizer for all of their crops, but only list a few fields in the offsets program. How can changes in fertilizer purchase for the entire farm be attributed to the specific fields in the program? Also, the timing of fertilizer purchase may not match fertilizer applications, for example, if excess fertilizer is purchased when prices are low. Non-synthetic fertilizer is even more difficult, as there may not always be purchasing records. A compliance offsets protocol must be reasonably verifiable, especially if it is to be used under a compliance regime. **(UCS)**

RESPONSE: The Reserve agrees that these are valid concerns. Please see the response to comment #107 for a discussion of the additional verification procedures that have been added to the protocol. In particular, the Reserve believes that the addition of the CSNT, inclusion of an agronomist on the verification site visit team, and providing additional guidance on confirming farmer N rates through a process of triangulating data greatly increases the assurance that N_2O reductions have occurred, by helping fill in gaps of uncertainty associated with farmer purchase and management records. Further, the Reserve has added the requirement that each project participant must submit a Field Monitoring Report, which includes a statement of accuracy where the project participant attests to the fact that all statements and information contained therein are true, and language has been added to the Aggregator's Attestation of Title asserting that the Aggregator has not knowingly allowed a third party (e.g. the project participant) to make or provide false, fraudulent, or misleading statements to the Reserve or any third party verifier.

109. CAR should seek professional review and comments from auditors and approved verification service providers. The verification approach outlined in NMPP V1.0 could be aligned with standard procedures from the insurance industry's approach to fraud detection, including an assessment of the risk of fraudulent reporting and gaming. Corn growers and aggregators will gladly accept harsh penalties for misreporting in exchange for a presumption of good faith efforts. **(Camco)**

    RESPONSE: Changes have been made to the verification section (Section 8) to reduce the total number of site visits required across an aggregate. Corn Stalk Nitrate Tests (CSNT) have been added as a monitoring requirement for all fields, allowing projects to demonstrate conformance without incurring burdensome site visit costs. Please see the response to comments #107 and #110.

110. Point source protocols tend to require in-depth site visits to complete verification but Programs of Activities (PoA) under the Kyoto Protocol are verified under a different approach that relies more on desktop reviews and programmatic verification. The reason for this is that highly accurate verification can be accomplished without travelling to each location, and because the costs of traditional boots-on-the-ground verification can exceed the value of the credits being generated, thereby eliminating the incentive for practice change.

    The approach to verification contained in NMPP V1.0 is based on verification of point sources where the costs of a field visit are warranted by the large number of credits originating at a single point. It will not work when applied to a large aggregate. The costs of verification would exceed the value of the credits and the project will collapse from excessive verification costs. An example is provided in the detailed comments to illustrate the impracticality of the current verification model. **(Camco)**

    RESPONSE: Please see the responses to comments #107-109. Similar to Programme of Activities (PoA) guidelines, verification bodies shall be allowed to vary the number of site visit performed based on levels of perceived risk. A minimum site visit sampling of 5% of enrolled fields is specified in the protocol. Verification bodies may sample above the 5% threshold (with a maximum of 15% fields visited in a given year), based on specific risks identified during the verification, such as the incidence of CSNT results within the "excessive" range, fields generating large proportions of the emission reductions of the aggregate, and/or demonstrated poor communication of N-reduction strategies and implementation between aggregators and participants. Additional language has been added to the protocol, providing verifiers with guidance on sampling percentages and perceived risk. Each verification report submitted must contain a description of the number of site visits along with justifications.[19]

Site Visit Verifications

111. The Climate Trust is concerned that site visit verification will offer little added value in terms of certainty of compliance or offset quantification while significantly and needlessly increasing the cost for project development. In its current scope, the NMPP only allows projects that employ

[19] CDM Executive Board 32 Report Annex 39 (paragraph 21). Available at: http://cdm.unfccc.int/EB/032/eb32_repan39.pdf

rate reductions in the amount of N fertilizer applied. Because fertilizer applications would be made several months before any site visit would occur, it is unclear what value a site visit would offer. The verifier will not be able to assess whether rate reductions have been implemented based on a field inspection, but would instead do so by reviewing the records that are already required to be kept by the methodology and could be reviewed without necessitating a site visit.

The Climate Trust recommends a significant reduction in the number of verification site visits based on consultation with the Scientific Advisory Committee regarding appropriate sampling intensities. We also encourage a clearer description in the NMPP of the justification and scope for verifier review during site visits, and that the costs of such site visits be considered by the Reserve in addition to any expected benefits they may offer. **(TCT)**

RESPONSE: Please see the responses to comments #107-110.

112. The benefit of site visit verification is unclear. On a farming field always in a state of change (planting, tilling, weeding, harvesting) what will a verifier observe during a visit to a field at any point in time? There is no call for the verifier to take soil samples for nitrogen analysis for instance, which would require a site visit.

Projects can make available a wealth of information for verification, from aerial photographs, to fertilizer purchase and application records, to crop yield records, and many other points of information to create an iron clad evidentiary trail. On-site verification seems unlikely to provide any tangible benefits to verification while adding considerable cost. As seen in the forestry sector, on-ground verification is extremely costly, time-consuming and has diminishing returns unless kept to a minimum. In forestry, a verifier needs to be on site to assess the composition and stratification of a forest and to evaluate the understory and make stand density measurements to complement aerial photography and other verifiable information. A verifier looking at a plowed field or even a field of corn will see only a field of corn, a snapshot in time of a dynamic system. **(Camco)**

RESPONSE: Please see the response to comments #107-110. Guidance for verifiers on what should occur on a site visit has been expanded in the protocol.

113. The term “OSN” is used in Tables 8.1 and 8.2. Please define the term OSN. **(SES)**

RESPONSE: OSN included in Tables 8.1 and 8.2 is an artifact of an earlier draft of the protocol, erroneously included in the current version. It has been removed.

8.3.3.1 Sampling for Site Visit Verification for Large Multi-Participant Aggregates

114. The costs of complying this with the provisions in this section are prohibitively large relative to the expected return from carbon financing. There are three rules used to determine the minimum number of mandatory site visits to project participants (growers). **[See cost example in Camco public comment submission, comment 31.]** Aggregators may suffer equal or greater costs as they prepare growers and verifiers in advance, attend every site visit, and follow up to respond to audit concerns. For a protocol like this requiring specialized expertise not previously found in audit and verification companies, it will be common to expect two people on an audit team, an experienced verifier and an agronomer for instance, which would raise

verification costs. These verification costs are not just expensive in absolute dollars – they are high relative to the projected carbon value of the project. **(Camco)**

RESPONSE: Thank you for sharing your cost estimate for verification. The Reserve recognizes that verification costs, particularly those associated with site visits, may likely be one of the most significant barriers to implementing nitrogen management projects. As such, in light of public comments received, the Reserve has reduced the site visit requirement in the protocol; please see comment responses #106-110. Though some other new requirements may result in a small added cost per field (e.g. the CSNT, which costs approximately $11-15 and must be performed for every field), we believe that the significant cost reductions due to reduced number of site visits, enabled in part by the inclusion of such a test, will more than make up for it.

115. A List of Forms would be useful to include in the preface [of the protocol]. Here is a complete list for aggregators:
    - Aggregate Submittal form
    - Field Management Transfer form
    - Aggregate Transfer Form
    - Aggregator Attestation of Title form
    - Attestation of Regulatory Compliance form
    - Attestation of Voluntary Implementation form

    (Camco)

    RESPONSE: We agree that a complete listing of forms required is useful to the project developer. The NMPP includes a complete list of forms, both for single field projects and for aggregators, in Section 7.1 pertaining to project submittal. The Reserve has added lists of additional forms required in subsequent years of the project (for single-field projects and aggregates).

116. The statistical justification for the prescribed sampling levels is unclear. The Climate Trust encourages the Reserve to develop a verification sampling strategy that is fundamentally tied to the scale of emissions reductions claimed and the sources of risks that such emissions reductions are being misstated or incorrectly calculated. Incorporating a sampling approach based on the total acreage, amount of nitrogen applied, or volume of emissions reductions claimed could help reduce the cost for statistically unnecessary auditing, which would be particularly helpful for projects with relatively smaller credit volumes.

    The Climate Trust recommends the NMPP be revised through consultation with the Scientific Advisory Committee to determine the most efficient and statistically robust sampling levels necessary to meet the Reserve's verification objectives. **(TCT)**

    RESPONSE: The site visit sampling minimum has been adjusted. Please see the response to comment #110.

Appendix A

117. In Appendix A, there are inconsistencies with the Figure numbers and Table numbers as referenced in the narrative portion of the Appendix. As such, this also affects the references in the body of the Protocol. **(SES)**

RESPONSE: We are correcting Appendix A references in the final protocol, as well as inconsistencies throughout the body of the protocol.

118. It appears that only a handful of crops and states are listed in Table A.8. What are the procedures for creating reference RTAs for additional crops and locations?

If no reference RTA is provided, the project developer should be able to use the historical RTA calculation as specified in Equation 5.8 as the test of additionality. **(Weyerhaeuser)**

RESPONSE: Table A.8 includes RTAs for corn (in both corn-corn and corn-soy rotations) in all twelve states in the North Central Region. As noted in Table 3.1 and throughout the protocol, this version of the NMPP is only applicable to corn in these twelve states. Procedures for meeting the performance standard for additional crops and locations will be established, if and when they are included in future versions of the protocol.

Appendix B

119. In regard to section B.2.5.2 (Switching from Fall to Spring Application), there is no mention about the potential for decreasing N rate due to improved N fertilizer recovery when moving to spring N application. Therefore, when applying N fertilizer in the spring, the N rate can be less than when applied in the fall to achieve the same level of corn production.

In addition, a nitrification inhibitor is always recommended when applying N fertilizer in the fall, while a nitrification inhibitor is not needed when applying near planting or for side-dressing. Therefore, the cost of producing and applying the inhibitor is always associated with fall application but should not necessarily be factored into spring or side-dress application.

In regard to the idea that this practice could have significant potential (for reducing nitrous oxide flux) in regions with winter freeze or spring thaw, I am confused. Fall N application is viewed as a possible practice only where there is a winter freeze and obviously a spring thaw. The farther north one travels in the Corn Belt, the more acceptable fall N application is. This is due to the fact that soils remain frozen during the winter and nitrification of ammonia fertilizers is limited. Here in central Illinois, fall N application may occur on more than 50% of the corn fields, but soils are rarely continuously frozen throughout the winter season (especially this past winter). The Illinois Agronomy Handbook discourages the use of fall N application on any soils south of Illinois Route 16 because the winters are too warm. Please clarify what is meant by the importance of a winter freeze and spring thaw in this section. **(Gentry)**

RESPONSE: The Reserve recognizes that switching from fall to spring application typically results in an inherent reduction in total N applied, due to the reduced amount of N leaching from the field and the improved N recovery by the plant. Appendix B has been revised to clarify this understanding. Due to the reduction in N rate associated with this practice, a farmer who implements a change from fall to spring application and in doing so reduces his N rate is actually eligible for crediting those N rate reductions. However, at this time, the protocol cannot also credit any additional N_2O reductions that may be associated with the reduced N-losses that may have taken place from fall to spring. Language is included in the monitoring section of the protocol to encourage farmers to keep detailed enough records to potentially allow for crediting of the fall to

spring switch, if it were to be included as a project type at a future date. The statement that this project type should only be considered where there is winter freeze/spring thaw was a recommendation by the Science Advisory Committee, as those regions are the only ones in which switching from fall to spring will consistently reduce N_2O emissions. Appendix B has been clarified to elaborate on this fact.