To: Climate Action Reserve

From: Eliav Bitan, representing the National Wildlife Federation
Dana Gunders, representing the Natural Resources Defense Council
Noel Gurwick, representing The Union of Concerned Scientists
Meredith Niles, UC Davis
Christina Tonitto, Cornell University

Subject: Comments pertaining to the Nitrogen Management Project Protocol Version 1.0 for Public Comment (April 24, 2012).

We appreciate the opportunity to provide public comments to the Climate Action Reserve regarding the Nutrient Management Protocol. We want to thank the Reserve's protocol development team for their helpful communications throughout the protocol development process.

Primary Comments

NMPP Section 3. Eligibility rules

The promotion of simplified rotations across America's agricultural landscape and the conversion of native lands to agricultural production results in increased greenhouse gas emissions and are major drivers of water quality degradation, soil depletion and loss of wildlife habitat. We are concerned that this protocol as currently written would contribute to these long term trends by providing further incentive to grow corn over other crops or on new land. We therefore recommend other eligibility criteria be put in place to prevent this.

In the year 2000, about 80 million acres of corn were planted in the United States. In that same year, about 74 million acres of soybeans were planted, and 35 million acres of winter wheat. These three crops together comprised over half of the nation's planted acres. By 2012, corn acreage had increased to 95.9 million acres. Winter wheat and soybean acres were mostly unchanged, or slightly decreased. The additional 15.9 million acres of corn were planted on land that had been formerly native ground or a different crop. In cases where corn replaced native land, the elimination of perennial grasses or trees and the physical disruption of the soil ecosystem likely caused significant net greenhouse gas emissions. This conversion also likely increased soil erosion by reducing the complexity and duration of vegetative cover on the landscape. Finally, valuable wildlife habitat was eliminated and the extent of agricultural chemical introduction into freshwater systems was expanded .

We are concerned that the Reserve's Nitrogen Management protocol as currently written will support environmental degradation. The protocol applies in states such as North Dakota and South Dakota, where native ground is being actively converted to corn production.

Recommendation:

1. 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) lands that are native ground (IE have no cropping history) prior to the enactment of the regulation are 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.

2. 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 of ensuring all land enrolled in the program meets minimum standards.

NMPP Section 3.1 – Crop Location and System

We support comments by Noel Gurwick, Meredith Niles, and Christina Tonitto as follows:

*Extrapolation from measurements on five fields to 12 states (*Use of MSU-EPRI empirical relationship, Table 3.1 p. 11).

The reduction in N2O emissions is estimated using a nonlinear regression developed at Michigan State University, based on several years of measurements on five fields in Michigan, all planted in corn (Section 5.4 p. 31-32) (Hoben et al. 2011). The draft protocol applies this regression across 12 states, called collectively the "North-Central Region (NCR)," and known commonly as the corn belt. Soil texture is a key driver of N2O emissions, as is soil moisture (which responds to tile drainage). Yet variation in soil texture, soil drainage, and temperature are all much greater across the NRC than across the five fields where this regression equation was developed. Similarly, climate patterns determine moisture availability; there is a large gradient in precipitation across the region considered, with Nebraska, North Dakota, and South Dakota significantly drier than the MI sites from which the equations were developed. In sum, the 12 state region represented in the draft protocol varies significantly from the five Michigan field sites. As a result, we do not believe the regression equation used to quantify N2O emission reductions should be extrapolated that far from the conditions under which it was developed. Doing so misrepresents the potential N2O emission reductions that can actually be achieved. Within the range of soil texture common in agricultural lands, 5-10% clay content is a good proxy for categorizing the soil into fine, medium, or coarse (alternatively heavy, medium, light) texture classes (http://soils.usda.gov/technical/aids/investigations/texture/). Categorizing the Bouwman et al. (2002) database into N2O emissions by crop and soil texture shows significant differences in mean, median, minimum, and maximum N2O flux among these texture classes (Tonitto et al 2009). And in DNDC model runs soil % clay is one of the most significant controls on N2O loss.

For precipitation, relationships developed with data from the five Michigan fields can reasonably be extrapolated to areas where the 10-year average growing season precipitation is within 1 standard deviation of the 10-year average of field sites.

<u>Recommendation:</u>

Until further field observations are available to refine these relationships, 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 N2O emissions calculations based on this MSU EPRI study are conservative and that they do not overestimate N2O emission reductions.

NMPP Section 3.3 – Crediting Period

The protocol only applies to a single crop, which will have an economic impact on the agricultural landscape. The protocol may provide economic advantage to farmers who grow corn annually, instead of more diversified farmers. At a landscape level, this may mean that the protocol has net negative environmental impacts by expanding the adoption of corn monoculture.

Three- and four-year rotations in Midwest corn systems have been shown to reduce nitrogen fertilizer inputs by 66% and 78% respectively. (Liebman et al. 2010) and hence would be expected to have reduced N2O emissions. In addition, soil and wildlife benefit from more diverse rotational systems.

The current crediting period discourages crop rotations and diversity by only allowing the full five years of crediting when a one or two year rotation is used.

<u>Recommendation:</u>

The crediting period should be extended beyond the 10-year timeframe to accommodate more complex rotations beyond corn-soybean. Furthermore, the protocol should not discourage a three-year rotation from being introduced in the middle of the crediting period. 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.

NMPP Section 5.2 – LRVO emissions
We support comments by Noel Gurwick, Meredith Niles, and Christina Tonitto as follows:

Leaching of nitrogen (Table 4.1, p. 22, top line; and equation 5.13, p.33)

Emissions of N2O occur on the farm field, but also occur "downstream," as a result of nitrogen that leaches into groundwater (L) or runs off into streams (R), or volatilizes and redeposits (VO). (In the draft protocol, CAR refers to these as LRVO emissions.)

The literature documenting how different farming practices can reduce N leaching – and hence downstream N2O emissions is very clear. A rigorous meta-analysis showed that for any given N application rate, using cover crops in grain cropping systems results in an average reduction in nitrate leaching of 40% for legume cover crops and 70% for non-legume cover crops (Tonitto et al. 2006). Additional evidence from 15N analysis also shows that fields using a legume N source retain 40% more N than other fields (Gardner and Drinkwater 2009). From an ecosystem budget point of view, these N losses are as important as N2O emissions that occur directly on the farm field, and estimates of how different agriculture practices influence leaching are much stronger than estimates of how N2O emissions, per se, respond to different management practices.

In section 1, 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. Kaspar et al. (2012, 2007) demonstrated that the inclusion of a rye cover crop consistently reduced nitrate leaching, with the annual reduction in nitrate leaching ranging from 35-75% and averaging a 53% reduction over a decade of study. Over the course of this study, nitrate loss as a percentage of N applied in corn years ranged from 15-30% and averaged 20% of N applied. . However, if CAR accepts our recommendation to exclude tile-drained lands from the protocol, then given that data underlying the MSU-EPRI protocol were collected on non-drained fields, the data from the Tonitto et al. (2006) meta-analysis, which included many studies on non-drained fields, are most applicable.

Operationally, the way to take these practices into account is to make a slight modification to equation 5.13, presented on page 33 of the draft protocol. It is understandable that this equation would have been used because it appears in the IPCC 2006 guidelines for estimating

N2O emissions (Klein et al. 2006). This equation assumes leaching of nitrogen added to a farm field (FRACleach) is 30% regardless of the N type or timing, and regardless of the farming system to which the N fertilizer is added. However, the knowledge base for estimating how farming practices influence N leaching has taken some big leaps forward since the publication of the 2006 guidance, and it is time to begin taking advantage of this knowledge.

In our view, the draft protocol is science-based and should take advantage of this strong understanding. Therefore, growers should be given credit for these downstream reductions.

For non-tile-drained field:

For legume cover crops, IPCC default of 30% of applied N leached * 60% (40% reduction) = 18% (based on Tonitto et al. 2006)

For non-legume cover crops, IPCC default of 30% of applied N leached * 30% (70% reduction) = 9%. (based on Tonitto et al. 2006)

For tile-drained fields (our recommendation for a future protocol version)

For legume cover crops, a default of 20% of applied N leached * 60% (40% reduction) = 12% (based on Kaspar et al. 2012, 2007; Tonitto et al. 2006)

For non-legume cover crops, a default of 20% of applied N leached * 50% (50% reduction) = 10%. (based on Kaspar et al. 2012, 2007)

Recommendation**:**

Modify FRACleach in equation 5.13 so that: For default conditions, FRACleach=30% of N applied. For fields with legume cover crops, FRACleach=18%/ For fields with non-legume cover crops, FRACleach=9%.

NMPP Section 5.5.2 – Manure Storage
We support comments by Noel Gurwick, Meredith Niles, and Christina Tonitto as follows:

Manure management changes: N2O from CAFO manure storage (Table 4.1, point 5, p. 23; 5.5.2, p. 38)

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, as currently written, the draft protocol takes these observations and turns them on their heads. 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. The consequence is that the responsibility for the manure's existence is placed on the crop farmer. A farmer using manure as an N source who decreases manure-N use to comply with draft protocol mandates will, according to the draft protocol rules for estimating emissions, create increased manure storage at a CAFO. By making the crop farmer responsible for the change in manure storage at the CAFO, the draft protocol makes it very difficult for farmers who use manure as the primary N source to participate. These farmers will always be forced to consider outside-the-farm-gate emission sources over which they have no control, as they reduce their manure inputs.

In reality, 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.

<u>Recommendation:</u> Do not attempt to address CAFO waste issues in this protocol. 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.

NMPP Section 5.5.3 – Manure Transport

We support comments by Noel Gurwick, Meredith Niles, and Christina Tonitto as follows:

Management-induced changes to fossil fuel CO2 emissions – manure life cycle analysis.

As currently written, the N management protocol is an incomplete life cycle analysis (LCA) with respect to CO2 emissions A farmer does not receive additional credits for the reduction in CO2 emissions that result from avoided production of synthetic N fertilizer (Table 4.1 point 8 pp. 23-24, discussed above). However, the draft protocol does consider CO2 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 (Table 4.1 point 6 p. 23; 5.5.3 p. 39). Both of these CO2 sources occur outside the farm gate. It is inconsistent to consider only some sources of CO2 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 CO2 emissions from farm management are to be considered, all of them need to be represented.

<u>Recommendations:</u>

Preferred: Do a complete LCA or none at all, to avoid biases towards or against particular practices.

Alternative: At a minimum, if emissions from manure transport are to be considered, then emissions from synthetic fertilizer transport should be similarly counted.

NMPP Section 5.5.4 – Leakage
We support comments by Noel Gurwick, Meredith Niles, and Christina Tonitto as follows:

Accounting for increased N2O emissions off-site as a result of decreased yield (leakage) (Section 5.5.4 pp. 40-41)

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 p. 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.

<u>Recommendation</u>*:* If there has been no net yield decline over the course of the crediting period, no yield penalties should be applied to greenhouse gas credits awarded to the grower.

<u>Additional Comments</u>

NMPP Section 2.2.1 – 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 yield are acceptable (within 15 percent of the average application rate for the entire field)."

NMPP Section 3.2 – 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.

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).

<u>Literature Cited</u>

Cruse, M.J., M. Liebman, D.R. Raman, and M. Wiedenhoeft. 2010. "Fossil energy use in conventional and low-external-input cropping systems." Agronomy Journal 102: 934-941.

Gardner, J. B. and L. E. Drinkwater (2009). "The fate of nitrogen in grain cropping systems: a meta-analysis of 15N field experiments." Ecological Applications 19(8): 2167-2184.

Hoben, J. P., R. J. Gehl, N. Millar, P. R. Grace and G. P. Robertson (2011). "Nonlinear nitrous oxide (N2O) response to nitrogen fertilizer in on-farm corn crops of the US Midwest." Global Change Biology 17(2): 1140-1152.

Kaspar TC, Janyes DB, Parkin TB, Moorman TB. 2007. Rye cover crop and gamagrass strip effects on NO3 concentration and load in tile drainage. Journal of Environmental Quality 36:1503-1511.

Kaspar TC, Jaynes TB, Parkin TB, Moorman TB, Singer JW. 2012. Effectiveness of oat and rye cover crops in reducing nitrate losses in drainage water. Agricultural Water Management 110:25-33.

Klein, C. D., R. S. A. Novoa, S. Ogle, K. A. Smith, P. Rochette, T. C. Wirth, B. G. McConkey, A. Mosier, K. Rypdal, M. Walsh and S. A. Williams (2006). N2O Emissions from Managed Soils, and CO2 Emissions from Lime and Urea Application. 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Tonitto, C., M. B. David and L. E. Drinkwater (2006). "Replacing bare fallows with cover crops in fertilizer-intensive cropping systems: A meta-analysis of crop yield and N dynamics." Agriculture Ecosystems & Environment 112(1): 58-72.