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May 23, 2012

Climate Action Reserve
523 W. Sixth Street, Suite 428
Los Angeles, CA 90014

Re: Version 1.0 Nitrogen Management Project Protocol

Dear Climate Action Reserve (CAR),

Thank you for the opportunity to contribute to the Nitrogen Management Project Protocol: Reducing Nitrous Oxide (N2O) Emissions through Improved Nitrogen Management in Crop Production. Environmental Defense Fund (EDF) works to develop incentives for farmers, ranchers and private forest landowners to increase the environmental benefits of their land. We recognize the significant role that agriculture can play in reducing greenhouse gas (GHG) emissions and we are very supportive of efforts to develop offset credits for these reductions. EDF is actively engaged in the development of agriculture offset protocols, including, as you know, the Workgroup for this protocol. Additionally, EDF has extensive experience working with corn and soy producers, producer associations, crop advisors, and agronomists among several crop types in the Midwest and Mid-Atlantic to expand the use of adaptive nutrient management. Given our experience, we see improved nitrogen management in crop production as an important opportunity to reduce GHG emissions efficiently and cost-effectively.

Recommendations
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.

Additional Activities, Crops and Regions. 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 N2O 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 N2O 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.

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We also 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 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. 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.

Methodology. 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 N2O 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.

Verification tools and approaches. 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.

Further comments and concerns

Additionality. EDF is supportive of approaches that allow for broad participation while maintaining integrity. 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.

The RTA threshold used to account for additionality is complex to understand in terms of what it means for GHG reduction potential and whether a farm or practice would qualify for credits. In order to determine whether or not the threshold would be overly exclusive, we suggest that you consider:

- Conducting some evaluations by looking at a few representative farms in each state to see what it would take for a farm to qualify in the program, and what type of benefit could be seen. We suggest you run the numbers on both an "average" farm and a farm that would be considered efficient for nitrogen application as a way to estimate the potential. These trials should be run for different locations in the state because yields and nitrogen application can vary widely across a state. The trials should also be run for different years because weather and thus nitrogen application also varies widely from year to year.
- Putting together a work group of agronomists and crop consultants that would be able to "ground truth" how the protocol would work in practice and react to its agronomic soundness and real-world feasibility. We would be happy to provide some names of respected nutrient management specialists from the agronomy departments at land grant universities serving the areas under consideration for advice on applicability and potentially also data for representative farms. This will be important for determining things like how temporal variability (such as year-to-year weather) and spatial variability (such as across a state or farm) could affect nitrogen efficiency, the performance standard threshold, and crediting.

Crediting. 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.

We appreciate the work and dedication that CAR has shown towards developing robust, scientifically valid protocols, and acknowledge CAR's desire to balance the ease of use and accuracy of this protocol. We hope that you will take our comments into consideration by further evaluating the usability of the protocol. Please don't hesitate to contact us for any additional clarification or information.

Sincerely,

Eric Holst
Senior Director, Working Lands
Environmental Defense Fund

APPENDIX A: Potential tools for verification purposes

For more information, please refer to http://adaptnetwork.org/tools/

There are many ways for farmers to test out and narrow down the nutrient needs for their specific farm sites. The best results occur from using a number of tools together in combination with outside evaluation of the data by technical experts (such as expert crop advisors or land grant university experts), as well as interpretation of the data in consultation with the farmer him or herself. There is no one perfect combination — rather, the process is about farmers finding the right set of tools for their particular needs. Some of the key tools used in the adaptive management process are summarized below. Click on the tool name for more information on each tool.

- ***Adapt-N Model:*** This computer model calculates a number of complex interactions specific to a given field (including incorporating high resolution weather data, soil type, etc) to provide a significantly more accurate nutrient prescription than has previously been possible. The model provides similar information to the PSNT test, but without the need for any in-field sampling.

- ***Replicated Strip Trials:*** Growers can use on-farm field trial procedures to evaluate various nutrient rates, timing, sources, and methods of application. By following the on-farm field trial procedures in this document, growers can objectively conduct a field trial on their land, interpret the results, and make adaptive management changes to their nutrient management strategy. These same on-farm field trial techniques can also be used to evaluate other management changes such as seeding rates, hybrid selection, tillage systems, cover crops, weed and pest control, etc.

- ***Aerial Imagery to Identify Nitrogen Stress:*** Nitrogen stress in corn affects the color of crop leaves and, therefore, the canopy. An aerial image of a field can reveal subtle differences of N stress within a field to a resolution of a single row, and yet can be used to evaluate an entire field. Once identified, other factors along with nitrogen levels will need to be evaluated to identify the source of the reduced productivity.

- ***Leaf Tissue Test:*** Leaf tissue testing is an indicator of the amount of N that has been taken up by the plant at that particular moment. This tool can help guide in-season fertilization changes, but cannot detect or predict N stress that may occur later in the season.

- ***Chlorophyll Meters:*** Nitrogen stress in a corn plant results in reductions of chlorophyll throughout the plant, which can be detected by a chlorophyll meter. A chlorophyll meter reading provides a snapshot of the N status at the time of sampling.

- ***Guided Stalk Sampling:*** The variability found in most fields makes it important to consider sample location in the context of the entire field. A technique called guided stalk sampling can give a more accurate picture of the entire field. This strategy combines the information of remote sensing with soil survey information and late-season corn stalk nitrate testing to characterize differences in the crop across the field that provide an estimate of the N availability to the crop.

- ***Crop Sensors:*** Crop sensors, which read canopy reflectance, are mounted on an N applicator and use the information collected by the sensors to guide or adjust the amount of N fertilizer applied. The two main crop sensors commercially available to monitor canopy reflectance are Greenseeker and the Crop Circle.

- ***The Pre-Side Dress Soil Nitrate Test (PSNT):*** Enables producers to estimate the amount of N available in the soil before corn plants begin taking it up intensively. The PSNT can be used to predict which fields might need additional N. The PSNT is most useful for systems using manure as a source of nutrients.

- ***Corn Stalk Nitrate Test (CSNT):*** Fall test serving as a "post mortem" of the crop, which can help determine if excessive amounts or inadequate amounts of nitrogen were used. CSNT can provide a general estimate of nitrogen availability to the crop in each field for the crop cycle being completed.