QUANTIFYING NITROUS OXIDE EMISSIONS REDUCTIONS FROM REDUCED USE OF NITROGEN FERTILIZER ON AGRICULTURAL CROPS

GUIDANCE DOCUMENT

VERSION 1.0

May 2017

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ABOUT AMERICAN CARBON REGISTRY® (ACR)

A leading carbon offset program founded in 1996 as the first private voluntary GHG registry in the world, ACR operates in the voluntary and regulated carbon markets. ACR has unparalleled experience in the development of environmentally rigorous, science-based offset methodologies as well as operational experience in the oversight of offset project verification, registration, offset issuance and retirement reporting through its online registry system.

CONTENTS

1. INTRODUCTION

1.1 What is the purpose of this document?

This document should be used in tandem with the American Carbon Registry (ACR) *Methodology for Quantifying Nitrous Oxide (N_2O) Emissions Reductions from Reduced Use of Nitrogen Fertilizer on Agricultural Crops version 1.0* to help clarify how the requirements of the methodology can be met. This document does not supersede nor provide additional requirements than those set forth in the methodology. Rather, it provides guidance regarding the intent of the methodology. If any incongruities arise during validation or verification due to guidance outlined in this document, please contact ACR staff directly. In certain sections, examples have been provided to demonstrate the options available to meet methodological requirements. However, please note that such examples are not exhaustive.

1.2 Who should use this document?

Anyone interested in a better understanding of the intent and requirements of the methodology may use this document. It is hoped that the project proponent will find it especially useful throughout their project design and management processes. ACR-approved Validation and Verification Bodies (VVB) can also refer to this guidance when evaluating a project's compliance with the methodology.

1.3 I want to develop a project; where do I start?

ACR suggests that you begin by reviewing the overarching ACR Eligibility Requirements (found in the current version of the ACR Standard) along with the methodology's Applicability Conditions section to first determine whether your project is likely to be eligible. Then, you should review the Data and Parameters section to determine if the monitored data required by the methodology, and the corresponding monitoring evidence is, or will be, available.

1.4 Is credit stacking allowed? If so, are there any limitations?

Projects using an ACR methodology may choose to participate in other environmental markets and credit stacking is allowed if the additional credits are issued for an environmental attribute other than the emission reduction, and all requirements of both programs are met. Beyond carbon credits, the most relevant environmental market for this project type is water quality. Projects must disclose to ACR any other crediting programs in which they are participating through the GHG Project Plan, and can choose to highlight those on the project's page of the ACR Registry.

2. GETTING STARTED

2.1 What activities does this methodology apply to?

This methodology is only applicable to the reduced use of nitrogen (N) fertilizer on agricultural crops. Different quantification procedures are specified depending on crop type and location. Projects that wish to implement other nitrogen fertilizer management practices can use ACR's *Methodology for N_2O Emission Reductions through Changes in Fertilizer Management*.

2.2 Can I implement project activities on a subset of my farm area?

Yes, a smaller area of a larger property may be included in the GHG project's geographical boundary if all required documentation regarding the delineation of the project boundary can be provided (Section 3). For example, if a farm is comprised of 10 fields, but a grower decides to only include 5 of the 10 fields, this is acceptable as long the project proponent can show the geographic boundaries of all the participating fields by providing an orthoimage using Google Earth, satellite photos, GIS shape files, etc.

2.3 Will my project be eligible?

All projects using this methodology will need to meet the project-specific eligibility conditions listed in the methodology, in addition to the overarching ACR Standard eligibility requirements. Upon registering the project with ACR, the project proponent must describe in detail in the GHG project plan how the project meets all eligibility requirements.

All projects must not be in violation of regulatory requirements throughout the crediting period. Please note that while the methodology v1.0 says "*To the best of our knowledge, implementation of project activities associated with this methodology, with or without registration as an AFOLU project, shall not lead to violation of any applicable law even if the law is not enforced*." Project proponents will be required to demonstrate during validation and verification(s) that there are no "material" regulatory violations. Regulatory compliance violations regarding administrative processes (e.g. a missed reporting deadline) will not disqualify a project from receiving carbon credits during the period of non-compliance, but must still be noted in the project's monitoring report.

Table 1: Eligibility criteria checklist – projects must meet all criteria below unless marked N/A

Eligibility Criteria	
Overarching ACR Standard Eligibility Requirements	
Start Date: ACR defines the Start Date for AFOLU projects as the date on which the Project Proponent began the activity on the first project site. Please refer to the current version of the Standard for more information on determining project start date.	
Minimum Project Term: Project types with no risk of reversal subsequent to crediting, such as this one, have no required Minimum Project Term.	N/A
Crediting Period: Crediting Period is the finite length of time for which a GHG Project Plan is valid, and during which a project can generate offsets against its baseline scenario. For this project type the crediting period is seven (7) years.	
Real: GHG reductions and removals shall result from an emission mitigation activity that has been conducted in accordance with an approved ACR methodology and is verifiable. ACR will not credit a projected stream of offsets on an ex-ante basis.	
Emission or Removal Origin: Project Proponent shall own, have control, or document effective control over the GHG sources/sinks from which the emissions reductions or removals originate. If the Project Proponent does not own or control the GHG sources or sinks, the Proponent shall document that effective control exists over the GHG sources and/or sinks from which the reductions/removals originate.	
Offset Title: Title to the offsets that may result from the project is clear, unique, and uncontested. The Project Proponent can provide documentation and attestation of undisputed title to all offsets prior to registration, including chain of custody documentation if offsets have ever been sold in the past. In the context of this methodology, unless there are specifications in the land lease or other legal documentation saying otherwise, the project proponent is considered to have complete control over the origination of the offsets, regardless of whether they also own the land on which the relevant crops are grown.	
Land Title: For U.S. projects, the project can provide documentation of clear, unique, and uncontested land title. For international projects, Proponent shall provide documentation and/or attestation of land title. For international projects, Proponent can provide documentation and/or attestation of land title. Please note that land title may be held by a person or entity other than the	N/A

Eligibility Criteria	
Project Proponent, provided the Project Proponent has clear, unique, and uncontested offsets title.	
Additional: The project uses *either* an ACR-approved performance standard and passes a regulatory surplus test, *or* passes a three-pronged test of additionality in which the project must: 1) exceed regulatory/legal requirements; 2) go beyond common practice; and 3) overcome at least one of three implementation barriers: institutional, financial or technical.	
Regulatory Compliance: The project is expected to maintain material regulatory compliance. To maintain material regulatory compliance, a project must complete all regulatory requirements at required intervals. Project Proponents are required to provide a regulatory compliance attestation to a verification body at each verification. This attestation must disclose all violations or other instances of noncompliance with laws, regulations, or other legally binding mandates directly related to project activities.	
Permanent: For projects with a risk of reversal of GHG removal enhancements, Project Proponents shall assess risk using an ACR-approved risk assessment tool. In the context of this methodology, all emissions reductions associated with the project activities are considered permanent, and therefore no ACR risk assessment/ mitigation is required; this criterion is not applicable this project type.	N/A
Net of Leakage: The project proponent will deduct leakage that reduces the GHG emissions reduction and/or removal benefit of a project in excess of any applicable threshold specified in the methodology.	
Independently Validated and Verified: The project proponent will have the project validated and verified by an ACR-approved Validation/Verification Body (VVB), at specified intervals prior to the issuance of ERTs.	
Community & Environmental Impacts: The community and environmental impacts associated with the project are expected to be net positive overall.	

Methodology-Specific Eligibility Requirements

The fertilizer applied in the baseline and project scenarios is either synthetic and/or organic. Please see the Definitions section for the description of each.	
US Based Projects: must be classified as any of the 3 project categories.	

Eligibility Criteria	
International Projects: Projects that are located outside the US are classified as either category 2 or 3. Please see the table in Section 4 of this document for more information on how to choose a project category.	
The fertilizer application compared during baseline and project periods is implemented on the same project area, and on the same crop type.	
Crop yield is not significantly reduced as a result of the reduction in N application rate in the project scenario.	
Nitrogen application is monitored per “cropping cycle” or “cultivation year”, rather than calendar year.	
During a project-crediting period, the crop management procedures adhere to Best Management Practices (BMPs) as they relate to the application of synthetic and organic N fertilizers at the cropping site. These BMPs are related to N fertilizer formulation (or N content of organic additions) and dates and methods of application.	
US Based Projects: Uses state-specific BMPs outlined by the relevant state department of agriculture or department of natural resources, if available. In cases where state-specific BMPs are not available, the project uses references from US Federal agencies, such as the Natural Resources Conservation Service (NRCS) or the USDA Farm Service Agency.	
International Projects: Uses BMPs locally approved by a government agency if available, or those described in the Global 4R Nutrient (Fertilizer) Stewardship Framework, published by the International Plant Nutrition Institute (IPNI).	
The project’s geographic boundary does not include sites with organic soils (also known as histosols), as defined by the World Reference Base for Soil Resources (FAO 2006)[1], which are ineligible.	
The project includes fertilized crops that fit under any one of the three project categories defined in Section 2.5 of the methodology, and they have been cultivated for at least five years (e.g., equivalent of five annual cropping seasons) prior to the project start date.	
The project duration is a minimum of one annual cropping season (not necessarily equivalent to one calendar year).	

[1] ftp://ftp.fao.org/agl/agll/docs/wsrr103e.pdf

2.4 Can multiple growers participate in the same project?

Yes, multiple growers can participate in the same project. See Question 3a for more information on the different options for proponents to aggregate multiple project participants into a single project.

2.5 What data do I need to collect?

Basic information about crop and fertilizer management practices will need to be collected for both the baseline and project scenarios. Figure 1 shows how to select which baseline quantification approach to use based on data availability. If using Approach 2, Table 2 lists the locations of state-recommended fertilizer application rates in the North Central Region as of January 2017. You will need to access previous years' recommendations for each state for baseline years prior to 2016.

Figure 1: Decision tree for selecting baseline quantification approach

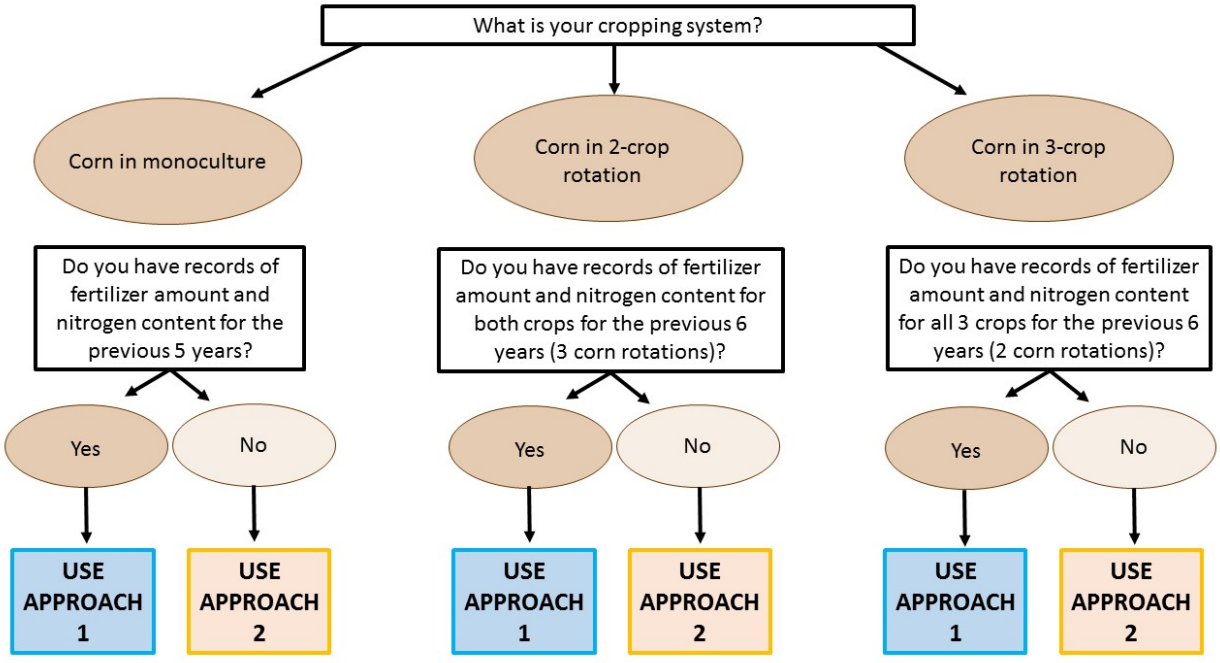


Table 2: Resources for crop yield and nitrogen application recommendations when using baseline Approach 2

1	Illinois	http://extension.cropsciences.illinois.edu/handbook/
2	Indiana	https://www.agry.purdue.edu/ext/corn/news/timeless/NitrogenMgmt.pdf
3	Iowa	https://store.extension.iastate.edu/Product/pm1714-pdf https://store.extension.iastate.edu/Topic/Crops/Soil-Management-and-Fertility
4	Kansas	https://www.bookstore.ksre.ksu.edu/pubs/MF2586.pdf https://www.bookstore.ksre.ksu.edu/Category.aspx?id=2&catId=221
5	Michigan	http://www.soils.msu.edu/wp-content/uploads/2014/06/MSU-Nutrient-recomdns-field-crops-E-2904.pdf http://www.soil.msu.edu/resources/bulletins/
6	Minnesota	http://www.extension.umn.edu/agriculture/nutrient-management/nutrient-lime-guidelines/fertilizer-recommendations-for-agronomic-crops-in-minnesota/
7	Missouri	http://extension.missouri.edu/p/IPM1027
8	Nebraska	http://extensionpublications.unl.edu/assets/pdf/ec155.pdf http://cropwatch.unl.edu/soils/resources
9	North Dakota	https://www.ag.ndsu.edu/publications/crops/north-dakota-fertilizer-recommendation-tables-and-equations
10	Ohio	http://agcrops.osu.edu/newsletter/corn-newsletter/2015-16/what%E2%80%99s-right-n-rate-corn-ohio http://agcrops.osu.edu/FertilityResources
11	South Dakota	https://igrow.org/up/resources/EC929.07.pdf
12	Wisconsin	http://www.soils.wisc.edu/extension/nitrogen.php http://www.soils.wisc.edu/extension/pubs/A2809.pdf

I	General Recommendations	https://www.agry.purdue.edu/ext/corn/desktop/fertility.html
II	USDA Yield Records	https://www.nass.usda.gov/

Please see Appendix A in this document for a complete list of monitored parameters, likely sources of evidence, and data frequency.

Also, it should be noted that if the project area is a subset of the total farm area, then the baseline and project parameters must be monitored at the field level. If 100% of the farm is contained within the project boundary, then the parameters may be monitored at the farm level.

It should be noted that a farm is comprised of the entire farming operations, may include multiple fields or parcels of land, and is under the management of a single owner or entity.

2.6 Is lab analysis a requirement to determine the baseline N content of manure?

No, lab analysis is not necessary. If the grower has access to fertilizer purchase records they should use Approach 1. Typically, agricultural retailers provide labels or blend information with fertilizers which should be sufficient. This information can also be found on the product packaging, invoices or any place where N-P-K is listed, which will depend on the quantity of fertilizer purchased. If a grower does not have access to these records, then you must use Approach 2.

3. PROJECT MANAGEMENT & ADMINISTRATION

3.1 What's the difference between a programmatic development approach and an aggregated project design, and which one should I use?

The programmatic development approach (PDA) and aggregation are defined and described in the ACR Standard.

The programmatic development approach is intended for projects where the complete enrollment of all project participants or sites is impractical at the time of initial validation. Project participants are enrolled in cohorts, which are a grouping of project participants, implementing eligible project practices or technologies, meeting all eligibility, project boundary, and additionality criteria of a project.

An aggregated project includes all project instances, fields, producers or facilities at the time of validation. Project boundaries, baseline definition, additionality demonstration, and all other requirements are applied at the level of the aggregate.

In the situation where a project proponent has many fields spread across multiple growers that will not implement the practice change at the same time, (for example because new growers or land owners that wish to participate are identified over a period of several years OR a single grower chooses to adopt the reduced fertilizer practice on more and more fields over a period of several years), a project developer has two options:

- Establish a single PDA and bring in cohorts sequentially; or
- Create several unique projects with ACR as fields are ready.

3.2 What information do I need to submit, to whom and when?

Appendix B lists the reporting requirements for project proponents and individual participants. Project proponents should draft a GHG Project Plan which is required to register the project with ACR. The project plan template is located on ACR's website and outlines the basic information needed. The methodology details what data will be needed to meet the monitoring requirements. Please review the Monitoring Requirements table reprinted in Appendix A to get a better understanding of what data and evidence is needed, and how often it should be

monitored or provided. In general, this information will need to be presented to the validation /verification body and ACR when undergoing validation and verification.

The Monitoring Requirements table in Appendix A represents what would *typically* be provided by a grower to an aggregator or project developer. A project developer should request additional information or evidence as needed. Project Developers are encouraged to contact ACR with questions or concerns at any time during the project cycle.

3.3 Do I need to conduct an environmental or social impact assessment?

No, this methodology does not currently require any additional environmental or social impact assessments as they can be assumed to be net positive for both social and environmental impacts, however project proponents should check the ACR Standard for any additional requirements.

3.4 What if a grower leases the land that they are farming? How do they prove ownership of the emission reductions?

In the case of a fertilizer management project, the actual activity of reducing the emissions belongs to the farming operation, not the landowner, as the grower who is running the operations is in control of the project. Ownership of the reductions can be demonstrated by providing lease agreements, FSA forms, business licenses, etc.

4. PROJECT SPECIFICATIONS

4.1 What are the physical boundaries of my project?

The physical boundaries of the project are around any participating fields. If all fields on a single farm are included, then the boundary can mirror that of the farm's boundary.

4.2 What is my project's start date?

The start date is the first day in the growing season that the first field in the project implemented the practice change. In other words, this corresponds to the first day of the first growing season that a rate change occurred in. For aggregated and PDA projects, this applies to the grower with the earliest practice change. It is fine that other growers in the project will implement their practice changes after the start date.

For example, if the first corn grower began land preparation on a field in the project on March 25, 2012, then the project start date is March 25, 2012.

4.3 What is my project's crediting period?

A crediting period is the finite length of time during which your GHG Project Plan is valid and therefore eligible to generate offsets against your baseline scenario. The crediting period start date should be the same as the project start date.

For this methodology, the crediting period is no more than 7 years, however project participants do not have to participate for the duration of the crediting period. The project may renew its crediting period so long as it continues to meet the requirements of the currently approved version of the methodology and the ACR Standard at the time of crediting period renewal.

4.4 What is a reporting period?

A reporting period is a portion of time during the crediting period that your project is reporting emission reductions to be verified. The ACR Standard requires that reporting periods do not exceed more than five (5) years in length, but may be as short as a cultivation year, which is typically 12 months and can include multiple crops. The first reporting period will begin on the same day as the project start date and the crediting period start date.

4.5 Section 6 states that "Year t is the 12-month period following the first input of N fertilizer dedicated to the project crop(s)". What if you

begin applying fertilizer for the following year's crop?

A cultivation year may not be exactly 12 months, but rather the annual cycle of activities related to the growth and harvest of crops within an approximate twelve-month period. A single cultivation year may contain a single cropping cycle or several cropping cycles. Project proponents can only include project activities and crops that are eligible under the Methodology for crediting within a given year, which may not equate to exactly 12 months.

4.6 How long do I have to commit to monitoring and reporting?

This project type is not required to have a minimum project term since the emission reductions are avoided rather than sequestered. What does that mean? Offset projects like those that protect and conserve the carbon dioxide stored in trees *sequester* carbon. Fertilizer optimization is a practice change that avoids the emission of N_2O entirely. Projects must participate for at least one cropping cycle to generate carbon credits, however a grower is not committed to participating for the length of the crediting period.

4.7 Which greenhouse gases are included?

See Table 1 in Section 3.3 of the methodology. The Methodology is focused on N_2O reductions from application of nitrogen-based fertilizers. Improved fertilizer management does not result in a net change of soil carbon and soil carbon improvements are therefore not included for this project type. This means that you do not have to monitor soil carbon pools, but rather the direct sources of N_2O from fertilizer application only. For more information on the exclusion of soil carbon, please refer to Annex B in the Methodology.

4.8 A new version of the methodology came out; do I need to use it?

If there's an update to an existing methodology, Project Proponents must continue using the version of the methodology that your GHG Project Plan was validated against. However, any projects applying for a renewed crediting period shall update to, and be validated against, the newest version of the methodology.

5. ADDITIONALITY AND BASELINES

5.1 How do I determine if my project is additional?

Broadly speaking, additionality is defined as the implementation of a practice or technology that is not considered business as usual. What that means in the context of a fertilizer management project is that the practice change that has been implemented was not required by any regulations or laws and that without the project, the emission reductions resulting from the project would not have occurred.

For this methodology, projects located in the U.S. should use the performance standard approach, which means that there is enough evidence to demonstrate that this project type is not commonly practiced and therefore exceeds business as usual. Every project will still have to demonstrate that it is not required by law using the Regulatory Surplus test (further detail below) required in Section 5.1 of the Methodology.

Projects outside of the U.S. will use the ACR Three-Prong Additionality Test which requires project proponents to demonstrate additionality through the regulatory surplus test, a common practice test and providing an adequate argument that an implementation barrier is being faced. More information can be found in Chapter 4 of the ACR Standard.

5.2 What evidence is required to pass the regulatory surplus test?

The regulatory surplus test requires project proponents to demonstrate that their project is indeed additional from a regulatory perspective. This means that neither the project nor the act of reducing the amount of fertilizer applied was required by any law, regulation, statute, etc.

If a farm or field in the project has been required to reduce the amount of fertilizer applied by a municipality at any level (i.e. federal, state or local), then it is not additional and will not be eligible to generate carbon offsets.

Annex D in the Methodology lists the relevant federal regulations as well as applicable state regulations for Michigan as an example. Other state fertilizer regulations and statutes can be found at the Association of American Plant Food Control Officials (AAPFCO) website, which is an organization comprised of fertilizer control officers from each state. It is the project proponent's responsibility as the project manager to contact any local municipalities that may have additional rules or regulations on the use of fertilizer within that region. The agencies will

vary from the California Department of Food and Agriculture, to the Arkansas State Plant Board (SPB), to the local Farm Service Agency (FSA) office, and so on.

5.3 I believe that the person who will know the local regulations is the grower. Would a grower attestation stating that there are no local regulations requiring them to reduce rates of N application suffice?

Yes, a grower attestation will suffice, however it's up to the validation and verification body to verify the validity of the attestation.

5.4 What sort of evidence and data (if any) will be required to demonstrate adherence to BMP's by a project proponent?

Growers will need two types of evidence to demonstrate adherence, with the first being the actual BMP itself, which can come from state or federal agencies such as the USDA Natural Resources Conservation Service or the USDA Farm Service Agency, the recommended BMPs in the Global 4R Nutrient Stewardship program, or local or regional nutrient management coalitions prescriptions.

The second type of evidence should demonstrate adherence through items like fertilizer application records, blend content of the fertilizers from invoices or labels, or soil and petiole analysis can also be used.

If multiple organizations have overlapping BMPs, the project proponent should explain why select BMPs were applicable in the GHG Project Plan.

5.5 In an aggregated project contains farms from multiple states, do the BMPs of each operation need to be specifically justified?

Each farm should have their respective BMP as they will be specific to the management needs of that farm, region, crop, etc.

5.6 Can I use the practice based performance standard?

As stated above, if your project meets the eligibility criteria, is not required by any regulation or law, and is in the U.S., then it is automatically deemed additional. Please refer to the "How do I know if my project is additional?" question for more information on how to determine if your project meets the additionality criteria.

5.7 How do I choose my baseline approach?

There are two baseline approaches, one which allows you to use field-specific data and one that utilizes county-level data to estimate the amount of fertilizer applied during the historical period. Figure 1 shows a decision tree for selecting the appropriate baseline quantification approach. If you can answer "Yes" to all of the below, use Approach 1.

- Does the project have at least 5 years' worth of fertilizer purchase and application records prior to implementing the practice change?
  - Does the project have the same types of records after the practice change was implemented?
    - Does the project have yield data for at least 5 years prior to implementing the practice change?
    - Does the project include organic or synthetic N fertilizer application?
    - Is the project located in the U.S.?

If you don't have purchase records or fertilizer application records from the historical period (five years of continuous monoculture or 6 years of a two- or three- crop rotation), then you should use Approach 2. Please note that Approach 2 is not applicable for the calculation of baseline organic fertilizer rates and records requirements for organic fertilizer are the same as those for inorganic fertilizer.

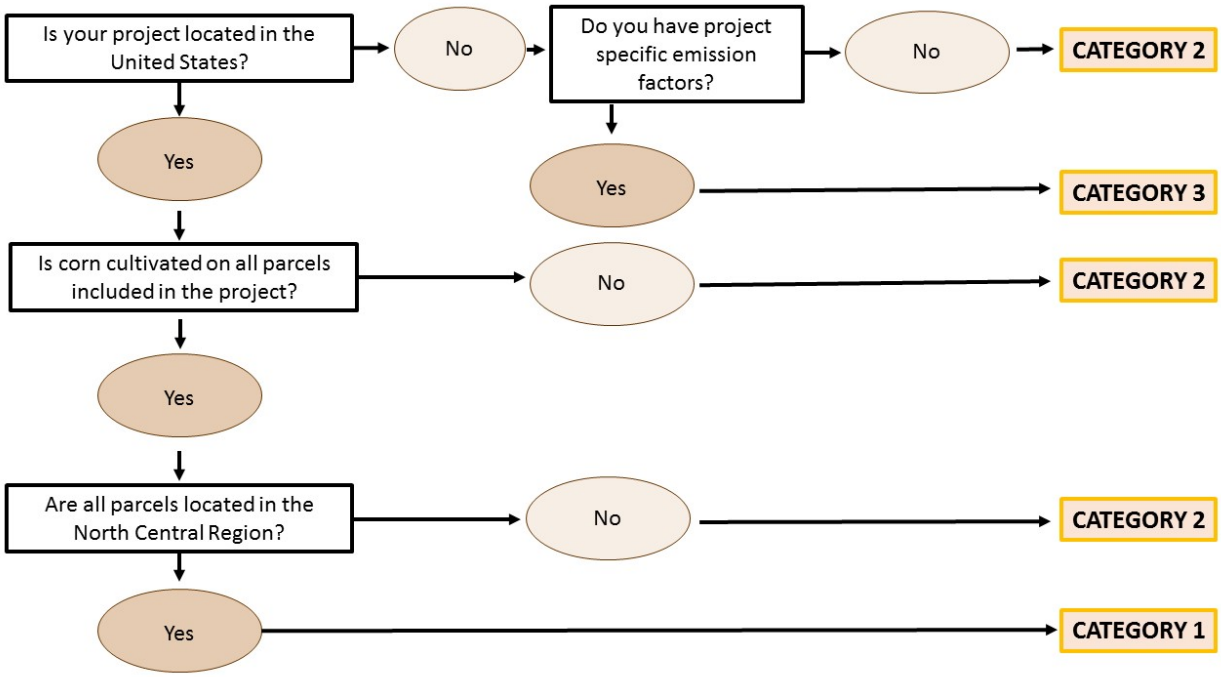
For Approach 1, appropriate records can include invoices or receipts for fertilizer, as-applied maps from onboard tractor systems, yield maps or invoices from farm-services contractors. This list is not exhaustive but is only meant to provide a few examples of acceptable evidence.

6. GHG EMISSION QUANTIFICATION

6.1 How do I determine which category my project is in?

See Figure 2 below.

Figure 2: Quantification categories available within the methodology



6.2 I'm outside of the North Central Region and/or I'm not growing corn; how do I develop my own Tier 2 emission factor?

Under this methodology, project developers and participants can develop a unique N_2O emission factor for crops other than corn, for corn grown outside of the 12-state north central region (NCR) or both. The emission factor should be developed from field measurements across the region of interest, across a range of conditions and be a scientifically robust representation of the change in both direct and indirect N2O emissions because of decreased fertilizer application. Models which have been calibrated and validated using field measurements can also be used to develop emission factors. The development of the emission factor must be presented in a peer reviewed, scientific journal and approved by ACR prior to use.

6.3 Do I need to account for leakage or risk of reversal?

- Accounting for leakage is **not required** for this methodology if the yield does not decline by more than 3% relative to baseline conditions or is not more than 3% less than county averages for the same growing season. This requirement is exempted if the change in yield is a direct result of extreme weather events, such as flood, fire or drought.
- Accounting for permanence is **not required** for this methodology as it is not possible to reverse the benefits of fertilizer that was not applied.

Term	General Definition	Methodology Specific Interpretation
Leakage	Leakage is an increase in GHG emissions or decrease in sequestration outside the project boundaries that occurs because of the project action.	Leakage is an increase in fertilizer application, and consequent N_2O emissions, occurring on fields not included in the project that occurs because of the project. For example, if yields on project fields declined because of lower fertilization rates and land owners tried to increase yields on other fields via increased fertilization rates.

Reversal	An event that causes the GHG benefits of a project (either avoided emissions or sequestration) to be reversed. Reversals can be unintentional such as a fire, flood, or insect infestation, or intentional when land owners or project proponents deliberately cease project activities.	This methodology credits the activity of reducing the amount of nitrogen fertilizer applied. It is crediting an activity that has not happened, the avoided application of fertilizer. It is not possible to reverse this lack of activity in a manner that would require ex post accounting of the reversal. Consequently, there is no "reversal" for this methodology.

6.4 How do I account for uncertainty?

Uncertainty refers to the difference between a measurement, calculation or estimate of a GHG emission and the actual amount that was emitted. Because it is impossible to know the exact number of molecules of a particular gas emitted at a specific time as a result of an action or activity, there is uncertainty associated with every estimate of a GHG emission, whether from a measurement, a model or empirically derived emission factors as are used in this methodology. Uncertainty must be accounted to ensure that projects are not over-credited and all transacted credits are real.

Category 1 and 3 projects, using either Approach 1 or 2, should use the process outlined in Equation 19 in Section 8 of the Methodology for quantifying uncertainty (UNC). Category 2 projects should use the uncertainty associated with the default factors in Table F1 of the Methodology.

6.5 How do I calculate the total emission reductions and ERTs?

Total emission reductions are calculated according to equation 20 in the Methodology and they are equal to the difference (on a per acre basis) between N_2O emissions in the baseline condition and N_2O emissions after landowners have reduced fertilizer applications rates, multiplied by the area where the practice change took place and the uncertainty deduction.

Project developers should develop their own spreadsheets or quantification tools.

6.6 How do I use USDA county level crop yield data?

If using Category 1, Approach 2, you will need county-level yield data for 5 (or 6) years prior to the reduction in nitrogen fertilizer rate as well as the recommended nitrogen application rates for

the appropriate state and county for the same years. This data can be found at the links in Table 1.

6.7 How do I find and use local precipitation and evapotranspiration data?

Annual precipitation and evapotranspiration are needed to determine which default fractional leaching factor to use (see Annex A in the methodology). Many weather stations record these parameters and are operated by state, county, university or other organizations. It is recommended that site specific data be used for these parameters or data from the closest weather station.

If site-specific data for precipitation and potential evapotranspiration are not readily available, data from local meteorological stations can be used. A centralized information source to identify these stations in the US can be found at the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) station information webpage: http://www.weather.gov/tg/siteloc.shtml.

Archived data for all US meteorological sites is at the National Climatic Data Center (NCDC):

http://lwf.ncdc.noaa.gov/oa/climate/stationlocator.html.

If evapotranspiration data is not recorded at the local station; it can be calculated from other meteorological parameters using the FAO Penman-Monteith approach described here:

http://www.fao.org/docrep/X0490E/x0490e08.htm

6.8 What's the difference between a cropping cycle and a cultivation year and how do they work in relation to a reporting period?

A cultivation year may consist of several cropping cycles within an approximate 12-month timeframe. A cropping cycle is a single crop grown, which may or may not be 12 months. For example, a grower may choose to grow corn during the summer and winter wheat during the colder months, meaning that they would have two cropping cycles in a single cultivation year. As described in Question 4d, a reporting period is the length of time over which your project is seeking credits verified. A reporting period is typically a subset of the crediting period and may continue over multiple cultivation years, but at least one cropping cycle.

7. VALIDATION AND VERIFICATION

7.1 What's the difference between validation and verification?

Validation is the process of reviewing your project's GHG Project Plan to confirm that it meets the requirements of the ACR Standard and the methodology you've chosen. Typically, the validator will look at the baseline assumptions, eligibility criteria, location of the project and any applicable regulations that may prohibit your project from receiving credits. The deliverable for this type of audit is a Validation Report as specified in Chapter 7 of the *ACR Validation and Verification Standard*.

Verification is the process of reviewing your project's monitoring documents to make sure that it has been implemented in accordance with the ACR Standard, methodology and GHG Project Plan as well as confirming that that the GHG assertion (total number of carbon credits) claimed during the reporting period under verification are correctly calculated. The deliverables for this type of audit are a Verification Statement and a Verification Report as specified in Chapter 12 of the *ACR Validation and Verification Standard*. Only once a positive Verification Statement is approved by ACR can you request issuance of ERTs.

It should be noted that validation and verification can occur simultaneously and if done together, the validation and verification reports can be combined into a single document.

7.2 I thought that the deliverable from verification was credits?

While the output of verification is a Verification Statement and Report, the validation and verification team will only affirm that the asserted carbon credits are real, accurately stated, and that the project has met ACR Standard and methodology requirements. After ACR confirms approval of the submitted documents you are then eligible to request that the ERTs be issued to your account.

7.3 How often do I need to get my project validated and verified?

Projects only need to be validated once each crediting period unless you're using the programmatic development approach and adding cohorts after the initial validation. Verifications

can happen multiple times throughout the crediting period, utilizing desk reviews between full verifications. The frequency of verification is up to you as the project proponent, but reporting periods cannot exceed five (5) years in length without a full verification. During a seven (7) year crediting period, your project will most likely undergo verification simultaneously with the initial validation, and again about halfway through and again at the end of the respective crediting period.

7.4 What's the difference between a desk review and a full verification?

A full verification should include a site visit to a subset of the fields in the project as well as an office visit. The audit team should also conduct a more in-depth risk assessment of the eligibility criteria. A desk review can be conducted remotely in between full verifications, checking the monitored parameters since the previous verification and the calculations that lead to the GHG assertion.

APPENDIX A: MONITORED PARAMETERS

Acronym	Unit	Parameter	Suggested Evidence	Source	Baseline or Project?	Applicable Approach	Frequency of Monitoring
$M_{B\ SF,\ t}$	Mg fertilizer/hectare, in year t	Mass of baseline synthetic N containing fertilizer applied	As-applied maps; purchase records for synthetic fertilizer for 5 years prior to start date; Application records for synthetic fertilizer for 5 years prior to start date; other grower records clearly demonstrating fertilizer application amounts for 5 years prior to start date; 6 years required for corn in rotational systems.	Grower records or state recommendations	Baseline	Both	Once per crediting period
$M_{B\ OF,\ t}$	Mg fertilizer/hectare, in year t	Mass of baseline organic N containing fertilizer applied	As-applied maps; purchase records for organic fertilizer for 5 years prior to start	Grower records or state	Baseline	1	Once per crediting period

			date; Application records for organic fertilizer for 5 years prior to start date; others grower records clearly demonstrating fertilizer application amounts for 5 years prior to start date; 6 years required for corn in rotational systems.	recommendations			
$NC_{B\ SF}$	g N / 100 g fertilizer	Nitrogen content of baseline synthetic fertilizer applied	Manufacturer/Supplier records of nitrogen content of synthetic fertilizer for all fertilizer applied for 5 years prior to start date; certified lab testing results for all fertilizer applied for 5 years prior to start date; 6 years required for corn in rotation systems.	Fertilizer purchase receipts, Ag service provider labels	Baseline	1	Once per crediting period

$NC_{B\ OF}$	g N / 100 g fertilizer	Nitrogen content of baseline organic fertilizer applied	Manufacturer/Supplier records of nitrogen content of organic fertilizer for all fertilizer applied for 5 years prior to start date; certified lab testing results for all fertilizer applied for 5 years prior to start date; 6 years required for corn in rotation systems.	Fertilizer purchase receipts, Ag service provider labels	Baseline	1	Once per crediting period
Y_B	Mg fertilizer/hectare, in year t	Baseline crop yield	Mill receipts, yield maps or NASS data	Grower records or USDA NASS data	Baseline	2	Once per crediting period
CA_B	Hectare	Baseline crop area	FSA signed forms; USDA EQIP signed forms; shapefiles	Grower records	Baseline	Both	Once per crediting period
$Frac_{GASF}$	N/A	Fraction of all synthetic N added to project soils that volatilizes as NH_3 and NO_x	Default number provided	2006 IPCC Guidelines for National Greenhouse	Both	Both	N/A

				Gas Inventories			
$Frac_{GASM}$	N/A	Fraction of all organic N added to project soils that volatilizes as NH_3 and NO_x	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Both	Both	N/A
$Frac_{LEACH}$	N/A	Fraction of N added (synthetic or organic) to project soils that is lost through leaching and runoff, in regions where leaching and runoff occurs	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Both	Both	N/A
EF_{BDM1}	Mg N_2O–N/Mg N input	Emission factor for baseline direct N_2O emissions from N inputs (Method 1)	Equation provided	MSU data	Baseline		Calculated once per crediting period
EF_{BDM2}	Mg N_2O–N/Mg N input	Emission factor for baseline direct N_2O emissions from N inputs (Method 2)	Default number provided	2006 IPCC Guidelines for National Greenhouse	Baseline	Both	N/A

				Gas Inventories			
EF_{BIV}	Mg N_2O–N/Mg NH_3–N + NO_x–N volatilized	Emission factor for baseline N_2O emissions from atmospheric deposition of N on soils and water surfaces	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Baseline	Both	N/A
EF_{BIL}	Mg N_2O–N/Mg N leached and runoff	Emission factor for baseline N_2O emissions from N leaching and runoff	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Baseline	Both	N/A
EF_{PM1}	Mg N_2O–N/Mg N input	Emission factor for project direct N_2O emissions from N inputs (Method 1)	Equation provided	MSU data	Project	Both	Calculated once per **reporting** period
EF_{PDM2}	Mg N_2O–N/Mg N input	Emission factor for project direct N_2O emissions from N inputs (Method 2)	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Project	Both	N/A

EF_{PIV}	Mg N_2O–N/Mg NH_3–N + NO_x–N volatilized	Emission factor for project N_2O emissions from atmospheric deposition of N on soils and water surfaces	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Project	Both	N/A
EF_{PIL}	Mg N_2O–N/Mg N leached and runoff	Emission factor for project N_2O emissions from N leaching and runoff	Default number provided	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Project	Both	N/A
$M_{P\ SF,\ t}$	Mg fertilizer/hectare, in year t	Mass of project synthetic N containing fertilizer applied	As applied maps; fertilizer purchase records	Grower records	Project	Both	Annual monitoring
$M_{P\ OF,\ t}$	Mg fertilizer/hectare, in year t	Mass of project organic N containing fertilizer applied	As applied maps; fertilizer purchase records	Grower records	Project	Both	Annual monitoring
$NC_{P\ SF}$	g N / 100 g fertilizer	Nitrogen content of project synthetic fertilizer applied	Manufacturer/Supplier records of nitrogen content of synthetic fertilizer for all fertilizer applied for 5 years prior to start	Fertilizer purchase receipts, Ag service provider labels	Project	Both	Annual monitoring

			date; certified lab testing results for all fertilizer applied for 5 years prior to start date; 6 years required for corn in rotation systems.				
$NC_{P\ OF}$	g N / 100 g fertilizer	Nitrogen content of project organic fertilizer applied	Manufacturer/Supplier records of nitrogen content of synthetic fertilizer for all fertilizer applied for 5 years prior to start date; certified lab testing results for all fertilizer applied for 5 years prior to start date; 6 years required for corn in rotation systems.	Fertilizer purchase receipts, Ag service provider labels	Project	Both	Annual monitoring
CA_P	Hectare	Project crop area	FSA signed forms; USDA EQIP signed forms; shapefiles	Grower records	Project	Both	Annual monitoring

APPENDIX B: REPORTING REQUIREMENTS

		SUBMISSION/ACTION	TO	WHEN	DESCRIPTION
Project Proponent	1	Project listing (optional)	ACR	Optional, but prior to submittal of GHG project plan	Project proponents can choose to submit a listing form ahead of submitting a draft GHG project plan.
	2	Submittal of GHG Project Plan (required)	ACR	Within 2 years of listing	ACR initially screens the GHG Project Plan for eligibility and basic conformance to the ACR Standard and the chosen methodology before the project undergoes validation. ACR may request changes in the Plan prior to accepting it. The project is active.
	3	GHG Monitoring Plan	ACR	With GHG Project Plan	The monitoring plan is a component of the GHG project plan and describes in detail the on-going monitoring as required by the methodology, data management and QA/QC. See the ACR Standard for requirements.
	4	VVB COI	ACR	After listing but before verification or validation services can begin	Confirmation that the VVB contracted for services does not have a conflict of interest to the project and can provide an unbiased audit of the emissions reductions claimed.

		SUBMISSION/ACTION	TO	WHEN	DESCRIPTION
	5	Monitoring report	ACR, VVB	End of each reporting period	Summary of emissions reductions achieved from the project for the reporting period.
	6	Calculations, supporting evidence	VVB	End of each reporting period	The VVB will ask for evidence supporting: eligibility, additionality, ownership of credits, leakage, all inputs into ERT quantification as described in the monitoring parameters in the methodology. The VVB can request additional evidence or information as needed to complete a thorough audit to a reasonable level of assurance.
	7	Validation/Verification Report and/or Verification Statement	ACR	Conclusion of validation/verification	ERTS issued based on verified credits reported in the verification statement and verified by a VVB. ACR reviews the audit documents submitted by the VVB prior to issuing carbon credits.
	8	Annual Attestations	ACR	Once per year while project is active	Demonstrates continuance, ownership or legal authority to conduct the project on the fields, provides a statement in regards to the community and environmental impacts and of changing the fertilizer practices as part of the project.

		SUBMISSION/ACTION	TO	WHEN	DESCRIPTION
Project Participants	**1**	Title	Project Proponent	Prior to validation	Demonstrates ownership or legal authority to conduct the project on the fields and to change the fertilizer practices as part of the project.
	2	Evidence of BMPs	Project Proponent	Prior to validation	Demonstrates adherence to USDA, state and/or local recommended BMPs for fertilizer application.
	3	Project boundaries	Project Proponent	Prior to validation, however may be updated as additional fields are added	Establishes the project boundaries and area of project activity; required for baseline and project scenarios.
	4	Soil maps of fields	Project Proponent	Prior to validation	Demonstrates if histosols are present.
	5	Historical crop records	Project Proponent	Prior to validation	Demonstrates crop type has been grown on field for baseline period and is the same crop or crop rotation as in the project scenario.
	6	Historical nitrogen application/purchase records	Project Proponent	Prior to validation	Evidence that the historical project fertilizer application in the baseline.
	7	Recommended N application rates	Project Proponent	Prior to validation	Needed for quantification.

		SUBMISSION/ACTION	TO	WHEN	DESCRIPTION
	8	N content of fertilizer (through fertilizer purchase record, label, etc.)	Project Proponent	Prior to validation	Needed for quantification if using Approach 1 to establish baseline fertilizer rates.
	9	Crop yield (county level)	Project Proponent	Prior to validation and for each verification	Needed for quantification if using Approach 2 to establish baseline fertilizer rates.