Nitrogen Stewardship

Description

Within the United States, agriculture is a significant source of nitrous oxide (N_2O) emissions, a GHG that is over 250 times more potent than the same amount of carbon dioxide. N_2O emissions from synthetic nitrogen fertilizers and organic sources represent a major source of GHG emissions from U.S. agricultural production. In 2013, cropland agriculture released approximately 136 $MMTCO_2e$ in direct N_2O emissions. Nitrous oxide emissions from synthetic fertilizer and organic amendments account for more than 50 percent of those emissions (72 $MMTCO_2e$). Management of nitrogen application can reduce these emissions.

N_2O emissions from cropping practices depend on many factors, but several key factors are the timing, source, placement, and quantity of nitrogen (both from organic sources and synthetic sources) applied. Weather and soil health also influence nitrogen losses and the resulting efficiency with which it is taken up by crops. Taking these factors into account, GHG emissions can be reduced substantially through improved nitrogen management practices and increased nitrogen use efficiency on crop and pasturelands. In addition to reducing N_2O emissions, these practices can also significantly reduce nitrate leaching, improving local and regional water quality, and reduce on-farm input costs.

For this building block, the primary practice used to reduce GHG emissions from nitrogen is the NRCS Conservation Practice Standard (CPS) Nutrient Management (590) through the implementation of the 4Rs (right source, right rate, right time, and right place). The 4Rs apply to not only the utilization of synthetic forms of nitrogen, but also the N_2O emissions from legumes, manure, compost, and other biosolids for crop production.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal ($MMTCO_2e$ per year by 2025)[3]
Support appropriate nutrient management on 64 million acres of cropland and pastureland.	7

[3] For more information on how to interpret this goal, see p. 6.

To achieve a reduction of 7 $MMTCO_2e$ per year by 2025, USDA and its partners will have to improve nutrient management on 4.5 million new acres each year from 2016 to 2025.[4] As with many of the building blocks, ensuring the legacy effect will be a key factor in achieving this goal. Specifically, 75 percent of the new acres established each year under an enhanced nutrient management plan would need to continue using those practices each of the following years, even after direct support from USDA programs (e.g., EQIP) has expired. (For more information on the legacy effect see p. 55.)

Although all agricultural crops require nitrogen and require nitrogen management to mitigate the loss of N_2O, corn production represents the largest crop source of N_2O emission in the United States. Thus, a major priority will be placed on enhanced nitrogen management for corn production to mitigate these emissions, particularly in the Midwest. To aid this effort, there are existing N_2O emission-reduction quantification methodologies for corn rotations in the Midwest and new dynamic modeling approaches that will further improve on both methods for quantification and mitigation of emissions in the coming years.[5]

Partnership Opportunities

NRCS staff alone will not be able to provide adequate technical support to improve nitrogen management on the estimated 4.5 million new acres each year that will be required to meet the goals of this building block. Technical Service Providers (TSP), industry groups, and outreach and extension specialists will be key partners in reducing N_2O emissions from nitrogen fertilizer.

In addition, assisting producers to maintain at least 75 percent of the acres under nutrient management will require technical assistance from both NRCS and TSPs. Nutrient management plans require annual maintenance to remain effective, including new soil and plant tissue testing, updating yields and crops, and consulting with agronomists to keep the plan current. Encouraging this legacy effect will be a key opportunity for NRCS and its partners.

[4] N_2O emission reductions are based on estimates from COMET-Planner (**http://www.comet-planner.com/**).

[5] Examples include the American Carbon Registry and Electric Power Research Institute project to quantify reductions in N_2O emissions (**http://americancarbonregistry.org/resources/reduced-use-of-nitrogen-fertilizer**) and the Adapt-N modeling tool (**http://www.adapt-n.com/**).

CASE STUDY

Michigan farmer Myron Ortner of Tuscola County is a leader in nutrient management and soil health. He has partnered with Michigan State University to test strategies to improve nutrient management on a 40-acre plot of land where he grows corn and soybeans. Ortner was chosen, in part, based on his commitment to innovation and meticulous recordkeeping.

"I wanted an accurate picture of what was happening on my farm, and now we've got good scientific data established," Ortner said. "It's been a good learning experience. I've committed one of my fields to this project, and I'm hoping to be a part of it for a while."

As a result of the project, Ortner was able to reduce his N rate by 15 percent without any loss of yield, leading to a first-of-its-kind credit from the American Carbon Registry. "It's not so much the carbon credits and the profit there, but the opportunity to use less fertilizer and save on input costs," Ortner said. "I was up at the 180 to 200 pounds (of fertilizer) level, and I voluntarily went down to about 160 on my farms. I learned from it."

Ortner is participating in the Delta Nitrogen Credit Program, which will pay qualified Corn Belt corn farmers who reduce their documented nitrogen rates. The program began as an NRCS Conservation Innovation Grant.

Nitrogen application in a contoured, no-tilled field. Photo courtesy of USDA NRCS.

To facilitate this coordination, NRCS is developing a Memorandum of Understanding with agricultural retailers and other conservation and industry groups to address natural resource concerns that are common among the organizations.

Another opportunity for partnerships to improve nitrogen stewardship is increasing the use of precision agriculture systems, including variable rate technology, automated GPS guidance systems, and on-the-go sensors. These technologies can improve the efficiency of input use and reduce GHG emissions from the over-application of nitrogen fertilizer, but the adoption of these practices has been less rapid than expected. To encourage the wider use of these technologies, USDA can partner with farm equipment companies, extension specialists, and industry and technology groups to provide cost-effective equipment, training, and maintenance for all sizes of farms.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Provide additional Technical Service Provider support to develop nutrient management plans on 2.5 million acres with focus on GHG reduction from nitrogen.	NRCS
Develop a Memorandum of Understanding among NRCS and several agricultural industry organizations and conservation groups to address the resource issues facing farmers and ranchers, including climate change and GHG emissions.	NRCS
Provide additional Technical Service Provider support to provide maintenance to manage nutrient management plans on 30.5 million acres with focus on GHG reduction from nitrogen management.	NRCS
NRCS staff develop nutrient management plans for producers on 2 million acres with focus on GHG reduction from nitrogen management.	NRCS
Provide support for the development of information, education, and outreach to producers and agribusinesses.	Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.
Develop, publish, and distribute literature on nitrogen management to improve nutrient use efficiency, reduce emissions, and improve water quality.	ARS, Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.

FY 2017

Action	Lead USDA Agency(s)
Provide additional Technical Service Provider support to develop nutrient management plans on 2 million acres with focus on GHG reduction from nitrogen.	NRCS
Partner with agribusinesses to provide assistance to producers for nutrient management on 0.5 million acres with focus on GHG reduction from nitrogen management.	NRCS
Provide additional Technical Service Provider support to provide maintenance to manage nutrient management plans on 34 million acres with focus on GHG reduction from nitrogen.	NRCS
NRCS staff develop nutrient management plans for producers on 2 million acres with focus on GHG reduction from nitrogen management.	NRCS
Provide support for the development of information, education, and outreach to producers and agribusinesses.	Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.
Develop, publish, and distribute literature on nitrogen management to improve nutrient use efficiency, reduce emissions, and improve water quality.	ARS, Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.

FY 2018

Action	Lead USDA Agency(s)
Provide additional Technical Service Provider support to develop nutrient management plans on 2 million acres with focus on GHG reduction from nitrogen.	NRCS
Partner with agribusinesses to provide assistance to producers for nutrient management on 0.5 million acres with focus on GHG reduction from nitrogen.	NRCS
Provide additional Technical Service Provider support to provide maintenance to manage nutrient management plans on 34 million acres with focus on GHG reduction from nitrogen management.	NRCS
NRCS staff develop nutrient management plans for producers on 9 million acres with focus on GHG reduction from nitrogen management.	NRCS
Provide support for the development of information, education, and outreach to producers and agribusinesses.	Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.
Develop, publish, and distribute literature on nitrogen management to improve nutrient use efficiency, reduce emissions, and improve water quality.	ARS, Facilitated by NIFA through grants to Land-Grant universities and other outside organizations.