



United States Department of Agriculture



USDA Building Blocks for Climate Smart Agriculture and Forestry



**Implementation Plan
and Progress Report**

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Introduction

On April 23, 2015, Secretary of Agriculture Tom Vilsack announced the U.S. Department of Agriculture's (USDA) Building Blocks for Climate Smart Agriculture and Forestry. This plan is designed to help farmers, ranchers, forestland owners, and rural communities respond to climate change and consists of the following 10 "building blocks," which span a range of technologies and practices to reduce greenhouse gas (GHG) emissions, increase carbon storage, and generate clean renewable energy:

- Soil Health
- Nitrogen Stewardship
- Livestock Partnerships
- Conservation of Sensitive Lands
- Grazing and Pasture Lands
- Private Forest Growth and Retention
- Stewardship of Federal Forests
- Promotion of Wood Products
- Urban Forests
- Energy Generation and Efficiency

USDA has a long history of cooperative conservation and partnerships with farmers, ranchers, and forestland owners. The principles that have guided USDA's cooperative conservation efforts also apply to each of these building blocks, and actions taken through this initiative will be:

- **Voluntary and incentive-based:** Farmers, ranchers, and forestland owners are stewards of the land. USDA has a track record of successful conservation through voluntary programs designed to provide technical assistance for resource management. These efforts fit within USDA's approach of cooperative conservation.
- **Focused on multiple economic and environmental benefits:** To be successful, the proposed actions should provide economic and environmental benefits through efficiency improvements, co-benefits, improved yields, or reduced risks.

- **Designed to meet the needs of producers:** This strategy is designed for working farms, ranches, forests, and production systems. USDA will encourage actions that enhance productivity and improve efficiency.
- **Cooperative and focused on building partnerships:** USDA will seek out opportunities to leverage efforts by industry, farm groups, conservation organizations, municipalities, public and private investment products, Tribes, and States.
- **Measured to evaluate progress:** USDA is committed to establishing consistent quantitative goals and objectives for each building block and will track and report on progress. USDA will continue to use internationally recognized measures and will enhance the accuracy and precision of these metrics.

Through this comprehensive set of voluntary programs and initiatives, USDA expects to reduce net emissions and enhance carbon sequestration by more than 120 million metric tons of carbon dioxide equivalent (MMTCO₂e) per year by 2025. This reduction is equivalent of taking 25 million cars off the road or offsetting the emissions produced by powering nearly 11 million homes per year.

The building blocks are significant not only within the United States, but also internationally. In December 2015, more than 180 countries agreed to a new framework to reduce global GHG emissions and enhance GHG sinks. The Paris Agreement, adopted under the United Nations Framework Convention on Climate Change, builds on the U.S.'s commitment to reduce GHG emissions by 26 to 28 percent below 2005 levels by 2025. By developing these building blocks, USDA and its partners have demonstrated that agriculture and forests can play a significant role in helping the U.S. meet its commitment. In turn, the U.S. is modeling practices and strategies that can be applied by nations worldwide to address emissions from the land sector while also meeting the world's needs for food, fiber, and energy.

This document provides an update on the building blocks framework since the April 2015 announcement. In particular, it:

- Outlines the goals for each building block, including estimated GHG reductions.
- Highlights actions that USDA has taken over the last year to help farmers, ranchers, and forestland owners respond to climate change.
- Provides implementation plans for each of the building blocks. Each implementation plan includes:
 - A description of the programs and authorities that can be used to encourage adoption of technologies and conservation practices that help reduce GHG emissions;
 - Opportunities for partnerships with other organizations, including industry groups; nongovernmental organizations; private companies; and other governmental agencies at the Federal, State, Tribal, and local levels; and
 - Actions that USDA plans to take over the next 3 years to lay the foundation for achieving the building block goals.
- Summarizes next steps under the building blocks framework.

The building blocks are a set of actions to help farmers, ranchers, forestland owners, and rural communities reduce GHG emissions and increase carbon sequestration. These actions are an important piece of USDA's broader effort to help agricultural, forestry, and rural communities respond to a changing climate. Other components of USDA's strategy to address climate change include:

- Supporting community resiliency to climate change by developing climate change adaptation plans, establishing Regional Climate Hubs, and supporting Cooperative Extension;
- Updating and implementing its Climate Change Science Plan to develop science-based knowledge and strategies to manage the risks, challenges, and opportunities of climate change; reduce GHG emissions; and enhance carbon sequestration;

- Contributing to the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, which tracks annual U.S. GHG emissions and removals, including in the agriculture and forest sectors; and
- Continuing to enhance USDA's tracking of its accomplishments under the building blocks, including GHG-related metrics.

Since the announcement of these building blocks, USDA and its partners have taken action to reduce GHG emissions and increase carbon sequestration from agriculture, forests, and rural areas. Through its Environmental Quality Incentives Program (EQIP), the Natural Resources Conservation Service (NRCS) will, in fiscal year (FY) 2016, invest approximately \$300 million in practices that have climate change benefits, including a targeted allocation of \$72.3 million specifically for practices that advance the building block goals. This funding is in addition to the more than \$1.4 billion that NRCS has invested since 2009 in funding for EQIP practices that have climate-related benefits. The Rural Development's Rural Business-Cooperative Service (RBS) awarded \$12.5 million in grants and loans to support the installation of 17 anaerobic digesters and biogas systems in eight States as part of the Rural Energy for America Program (REAP). In partnership with the Softwood Lumber Board and the Binational Softwood Lumber Council, USDA announced the winners of the U.S. Tall Wood Building Prize Competition. The two winning development teams were granted a combined \$3 million in funding to support the development of tall wood demonstration projects in New York and Portland, Oregon. These are only three of the numerous actions that USDA and its partners have taken over the last year; a detailed list can be found starting on p. 7.

To build on these accomplishments, the building blocks will remain an adaptable framework that will be revisited as new programs, research, technology, and partnerships expand opportunities to further reduce GHG emissions and enhance carbon sequestration. As this update shows, USDA is confident that the agricultural and forestry communities can continue to play an important role in reducing GHG emissions and increasing carbon storage in the Nation's forests and soils.

Building Block Goals and Key Actions

Building Block	Goals (by 2025)	Greenhouse Gas (GHG) Reduction Goal (MMTCO ₂ e per year by 2025)
Soil Health	Integrate with the NRCS Soil Health Initiative and promote more than 10 NRCS conservation practices that improve soil organic matter, reduce emissions from soils and equipment, and promote healthier soils nationwide.	4.0-18.0
Nitrogen Stewardship	Reduce nitrous oxide emissions and provide cost savings by focusing on the right timing, type, placement, and quantity of nutrients.	7.0
Livestock Partnerships	Install 500 anaerobic digesters; install impermeable covers and flares on 10 percent of dairy cattle and swine operations.	21.2
Conservation of Sensitive Lands	Enroll 400,000 acres of Conservation Reserve Program (CRP) with high GHG benefits; protect 40,000 acres through easements; transfer expiring CRP acres to permanent easements.	0.8
Grazing and Pasture Lands	Establish grazing management plans on an additional 9 million acres for a total of 27 million acres.	1.6
Private Forest Growth and Retention	Through the Forest Service Forest Legacy Program and Community Forest and Open Space Conservation Program, protect almost 1 million acres of environmentally important private forestland from conversion to nonforest uses. Establish trees and shrubs on an additional 1 million acres of nonindustrial private forestland through NRCS conservation title programs.	4.8
Stewardship of Federal Forests	Reforest 320,000 acres on National Forest System lands.	2.5
Promotion of Wood Products	Increase the number of building projects supported annually through technical assistance from 440 in 2015 to 900 in 2025.	19.5
Urban Forests	Plant 100,000 additional trees in urban areas.	0.1
Energy Generation and Efficiency	Promote renewable energy technologies and improve energy efficiency through the Energy Efficiency and Conservation Loan Program, High Energy Cost Grant Program, Rural Energy for America Program, the National On-Farm Energy Initiative, and Rural Housing Service programs.	60.2
TOTAL		121.7-135.7

Building Block	Key Actions (2016-2018)
Soil Health	<ul style="list-style-type: none"> • Develop and implement a Soil Health Monitoring and Enhancement Network. • Develop advanced soil health training course and complementary webinar series to train trainers, as well as certification requirements for soil health management planners. • Provide advanced soil health training for more than 2,000 field, area, and state technical staff to build capacity for improved technical assistance to stimulate adoption. • Continue to leverage partnerships to develop standardized comprehensive soil health assessment availability and economic data. • Review and update Conservation Practice Standards related to soil health management systems (SHMS). • Continue to invest in research, education, and extension on practices that promote soil health and reduce GHG emissions from cropland.
Nitrogen Stewardship	<ul style="list-style-type: none"> • NRCS staff develop nutrient management plans for producers on 13 million acres. • Provide additional Technical Service Provider support to develop nutrient management plans on 6.5 million acres. • Partner with agri-businesses to provide assistance to producers for nutrient management on 1 million acres. • 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. • Develop, publish, and distribute literature on nitrogen management to improve nutrient use efficiency, reduce emissions, and improve water quality. • Support the development of extension materials on nitrogen fertilizer and manure management.
Livestock Partnerships	<ul style="list-style-type: none"> • Recruit and train the additional NRCS and RBS technical professionals and Technical Service Providers needed to provide direct technical assistance to producers to install and operate anaerobic digesters and the associated electrical generation equipment, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions. • Through REAP and EQIP, explore mechanisms to prioritize anaerobic digesters and the appropriate associated electrical generation technology, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions.
Conservation of Sensitive Lands	<ul style="list-style-type: none"> • Enroll 120,000 additional high-carbon acres in wetland and riparian buffer practices. • Provide technical assistance funding for States to hire additional foresters. • Provide outreach funds for State foresters.
Grazing and Pasture Lands	<ul style="list-style-type: none"> • Identify regions (Major Land Resource Areas) with the greatest potential for carbon sequestration and methane emission reduction via Prescribed Grazing. • Adjust NRCS State Office priorities for providing technical assistance to grazing land managers in high priority regions. • Implement conservation field trials for organic waste application in California. • Initiate research and development effort to improve enteric fermentation/forage intake estimation model. • Enroll an additional 2 million acres into the Prescribed Grazing, Range Planting, and Forage and Biomass Planting Practice Standards.
Private Forest Growth and Retention	<ul style="list-style-type: none"> • Enroll an additional 275,000 acres of private forestland in the Forest Legacy Program and Community Forest Program.
Stewardship of Federal Forests	<ul style="list-style-type: none"> • Reforest 96,000 acres of post-disturbance National Forest System (NFS) lands. • Treat 8.1 million acres to sustain or restore watershed function and resilience. • Treat 5.1 million acres of high-priority fuels in the Wildland Urban Interface on NFS lands.
Promotion of Wood Products	<ul style="list-style-type: none"> • Provide technical assistance for more than 1,500 wood building projects. • Organize and host a national conference on mass timber (including cross laminated timber and related technologies).

Building Block	Key Actions (2016-2018)
Urban Forests	<ul style="list-style-type: none"> Plant 30,000 additional trees in urban areas.
Energy Generation and Efficiency	<ul style="list-style-type: none"> Analyze and refine framework for interagency communication and program delivery for energy efficiency improvements. Develop a baseline data collection plan to evaluate the energy efficiency benefits of RHS programs. National Institute of Food and Agriculture (NIFA), NRCS, RBS, and Rural Utilities Service (RUS) collaborate on a pilot to deploy the Partner Collaboration Framework to a targeted agricultural segment. Increase implementation rate of energy efficiency projects through expanded technical assistance.

Note on the Building Block GHG Reduction Goals

The GHG reduction goals account for the impact of actions that USDA and its partners take between 2015 and 2025. Unless otherwise stated, USDA assumes that actions taken over that period continue to have GHG benefits in 2025. For example, USDA aims to enroll almost 100,000 acres in the Forest Legacy Program and Community Forest Program each year from 2016 to 2025, resulting in approximately 0.48 MMTCO₂e sequestered from those new enrollments during each year of this framework. By the end of 2025, the Forest Service will have enrolled 1 million acres in those programs, for a total sequestration of 4.8 MMTCO₂e in that year.

Figure 1 illustrates this calculation. The 100,000 acres of forestland enrolled each year begin sequestering approximately 0.48 MMTCO₂e *in that year* (as indicated by “NEW Annual Sequestration”). Over the 10 years of this framework, those acres continue to sequester in the years following their enrollment (indicated by “TOTAL Annual Sequestration”).

Unless otherwise stated, USDA accounts for the cumulative benefits of all of the building block actions and their respective GHG goals.

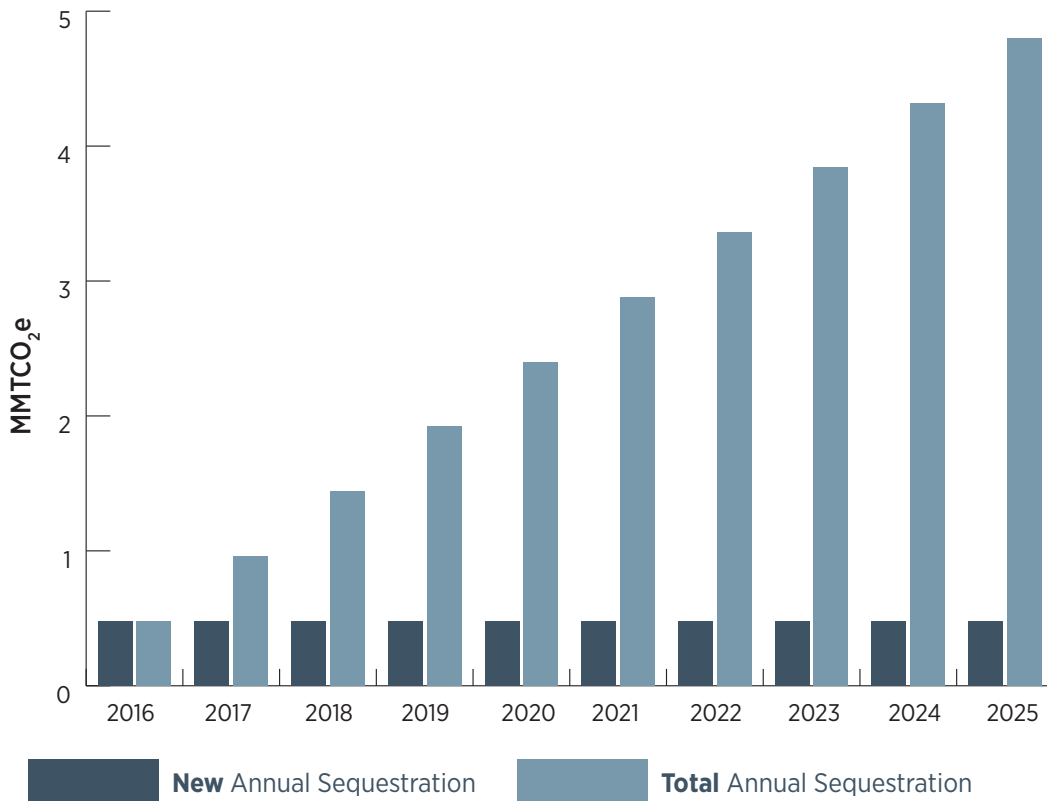


Figure 1 - Estimated annual and total carbon sequestration for the Private Forest Growth and Retention building block.

Actions to Date

Over the last year, USDA has continued taking action to help farmers, ranchers, and forestland owners respond to climate change. The following list includes many of the actions that USDA and its partners have taken to achieve the building block goals since the initiative was launched.

Soil Health

- NRCS has established the Soil Health Division within the Science and Technology Deputy Area of NRCS, with 17 new staff members and 4 more to be hired. The goals of the division are to increase long-term adoption of soil health-based practices and soil health management systems (SHMS) on working lands, and increase the education, awareness, and technical capacity of producers, stakeholders, and NRCS staff.
 - Staff reached well over 8,000 participants in workshops, trainings, and presentations in their first quarter.
 - Efforts to inventory needs, opportunities, challenges, and potential partnerships to leverage for greater collaborative impact are under way.
 - Training and technical resources are being updated and designed.
 - The division is leading efforts to standardize comprehensive soil health assessment in collaboration with the scientific community and other stakeholders, provide guidelines for data-informed soil health management planning, and use such approaches to inform adoption of economically viable and effective SHMS adapted to soil, climate, production system and producer realities.
- As part of the Soil Health Initiative, USDA is:
 - Establishing national guidelines for cover crops to ensure their beneficial use in crop production;
 - Providing financial and technical assistance to farmers to implement practices such as Residue and Tillage Management, No-Till, Reduced Tillage, Contour Buffer Strips, Grassed Waterways, Filter Strips, Field Borders, Conservation Crop Rotation, Vegetative Barriers, Herbaceous Wind Barriers, and Cover Crops;
 - Expanding our capacity to use multimedia to convey the message of soil health by providing funding to develop videos, podcasts, and interactive online materials (67,000 views of NRCS soil health-related YouTube videos and 55 million viewer impressions of TV PSAs were achieved in the first quarter of FY 2016);
 - Establishing new guidelines for soil health assessments in collaboration with research entities, public/private labs, and other partners. Soil health testing needs to become publicly available, affordable, and commercially viable, while remaining science-based and standardized so that it can be integrated into effective programming; and

- Developing a Soil Health Monitoring and Enhancement Network, which will routinely assess and monitor soil dynamics across the United States, provide producers with science-based options for enhancing soil health, and leverage partners to accelerate adoption of these practices.
- Through the Conservation Innovation Grant (CIG) program, NRCS has provided funding for over two dozen currently active projects that provide tools and information to farmers and landowners to improve soil health in a variety of climates, soils, and production systems.

Nitrogen Stewardship

- NRCS funded two projects through the Regional Conservation Partnership Program (RCPP) that focus on nitrogen stewardship in the Midwest:
 - The first RCPP provides \$5.3 million to the Illinois Corn Growers Association and its partners to integrate conservation into the foundational farm management of commodity crop operations. The partnership will achieve this goal by encouraging producers to use the Precision Conservation Management program (PCM). PCM integrates a variety of public and private services to streamline the process of assessing farm and natural resource concerns and applying for NRCS programs that will help address those concerns.
 - The second RCPP provides \$9.5 million to the Midwest Agriculture Water Quality Partnership to advance a science-based, non-regulatory approach to reducing nutrient loss and improving water quality, soil health, and habitat for at-risk species. The partnership has assembled over 40 partners and \$38 million in non-Federal funds to focus on improving nutrient management in Iowa, Illinois, and Nebraska. The project uses traditional approaches to deliver conservation through scaling up conservation planning and conservation practices with a non-traditional, highly innovative precision agriculture platform integration component that will lead to greater practice adoption and improved conservation outcomes.
- Through the CIG program, NRCS funded a \$960,000 project with the Environmental Defense Fund, United Suppliers, the Almond Board of California, and farmer networks to create a large-scale pilot generating the first aggregated nutrient management GHG credit project. This project will demonstrate how growers implementing enhanced nitrogen management processes on annual and perennial crops can participate in GHG markets.
- The Adapt-N tool, supported by a NIFA grant, provides

local, location-specific nitrogen rate recommendations for corn production, increasing nitrogen use efficiency, reducing runoff and GHG emissions from over-application of nitrogen fertilizer. The tool recently incorporated nitrous oxide emissions calculations and in 2012 was voted *AgProfessional's* Best New Product of the Year.

- In March 2016, NRCS convened a focus group with agricultural industry, retailers, and conservation groups to explore how the agency can partner to improve soil health and reduce GHG emissions from agriculture.

Livestock Partnerships

- In October 2015, USDA, through REAP, awarded \$12.5 million in grants and loans to support the installation of 17 anaerobic digesters and biogas systems in California, Maine, Massachusetts, Michigan, New York, North Carolina, Ohio, and Washington. When operational, these systems are projected to generate over 167,000 megawatt hours of renewable power annually.
- In 2015, USDA Rural Development awarded a biogas system planning grant of almost \$54,000 under the Value Added Producer Grant program.
- In December 2015, USDA, the Environmental Protection Agency, and the Department of Energy released an update and progress report for the Biogas Opportunities Roadmap, which outlines voluntary strategies to overcome barriers limiting further expansion and development of a robust biogas industry in the United States.
- Through EQIP, NRCS supported eight anaerobic digesters in FY 2015 and one in the first quarter of FY 2016.
- In the past year, NIFA has provided Hatch funds dedicated to anaerobic digestion through universities involved in the S-1041 Multistate Committee, "The Science and Engineering for a Biobased Industry and Economy." Projects focus on producing economically valuable co-products of digestion along with fuel, developing economical processes for biogas purification, and examining nutrient-recovery processes for recovering nitrogen and phosphorus as fertilizer.

Conservation of Sensitive Lands

- Through the CIG program, NRCS provided \$1.2 million for five projects that avoid GHG emissions by retaining lands with high conservation values.
- NRCS provided over \$800,000 through the RCPP to incentivize agricultural and timber producers in Georgia to protect and restore critical wetland areas in two of the State's important watersheds.
- New Conservation Reserve Program (CRP) contract acres associated with riparian buffers and other tree plantings nearly doubled from 2012 to 2015, increasing from almost

50,000 to 99,000 acres. In addition to sequestering carbon, riparian buffers also cool the temperatures of rivers and streams due to the shade they provide.

- In FY 2015, the USDA Farm Service Agency (FSA) awarded \$4 million to four States in the Chesapeake Bay Watershed (Delaware, Virginia, West Virginia, and New York) to support CRP enrollment of riparian forested buffers, which reduce GHG emissions and improve water quality in the Bay.
- Also in the Chesapeake Bay Watershed, FSA is partnering with the USDA Forest Service and providing \$550,000 per year for eight additional foresters and \$235,000 for outreach and training (\$180,000 in FY 2015 and \$55,000 in FY 2016) to these State foresters to contact resident and absentee landowners regarding enrollment in the CRP to establish riparian buffers along rivers and streams. The Forest Service will conduct a series of webinars and field days and will distribute brochures and other outreach material specifically targeted to livestock producers; provide foresters with training on buffer monitoring and assessment protocols; and conduct other activities.
- Land in organic or muck soils is often associated with high yields and valuable crops. However, the rich organic matter in these soils rapidly breaks down when exposed to air, becoming highly erodible and releasing substantial amounts of carbon dioxide. Research has shown that the impact on climate change of cropping on organic soils may be tenfold that from other soils. FSA is partnering with NRCS and the Center for Experimental and Behavioral Economics at the University of Delaware to help USDA best understand how to capture the interest of producers with organic soils and encourage them to participate in FSA and NRCS conservation programs. That work is underway now and will conclude in FY 2016.

Grazing and Pasture Lands

- Through the RCPP, NRCS provided \$1.8 million to the Interagency Agriculture Council and its partners to integrate conservation stewardship projects with activities that reduce GHG. The project is nationwide, but will focus on Tribal rangelands in Alaska, Nebraska, New Mexico, Oklahoma, and South Dakota. One of the anticipated outcomes from the project is the development of carbon offsets from soil amendment and grazing land and livestock management activities. The project will engage private investment in those pilot project sites that both meet investors and credit buyers' interest in high-quality carbon offsets, and Tribes' interest in promoting appropriate conservation practices and economic development on Indian lands.

- Through the CIG program, NRCS funded two projects related to grazing and pasture lands. The first is a \$491,000 project with the Chesapeake Bay Foundation (CBF) to expand the use of management intensive grazing in the Chesapeake Bay watershed, enrolling at least 35 farmers to transition 1,400 acres of farmland to rotation grazing. CBF will quantify the nutrient and GHG benefits associated with the transition and explore opportunities for producers to participate in water-quality trading and GHG markets. The second project provides \$731,000 in funding to improve the viability of GHG markets for range and pasture lands through a variety of activities across five States (California, Oregon, Washington, Texas, and Hawaii). As part of the project, Terra Global Capital, LLC and the Climate Action Reserve will develop a comprehensive range and pasture land GHG protocol to quantify the benefits of these activities.

Private Forest Growth and Retention

- The Forest Service manages two programs that result in permanent protection of forestland. In FY 2015, the Forest Legacy Program (FLP) enrolled 106,389 acres in 15 States, bringing the total of protected forest acreage to over 2.5 million over the life of the program. In addition, the Community Forest and Open Space Program (CFP) has conserved approximately 756 additional acres by preventing conversion to non-forest use. These programs positively impact GHG emissions by permanently conserving critical private forestland, and the associated carbon benefits (sequestration) that otherwise would have been converted and lost. Twenty additional FLP projects have been identified for funding in FY 2016.
- From 2011 through 2015, NRCS enrolled more than 485,000 acres in the Tree/Shrub Establishment Conservation Practice, providing afforestation or reforestation for conservation benefits on private nonindustrial forest lands. Additional planting took place as part of establishing windbreaks, riparian buffers, and wildlife habitat. Establishing woody plants is an effective action for capturing CO₂ emissions.
- As part of the RCPP, NRCS allocated \$1 million for a project focused on forest retention and carbon sequestration for non-industrial private forest (NIPF) landowners in the Pacific Northwest. The project will target NIPF landowners in Oregon and Washington who wish to participate in a regional carbon crediting program and who possess lands in NRCS and State priority areas as defined in regional conservation strategies.
- NRCS is providing \$10.6 million in funding to aid forest managers working to restore longleaf ecosystems on private land in nine Southeast States. NRCS provides technical and financial assistance to help landowners and land managers plant longleaf pine as well as manage

longleaf forests through practices like prescribed burning. Healthy longleaf pine ecosystems provide highly valuable timber, support wildlife habitat, and sequester carbon in wood products, biomass, and soils.

- PINEMAP, a coordinated agricultural project funded by NIFA, has developed a comprehensive Extension program to educate forestry professionals in the Southeastern United States. The project aims to better manage forests to increase carbon sequestration; increase the efficiency of nitrogen and other fertilizer inputs and adapt forest management approaches and plant improved tree varieties to increase forest resilience and sustainability under variable climates. As part of the Extension program, educators conducted 4 webinars for 315 forestry consultants and State forestry agency personnel and distributed research results and information to the Western Gulf Silvicultural Technology Exchange, reaching 72 silviculturists who manage 5 million acres of pine forests.

Stewardship of Federal Forests

- The Forest Service has developed regional carbon assessment reports to help forest managers and the public understand how much carbon is stored in forest ecosystems and harvested wood products. The baseline forest carbon reports provide data on carbon stocks and trends for seven different forest ecosystem carbon pools – above-ground live tree, below-ground live tree, standing dead, understory, down dead wood, forest floor and soil organic carbon – for the baseline period 1990 to 2013 (and 2005 to 2013). These reports also provide estimates of carbon stored in harvested wood products over longer time periods depending upon data availability. This information is provided as a nationally consistent data set with which we can better understand geographic differences and important trends.
- In FY 2015, the Forest Service treated 4.7 million acres to sustain or restore ecosystem resilience and watershed function and planted over 41,000 post-disturbance acres (wildfire, weather, and insect and disease).

Promotion of Wood Products

- In the fourth quarter of 2015, USDA's Wood Innovation grant project partner WoodWorks influenced and converted 110 design projects to wood frame construction. This resulted in a 223,000-metric-ton carbon benefit to the environment (71,200 metric tons sequestered and 151,000 metric tons of emissions avoided). Additional contributions included providing 10,472 educational hours to almost 5,000 construction specifiers through 57 events.
- In September 2015, USDA, in partnership with the Softwood Lumber Board and the Binational Softwood

Lumber Council, announced the winners of the U.S. Tall Wood Building Prize Competition. The two winning development teams were granted a combined \$3 million in funding to support the development of tall wood demonstration projects in New York and Portland, Oregon.

- In FY 2015, the Forest Products Laboratory in cooperation with 3M improved wood-plastic composite materials so they are more user-friendly and durable. By carefully adding hollow glass microspheres during composite production, collaborating scientists made wood-plastic composite materials that were both stiffer and lighter. These composites are a major outlet for recycled film and are often used in exterior building applications including roofing, fencing, siding, window/door profiles, railing, and decking.

Urban Forests

- In the spring of 2015, the Energy Saving Trees program, led and managed by the Arbor Day Foundation, engaged homeowners and leveraged funds from electric utilities to plant more than 25,000 trees. In the fall of 2015, the Energy Saving Trees program engaged over 6,000 homeowners and leveraged \$485,000 from electric utilities to plant more than 10,000 trees. Since July 2011, the program has engaged 24 utilities, 2 retail organizations, 1 state government, and 1 city government across 27 states and the District of Columbia. These tree plantings have saved more than 294,000 mWh of power and just under 4,000,000 therms of natural gas, and sequestered almost 300,000 metric tons of carbon.
- In 2014, USDA began a new effort to inventory urban forests as part of the Forest Service's Inventory & Analysis program (FIA); its first city inventory was published in February 2016. The Urban FIA program will help USDA provide better estimates of long-term carbon trends for the Nation's urban forests.
- USDA recently began a collaborative initiative to help urban managers and landowners incorporate climate change considerations into decision making. The Chicago Wilderness was selected as a pilot area; Forest Service scientists are working with regional and local partners to assess the vulnerability of Chicago's urban forests to climate change, identify adaptation tools and strategies, and share examples of climate-informed management.

Energy Generation and Efficiency

- In October 2015, USDA announced funding for more than 1,100 renewable energy and energy efficiency projects to help rural small businesses and agricultural producers reduce energy usage and costs in their operations

nationwide. USDA is providing more than \$102 million in loan guarantees and \$71 million in grants through REAP. In total, the projects are expected to generate enough energy to power more than 83,000 homes for a year and reduce emissions by 13.4 million metric tons of carbon dioxide, the equivalent of eliminating a year's worth of pollution for more than 131,500 cars.

- Through the RCPP, NRCS is providing \$1.1 million to reduce energy use in Colorado dairies and irrigated operations. Through this funding the Colorado Energy Office (CEO) and its partners will provide participating producers with on-farm energy audits and assist them in selecting and implementing cost effective improvements that reduce energy use, water, environmental impacts, and producer operating costs. CEO will work with its partners to reduce electricity usage by 3.5 million kWh and water usage by 350,000 gallons annually.
- The NRCS National On-Farm Energy Initiative funded 625 on-farm energy management plans in 2015, bringing the agency's total to more than 4,000 since 2010. Additionally, more than \$17,825,000 was obligated last year for 1,374 energy efficiency projects, which will reduce GHG emissions by an estimated 50,000 metric tons annually for the life span of the projects.

In addition to accomplishments specific to each building block, USDA and its partners have taken several actions to advance the framework as a whole:

- Through EQIP, NRCS has allocated \$72.3 million specifically for practices that advance the building block goals, in addition to the \$1.3 billion in EQIP funding that has broad climate-related benefits.
- The USDA Climate Hubs are hosting workshops in each of the regions to convene USDA agency representatives and partners to discuss the Building Blocks for Climate Smart Agriculture and Forestry. The Hubs are providing their technical expertise on selected practices within each building block to build climate literacy both within and outside of USDA and advance the building blocks framework.
- Cornell University's Institute for Climate Change and Agriculture established a Climate Smart Farming Extension Team through a NIFA Smith-Lever-funded Extension project. The project also includes a research component supported by NIFA Hatch funding.
- NRCS and Colorado State University trained more than 500 people on COMET-Farm and COMET-Planner, web-based tools that help farmers and ranchers assess the GHG impacts of their operations.

Implementation Plans

Implementation plans will guide USDA agency actions over the next several years to advance each of the building block goals. Each implementation plan includes:

- A description of the building block, including programs and authorities that can be used to encourage adoption of the various technologies and conservation practices that reduce GHG emissions or increase carbon sequestration;
- A quantitative GHG reduction goal;
- Opportunities for partnerships with other organizations, including industry groups; non-governmental organizations; private companies; and other governmental agencies at the Federal, State, Tribal, and local levels; and
- Actions that USDA plans to take over the next 3 years to lay the foundation for achieving these goals. The actions fall into several categories, including:
 - Direct USDA support for conservation measures that result in net GHG reductions (e.g., payments through EQIP or loan guarantees for renewable energy projects);
 - Policy and guidance to encourage reduction of GHG emissions from agriculture and forests;
 - Outreach and training for USDA staff and stakeholders;
 - Continued investment in research, education, and extension on climate smart agricultural practices; and
 - Partnerships, either across USDA agencies or with external organizations.

The building blocks are a framework to highlight and guide efforts at USDA to reduce GHG emissions from agriculture and forestry. As such, the programs and activities included in these implementation plans are not a comprehensive list of the actions that USDA and its partners are taking to address climate change. For example, USDA is taking numerous actions to increase the resilience and adaptability of agriculture and forests to climate change.

Likewise, many actions that help farmers, ranchers, and forestland owners adapt to climate change also reduce GHG emissions or increase carbon sequestration. The focus of this report is to highlight the mitigation potential of a selection of USDA's programs, including through direct actions (e.g., replanting in national forests); technical and financial assistance; and research, education, outreach, and extension.

Soil Health

Description

Land use and management can build or reduce soil carbon depending on the particular management practices used. As a result, opportunities for GHG mitigation in agriculture include encouraging practices that increase soil carbon or discouraging those that reduce soil carbon. Management practices that improve soil health decrease erosion of carbon-rich top soil and increase soil organic matter. These practices result in organic matter stabilization and

carbon sequestration. Additionally, soil health management systems (SHMS, or suites of soil health promoting practices) and improved soil health status can reduce net CO₂ and N₂O emissions, both directly on farm and indirectly, for example through reductions in inputs and fuel usage.

This building block is cross-cutting; changes in soil health impact and are impacted by a number of the other

CASE STUDY

Leon Moses has transformed the farm he operates. More importantly, he has also transformed his thinking. He no longer sees the soil as just a medium for producing crops. Instead, he sees a living soil that's the focus of his operation. "I'm doing something good for the soil, and in turn the soil rewards me with yields that don't even compare to what we used to have," says the superintendent of the 492-acre North Carolina A&T State University farm. Moses began experimenting with no-till and strip till farming 25 years ago as a research technician. "I saw what happened there and decided no-till was the right thing to do. When I became superintendent in 2004, we began using no-till for all our corn and soybeans," he says.

In 2006, he added cover crops — not for what they could do for the soil, but because he had a shortage of hay for the farm's livestock. "But I began to learn very quickly that no-till and cover crops combined to make healthy soils that rewarded me with higher yields," Moses says.

Now, he uses no-till and cover crops on 100 percent of his operation. "In 2004, some soybean yields were at 25 bushels an acre. Now we can easily get 65 bushels per acre of soybeans," he says. "It used to take 40 acres of corn to fill our silo and now we only have to cut 10 acres of corn to fill the silo. We were getting 10 tons per acre of silage and now it's 22 tons an acre. The yield we used to get just doesn't begin to compare with what we get now."

"The return on my investment on this farm is easily a 35-percent to 45-percent increase, and we get three or four times more production," Moses says. "It's the best way to go. The proof is always in the pudding."

More information on soil health in North Carolina, including a video with Leon Moses, can be found here: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/nc/soils/health/>.



Corn emerging through a terminated cover crop on the North Carolina A&T State University farm near Greensboro. Photo courtesy of USDA NRCS.

building blocks. As such, the benefits of improved soil health for climate change mitigation and many other desirable environmental, social, and economic outcomes are diverse, are an opportunity in all land management systems, and can be challenging to quantify completely. This summary provides a broad overview of the potential opportunities that exist for mitigation. Some of these will be accounted for in other related building blocks, such as soil health benefits of improved Grazing and Pasturelands, and Conservation of Sensitive Lands. Other opportunities cannot yet be quantified due to lack of existing data and methods for proper estimation.

The estimated GHG reductions for this building block are a conservative estimate for crop lands. However, the broader implementation strategy, particularly with respect to education, revision of NRCS Conservation Practice Standards, and technical and financial assistance, will interact with and enhance results achieved by the Building Blocks on Nitrogen Stewardship, Grazing and Pasturelands, Conservation of Sensitive Lands, and others.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ¹
Increase soil carbon sequestration by improving soil health, decreasing erosion of carbon-rich top soil, and increasing soil organic matter.	4 - 18 ²

¹ For more information on how to interpret this goal, see p. 6.

² The lower bound of this goal continued patterns of adopting individual Conservation Practice Standards related to soil health, while the upper bound could be achieved by broad adoption of soil health management systems.

Partnership Opportunities

Numerous partnership efforts will facilitate broad national impact on practice adoption by leveraging skills, resources, and shared goals to accomplish the plan laid out below. The NRCS is and will be partnering with a number of other organizations:

- USDA’s Risk Management Agency and Farm Service Agency, the National Soybean Association, Midwest Cover Crops Council, National Wildlife Federation, Land-Grant Universities, National Crop Insurance Services, Inc., and others to develop national and regional guidelines (as applicable) for cover crops to ensure their beneficial use in crop production.
- National Corn Growers Association, Monsanto, The Nature Conservancy, Environmental Defense Fund, USDA’s Agricultural Research Service, and numerous universities, among others, to establish and evaluate soil health demonstration field sites to encourage adoption of soil health-promoting practices.
- National Association of Conservation Districts to inventory SHMS demonstration sites and various interested partners to train agricultural service providers in Soil Health Management Planning.
- USDA Climate Hubs, Land-Grant Universities, Cooperative Extension Service, Farm Foundation, and the Samuel Roberts Noble Foundation and their diverse partners in the Soil Renaissance program and Soil Health Institute. Additional stakeholders include independent crop consultants; fertilizer, equipment, seed dealers and other industry partners; soil testing laboratories; and non-profit organizations with interest in improving farm sustainability. More information on Soil Renaissance and the Soil Health Foundation can be found at <http://soilrenaissance.org/> and <http://soilhealthinstitute.org/>.
- National Grazing Lands Coalition and other grazing groups to be identified to increase soil health in rangelands and pastures. See Grazing and Pasture Lands building block for more details (p. 29).

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Complete staffing, orientation, and training of NRCS Soil Health Division, and implement mechanism for States to efficiently receive technical assistance.	NRCS
Continue to build capacity among partners to increase the adoption of SHMS.	NRCS
Develop advanced soil health training course and complementary webinar series to train trainers; start development of certification requirements for soil health management planners.	Primarily NRCS Soil Health Division in collaboration with the Agricultural Research Service (ARS), NIFA, and partners
Provide advanced soil health training for at least 500 field, area, and State technical staff to build capacity for improved technical assistance to stimulate adoption.	NRCS
Develop and implement pilot cost sharing for Soil Health Assessment and Management Planning and integrate soil health into conservation planning.	NRCS
Continue to leverage partnerships to develop and make available standardized comprehensive soil health assessments and economic data.	NRCS in collaboration with ARS, NIFA, and partners
Develop plans for a Soil Health Monitoring and Enhancement Network, which will routinely assess and monitor soil dynamics across the United States, provide producers with science-based options for enhancing soil health, and leverage partners to accelerate adoption of these practices.	NRCS
Review and update Conservation Practice Standards related to SHMS.	NRCS
Support building block implementation through research, data, tools, and educational activities related to soil health within USDA and USDA-funded research programs.	ARS, Economic Research Service (ERS), NIFA

FY 2017

Action	Lead USDA Agency(s)
Continue to build capacity among partners to increase the adoption of SHMS.	NRCS
Update advanced soil health training course and complementary webinar series to train trainers, as well as certification requirements for soil health management planners.	Primarily NRCS Soil Health Division, in collaboration with ARS, NIFA, and partners
Provide advanced soil health training for at least 750 field, area, and State technical staff to build capacity for improved technical assistance to stimulate adoption.	NRCS
Continue to leverage partnerships to develop standardized comprehensive soil health assessment availability and economic data.	NRCS in collaboration with ARS, NIFA, and partners
Implement Soil Health Management Planning as part of Conservation Plans via additional Technical Service Provider (TSP) and Field Office Technical Assistance support on at least 250,000 acres.	NRCS
Implement Soil Health Monitoring and Enhancement Network.	NRCS
Support building block implementation through research, data, tools, and educational activities related to soil health within USDA and USDA-funded research programs.	ARS, ERS, NIFA

FY 2018

Action	Lead USDA Agency(s)
Continue to build capacity among partners to increase the adoption of SHMS.	NRCS
Provide advanced soil health training for at least 1,000 field, area, and State technical staff to build capacity for improved technical assistance to stimulate adoption.	NRCS
Continue to leverage partnerships to develop standardized comprehensive soil health assessment availability and economic data.	NRCS in collaboration with ARS, NIFA, and partners
Implement Soil Health Management Planning as part of Conservation Plans via additional Technical Service Provider (TSP) and Field Office Technical Assistance support on at least 500,000 acres.	NRCS
Continue implementation of Soil Health Monitoring and Enhancement Network.	NRCS
Support building block implementation through research, data, tools, and educational activities related to soil health within USDA and USDA-funded research programs.	ARS, ERS, NIFA

Nitrogen Stewardship

Description

Within the United States, agriculture is a significant source of nitrous oxide (N₂O) emissions, a GHG that is over 250 times more potent than the same amount of carbon dioxide. N₂O 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 MMTCO₂e in direct N₂O emissions. Nitrous oxide emissions from synthetic fertilizer and organic amendments account for more than 50 percent of those emissions (72 MMTCO₂e). Management of nitrogen application can reduce these emissions.

N₂O 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 N₂O 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 N₂O emissions from legumes, manure, compost, and other biosolids for crop production.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e 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 MMTCO₂e 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 N₂O, corn production represents the largest crop source of N₂O 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 N₂O 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 N₂O 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 N₂O 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 N₂O 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.

Livestock Partnerships

Description

When livestock manure is treated and stored in anaerobic conditions (e.g., as a liquid/slurry in lagoons, ponds, tanks, or pits), decomposition results in large emissions of methane, a GHG that is more potent than carbon dioxide with higher short-term impacts on the atmosphere. Managing manure to either encourage aerobic decomposition, which produces little to no methane, or capturing the methane through digester technologies or covers with flaring, can greatly reduce the GHG emissions from livestock production. USDA has a variety of programs that encourage these opportunities to reduce emissions while improving the economy of operations for farmers and ranchers.

Anaerobic digesters are one promising option for reducing GHG emissions from manure management by capturing methane and either combusting it for energy generation or processing it as a replacement for natural gas. Anaerobic digestion also provides a variety of co-products that can be used as fertilizer, bedding, and soil amendments.

In addition to anaerobic digesters, there are other technologies that reduce methane emissions from livestock operations. Lagoon and waste storage covers from which methane can be flared reduce those emissions, are much less expensive than digesters, and take much less management and maintenance. Enhanced solid separation can also significantly reduce methane emissions from liquid waste streams by removing solids before they can break down into methane. After removal, solids can be used for fertilizer, bedding, compost, or with another energy generation technology. Solid separators can be used in combination with a variety of other processing practices, including digesters and covers. Other technologies to reduce methane emissions include thermochemical conversion, incineration, gasification, and pyrolysis.

USDA has several programs that can support the installation of anaerobic digesters and other technologies that reduce GHG emissions from manure management practices. They include:

- EQIP, which includes conservation practice standards for both anaerobic digesters, solid separators, and roofs and covers with methane flaring;
- REAP, which supports anaerobic digesters through grants and loans; and
- Research, education, and extension programs to explore the development and implementation of technologies and practices that reduce methane emissions from animal manure.

Greenhouse Gas Reduction Goal

Goal ⁶	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ⁷
Install 500 anaerobic digesters.	6.1 ⁸
Cover lagoons and waste storage ponds and structures and flare captured methane from 10 percent of dairy cattle and market swine.	15.1 ⁹
Total	21.2

Partnership Opportunities

A challenge to widespread adoption of many of these technologies is that, without additional incentives such as streamlined power purchase agreements and payment for GHG reduction credits, they may provide little or no economic return to producers. For example, a small anaerobic digester may be feasible for a dairy farm owner to operate, but, without additional assistance, the products from its operation do not provide enough financial returns to justify its construction. A larger anaerobic digester may be more financially viable because it is able to produce more outputs (e.g., natural gas, electricity, and other bio-based products) per dollar of investment. At the same time, its operation requires a separate, full-time manager, which may not be possible for smaller operations. Individual USDA financial and technical assistance programs address some of these challenges, and agencies are developing partnerships both within USDA and with outside stakeholders to encourage these technologies.

⁶ At this time, there is no quantified goal for installing solid separators. As part of the ongoing work related to this building block, a goal may be established.

⁷ For more information on how to interpret this goal, see p. 6.

⁸ Assumes the installation of 500 average-sized digesters, which reduce emissions by approximately 12,000 MTCO₂e each (9,800 MTCO₂e from avoided methane emissions and 2,200 MTCO₂e from substituting for more GHG-intensive electricity generation). The same amount of emissions may be realized through fewer large digesters, which may also improve the long-term financial sustainability of these operations.

⁹ Assumes the installation of non-permeable covers with flares. Covers would be placed on manure storage structures for 900,000 dairy cattle and 11 million market swine, reducing methane emissions by 5.8 MTCO₂e and 0.9 MTCO₂e per animal, respectively. This goal would equate to approximately 3,600 covers on dairy operations (focusing on operations with more than 1,000 animals) and 1,800 covers on hog operations (focusing on operations with more than 1,000 animals). However, there may be fewer covers installed if they are used in operations with more animals.

CASE STUDY

Bob Giacomini operates a 720-acre dairy in Marin County, CA with daughters Karen, Diana, Lynn, and Jill. The dairy is the heart of the Point Reyes Farmstead Cheese Company, where the Giacominis make their award-winning cheeses and demonstrate sustainable farming practices. A leader in the dairy industry, Giacomini sat on the National Dairy Board from 1989 to 1995, including as President for his last 2 years of service.

Like farmers across the State, his farm has faced record drought, and he has real concerns about having enough forage for his cows. He is not just worried about his 800 animals—he also wonders whether his farm will have enough drinking water since he relies on a well.

Giacomini's farm is at the forefront of conservation. Rotational grazing of their cows keeps soils healthy and helps prevent harmful erosion into Tomales Bay. To preserve their open space and working landscapes, they transferred their development rights to the Marin Agricultural Land Trust.

The Giacominis also use a methane digester to convert cow manure into clean, renewable energy that powers their dairy and cheese facility. The digester, which was installed in 2009, was funded in part by grants from the USDA Natural Resources Conservation Service, the California Energy Commission, administered by Western United Resource Development, Inc., and the Pacific Gas and Electric Company's Self Generation Incentive Program. Most recently, the Giacominis received a grant from USDA's Rural Energy for America Program. Electricity generated by the digester system is used to power dairy operations as well as on-site cheesemaking operations at the family's Point Reyes Farmstead Cheese Company. Hot water is recaptured from the system and used both in the milk parlor and in the cheese plant, saving approximately \$1,000 a month on propane costs.

In addition to land stewardship, diversification is a key component of the Giacomini's operation. In 2010, they opened The Fork, a culinary and educational center situated on their property. Agri-tourism has been an integral component to the marketing and promotion of their products, and the experience creates brand loyalty for both trade and consumer customers who visit them from across the country. Their property is a model for the region and the dairy industry, and they have been recognized for their leadership with the 2013 Leopold Award.

"I've always felt it was the responsibility of a rancher and landowner to take care of the land for the next generation," said Giacomini.



Point Reyes Farmstead Cheese Company. Photo courtesy of the Giacomini Family and Kodiak Greenwood.

For example, USDA Rural Development has developed a comprehensive plan which lays the foundation for sustained development of digester projects. This plan includes cooperation with NRCS, the Environmental Protection Agency's (EPA) AgStar Program, project developers, equity partners and lenders, industry partners, and producers. The plan is a multiyear effort that will work closely with feedstock suppliers and encourage the participation of Science, Technology, Engineering, and Mathematics students working through colleges and eXtension venues.

USDA and its partners have signed a variety of memoranda of understanding (MOU) to coordinate and encourage manure management and biogas technologies. The Rural Business-Cooperative Service (RBS) and NRCS have recently renewed and expanded an MOU on energy programs which allows the agencies to work closely together and coordinate programs. The agencies are exploring a coordinated program to encourage the adoption of anaerobic digesters by using EQIP funding for infrastructure installation and REAP funding to support electricity generation from the digester.

RD, NRCS, and EPA are also exploring an extension of the MOU to support the AgStar program, which promotes the use of biogas recovery systems to reduce methane emissions from livestock waste. This agreement would encourage USDA to take a more active role in managing that program to reach potential stakeholders that would otherwise be missed.

Finally, an MOU currently exists between USDA and Dairy Management Inc., a dairy industry group, to increase communication and cooperation between the entities, particularly in the areas of technology creation and adoption. Adopting similar MOUs with the other animal and energy industry groups would be beneficial.

There are additional opportunities to reduce GHG emissions by coordinating with wastewater treatment plants, food processors, and other organic waste generators. These partners may be able to reduce disposal costs by incorporating anaerobic digesters into their waste management plans. Reducing food waste sent to landfills through anaerobic digestion also provides a significant opportunity to reduce GHG emissions and generate cleaner electricity. EPA estimates that if 50 percent of food waste generated each year in the U.S. was anaerobically digested, the electricity produced would power 2.5 million homes for 1 year.¹⁰ These partnerships are explored in detail in the Biogas Opportunities Roadmap, released in 2014, and its recent progress report from December 2015.¹¹

¹⁰ More information is available at www.epa.gov/region9/waste/features/foodtoenergy/.

¹¹ Available at http://www.usda.gov/oce/reports/energy/Biogas_Opportunities_Roadmap_8-1-14.pdf and <http://www.rd.usda.gov/files/Biogas-Roadmap-Progress-Report-v12.pdf>.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Recruit and train the additional NRCS and RBS technical professionals, and TSPs needed to provide direct technical assistance to producers to install and operate anaerobic digesters and the associated electrical generation equipment, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions.	NRCS, RBS
Through REAP and EQIP, explore mechanisms to prioritize anaerobic digesters and the appropriate associated electrical generation technology, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions.	NRCS, RBS
Publish a draft of the updated Conservation Practice Standard for Anaerobic Digesters (366).	NRCS
Support building block implementation through research, data, and tools related to manure storage, treatment, and utilization.	ARS

FY 2017

Action	Lead USDA Agency(s)
Recruit and train the additional NRCS and RBS technical professionals, and TSPs needed to provide direct technical assistance to producers to install and operate anaerobic digesters and the associated electrical generation equipment, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions.	NRCS, RBS
Publish a draft of the updated Conservation Practice Standard for Waste Storage Facilities (313).	NRCS
Support building block implementation through research, data, and tools related to manure storage, treatment, and utilization.	ARS

FY 2018

Action	Lead USDA Agency(s)
Recruit and train the additional NRCS and RBS technical professionals, and TSPs needed to provide direct technical assistance to producers to install and operate anaerobic digesters and the associated electrical generation equipment, covers with flares, solid separators, and other manure management technologies that reduce GHG emissions.	NRCS, RBS
Support building block implementation through research, data, and tools related to manure storage, treatment, and utilization.	ARS

Conservation of Sensitive Lands

Description

The term “sensitive lands” denotes soils and landscapes that are valuable due to properties (e.g., high organic matter, wet hydrology) and/or function (e.g., wildlife habitat, filtration, and hydrologic storage). Typical examples of these soils are organic rich histosols, floodplains, or wetlands along riparian areas. Properties and functions of these soils are easily disrupted from agricultural or urban land use. Sensitive lands that are used for agricultural production can be protected by changes in land use (long-term cover). This reduction in land use intensity can provide multiple environmental benefits, including substantial GHG mitigation that occurs as carbon is sequestered or preserved in soils and vegetation. When land is removed from crop production, several activities—including tillage, nitrogen fertilization, and energy use—are substantially reduced or eliminated, generating additional GHG mitigation. FSA and NRCS are committed to identifying these sensitive lands and encouraging landowners, farmers, and ranchers to voluntarily adopt conservation systems—using financial and technical assistance—to generate GHG benefits.

This building block has four separate elements:

1. Identify and target eligible lands to enroll additional riparian buffers, wetlands, and other conservation practices with large GHG mitigation benefits into CRP;
2. Extend benefits from CRP conservation by enrolling lands into permanent or long-term easements within the Agricultural Conservation Easement Program (ACEP), with State easement programs under the Conservation Reserve Enhancement Program (CREP), and with private partners;
3. Enroll organic soils used for crop production into CRP or wetland restoration easements under ACEP; and
4. Increase conservation actions on highly erodible lands (HEL) and wetlands as a result of conservation compliance provisions included in the 2014 Farm Bill.

Each of these elements is described in detail below:

1. *Identify and target eligible lands to enroll additional riparian buffers, wetlands, and other conservation practices with large GHG mitigation benefits into CRP.*

The CRP was instituted by the Food Security Act of 1985 to reduce erosion by protecting highly erodible cropland. As other benefits from CRP were identified, program goals were expanded in later Farm Bills. Long-term conservation covers such as grass, trees, and wetlands were established on croplands, protecting soils, improving water quality, enhancing wildlife habitat, reducing emissions, and sequestering carbon. By placing cropland

into long-term vegetative covers, practices such as tillage, fertilization, and machinery use are stopped. This change in land management reduces GHG emissions associated with crop production and leads to carbon being stored in the soils and vegetation when enrolled in the CRP. The substantial amount of GHG mitigation from CRP practices establishing trees, wetlands, and other vegetative covers has been well documented.

CRP wetland and riparian buffer practices have regional concentrations because land suited for wetland restoration and buffers is distributed unequally across the country. Seventy-five percent of wetlands are in North Dakota, South Dakota, Minnesota, and Iowa, while about 60 percent of riparian buffers are located in 7 Mississippi River-bordering States. These different regional patterns demonstrate the need to use targeted incentives and outreach efforts to expand the adoption of practices with high GHG benefits. An important aspect of this targeting is the development of new partnerships with State and local governments and non-governmental organizations that focus on regional concerns, including the mitigation of GHGs. These partnerships can bring together organizations with multiple primary objectives that will support common practices. The following examples of conservation practices through FSA and NRCS programs provide examples of how partnerships can encourage GHG reduction and carbon sequestration on riparian buffers, wetlands, and forestlands:

Riparian buffers – FSA is developing a targeted outreach and technical assistance effort for the Chesapeake Bay watershed. In 2015, FSA increased technical assistance funds for the Chesapeake Bay States by six-fold to hire and train nine additional foresters to identify eligible lands and work with landowners to increase forested riparian buffer enrollment in the watershed. The effort will be supported by the States’ need to meet Total Maximum Daily Load water quality standards. In addition, FSA is making \$5 million available to the six Chesapeake Bay States as a “challenge grant” to develop ways to accelerate the adoption of riparian buffers. Similar efforts will be explored within the Mississippi River Basin as States develop their nutrient management strategies. In addition to reducing nutrient runoff, these riparian buffers can absorb nitrogen that would otherwise be released as nitrous oxide.

Wetlands – FSA has developed several initiatives to encourage landowners and farmers to restore and create wetlands using the CRP. These initiatives include a one-time signup incentive payment, a 40-percent practice incentive payment, and an extra 20-percent

rental rate payment. Additional incentives may be provided when the land is enrolled within a Conservation Reserve Enhancement Program agreement. FSA has developed formal and informal partnerships with several organizations to deliver wetland practices within the CRP, including Ducks Unlimited, joint ventures, State agriculture and water quality agencies, and organizations working to improve the health of the Gulf of Mexico. We will continue efforts to attract new partners.

Forestlands – CRP has several practices to establish and manage forestlands, including the Longleaf Pine and Bottomland Hardwood. These initiatives offer additional incentives for landowners to adopt these practices. Additional discussion of these practices is included in the Private Forest Growth and Retention building block (p. 33).

Given the incentives currently in place, focused outreach efforts, and past landowner response to CRP incentives, FSA believes that enrollment of riparian buffer, wetland, and other practices with high GHG benefits can be increased by 40,000 acres per year (using 2014 as the base year).

2. *Extend benefits from CRP conservation by enrolling lands into permanent or long-term easements within ACEP, with State easement programs under CREP, and with private partners.*

The Agricultural Act of 2014 established ACEP “for the conservation of eligible land and natural resources through easements...” The Act specifically identifies wetlands and riparian areas as eligible land and states that the Secretary may terminate or modify CRP contracts if that land is entered into the ACEP.

Enrolling CRP land into easements such as ACEP can provide several GHG mitigation benefits: (1) the easement will maintain the conservation and agricultural use permanently or for extensive periods; thus, the carbon sequestered by CRP in the soils and vegetation is protected and will not be released; and (2) while CRP is statutorily limited in the number of acres it can enroll, land that transitions from CRP to other easement programs will allow CRP to enroll additional land with high GHG benefits into the program.

Under the ACEP-Agricultural Lands easement component, NRCS provides cost share assistance to eligible entities to purchase easements from eligible landowners to protect agricultural use, including grazing. “Eligible Entities” include State and local governments, Indian Tribes, and certain non-governmental organizations (e.g., American Farmland Trust, Nature Conservancy). The agreement with NRCS allows the protection of natural resources and

the agricultural value of the land, while permitting the landowner the right to continue agricultural production and related uses. NRCS may contribute up to 50 percent of the fair market value of the agricultural land with the eligible entities whose applications are selected for funding.

Under ACEP-Wetland Reserve Easement program, NRCS will purchase a reserved interest in eligible lands directly from eligible landowners. Easement types for wetlands are: (a) *Permanent Easements* (conservation easements in perpetuity)—NRCS pays 100 percent of the easement value for the purchase of the easement, and between 75 to 100 percent of the restoration costs; (b) *30-Year Easements*—NRCS pays 50 to 75 percent of the easement value for the purchase of the easement, and between 50 to 75 percent of the restoration costs; (c) *Term Easements* (for the maximum duration allowed under applicable State laws)—NRCS pays 50 to 75 percent of the easement value for the purchase of the term easement and between 50 to 75 percent of the restoration costs; and (d) *30-Year Contracts*—only available to enroll acreage owned by Indian Tribes.

3. *Enroll organic soils used for crop production into a program such as ACEP or CRP.*

The vast majority of agricultural soils remove carbon from the atmosphere; in 2013, 855.6 million acres of mineral soils sequestered 34.3 MMTCO₂e, or the equivalent of removing 7.2 million cars from the road for 1 year. In contrast, a small area of cultivated organic soils—around 2.5 million acres—was a net source of emissions, releasing 26.9 MMTCO₂e into the atmosphere. These soils are high in organic matter, and release CO₂ as they are drained and cultivated. Carbon emissions from the small amount of organic soils—less than 0.1 percent of all crop and forestland in the United States—cancel out more than three-quarters of the carbon sequestration of the remaining soils.

To address this concentrated source of GHG emissions, USDA is focusing on cropland with organic soils. However, enrolling organic soils into a cropland conservation program will likely not be successful without a strong outreach effort to farmers with organic soils, as producers on these lands have not regularly participated in these types of programs. This outreach effort will be enhanced by the development of conservation systems that reduce GHG emissions within the integrated context of the producers’ farm operation. USDA anticipates 5 years of focused outreach and conservation efforts will need to occur before organic cropland soil will be enrolled. Once outreach has occurred, this building block would target up to 5,000 acres of organic rich soils to be enrolled in these programs each year.

4. *Increase the conservation actions on HEL and wetlands as a result of conservation compliance provisions included in the 2014 Farm Bill.*

The 2014 Farm Bill links availability of crop insurance premium subsidies to HEL and wetlands compliance provisions. Because these provisions have been a requirement for most farm programs, many producers already have certified that they are in compliance. An initial cost-benefit analysis associated with this new provision indicates that, at a maximum, 1.5 million acres of HEL and 1.1 million acres of wetlands may require producers to undertake additional conservation actions. FSA and NRCS are working with USDA’s Risk Management Agency to acquire additional data and develop a more refined baseline estimate. USDA estimates that this additional baseline information will be available in the fall of 2016 and will help FSA and NRCS better target conservation assistance to specific geographic locations.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ¹²
Enroll 400,000 additional acres with high carbon sequestration potential in wetland and riparian buffer practices (CRP).	0.8
Transfer 40,000 expiring CRP acres into ACEP or other easement to preserve the conservation benefits—including carbon sequestration—of conservation.	<0.1
Total	0.8

For the remaining two elements of the building block—enrolling organic soils into CRP and increasing conservation actions on HEL and wetlands—USDA has not yet established a quantified GHG reduction goal. While organic soils have a high potential to reduce net GHG emissions, there are significant questions about how to encourage conservation practices or voluntary removal of these lands from production. Likewise, USDA is exploring opportunities to link crop insurance and conservation programs and is gathering data to quantify the potential GHG benefits of that coordination.

¹² For more information on how to interpret this goal, see p. 6.

Partnership Opportunities

There are many opportunities for USDA agencies to partner with agricultural and forestry stakeholders to reduce GHG emissions from sensitive lands. In particular:

- CREP partners with States to address agricultural-related environmental concerns in specific geographic regions. Under this program, States identify critical resource concerns that can be addressed using CRP practices. The States work with USDA to geographically target specific practices and enhance conservation effectiveness. States contribute technical and financial assistance to CREP. In agreements through this program, States can acquire easements on the land enrolled, ensuring that conservation practices are maintained after the CREP contract expires. There are currently 1.2 million acres enrolled in 47 CREP agreements covering 34 States. States are full partners with USDA in developing projects and identifying locations and conservation practices that will address important State resource concerns. Many CREP agreements include practices such as forested riparian buffers and wetland restoration that provide large GHG mitigation benefits. Additional agreements would allow USDA and States to focus on areas of particular concern.
- Easement programs within States can also be potential partners for GHG reduction. Forty-nine States have laws pertaining to conservation easements; these laws allow public agencies and private conservation organizations to acquire interest in land for conservation and preservation. Many States, such as Michigan, Minnesota, New York, Florida, Georgia, Kansas, Oregon, California, and Colorado, have easement programs. As of 2012, there were 27 States that had State-level purchase of agricultural conservation easement programs.
- To evaluate potential outreach to farmers who cultivate organic soils, USDA has partnered with the Center for Behavioral and Experimental Agri-Environmental Research to evaluate interest by producers in converting organic soils currently in agricultural production into a program such as ACEP or CRP.

CASE STUDY

The Prairie Pothole Region is a huge expanse of grassland, stretching from Iowa, through the Dakotas, and into Canada. Small wetlands called “potholes” or “sloughs” spatter the rolling grasses and provide ideal habitat for waterfowl. Birds such as pintails, mallards, and shovelers rely on the region for breeding habitat—others, including snow geese, depend on the area during migration. The potholes also benefit people by recharging groundwater and storing carbon that builds up over years in the prairie soil. The prairie provides an ideal setting for ranching, allowing cattle to feed on plentiful native grasses.



A Missouri Coteau wetland near Bismark, ND, in the heart of the Prairie Pothole Region. Photo courtesy of Jim Ringelman, Ducks Unlimited.

But all is not well in the Pothole Region. An estimated 194,000 acres of grassland have vanished since 1984, and over half of the potholes in some regions are either gone or degraded. The prairies are increasingly falling under the plow for crop production, as producing certain crops has recently offered farmers higher incomes than traditional ranching. Cultivating grasses for crop production releases carbon into the atmosphere as soil organic carbon oxidizes. It also causes erosion and destroys habitats. Conserving these sensitive lands is a key part of both fighting climate change and ensuring critical habitat is retained for future generations.

Recently, the USDA Natural Resources Conservation Service teamed up with Ducks Unlimited to combat these losses. The USDA awarded Ducks Unlimited with a Conservation Innovation Grant aimed at providing incentives for ranchers to retain rangeland instead of converting their acres to crop production. By registering stored carbon that would otherwise be released via crop farming, ranchers can sell carbon offsets, which act as an alternative source of income. In turn, the partnership protects water quality, reduces erosion, and retains habitat by placing an avoided tillage easement on the ranches to ensure that the working grasslands will be available for grazing and duck nesting habitat for years to come.

South Dakota native Brad Magness made the choice to preserve his ranchland. “I have a concern not just because I’m a rancher, but because I run a livestock auction market. And when I see grass get torn up, that’s just that many fewer cattle that have a chance to come through my sales... (conserving grassland) wasn’t a hard decision, because it wasn’t going to alter any of my operations.”

“There’s interest from landowners to protect these areas that’s consistent with their view of how this land should be used. And really we need the funding to get that job done,” said Scott Stephens, Director of Planning at Ducks Unlimited. Luckily, the USDA is ready to rise to the challenge and work with partners to preserve these critical lands—and at the same time, benefit ranchers, wildlife, and the environment.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Enroll 40,000 additional high-carbon acres in wetland and riparian buffer practices.	FSA
Provide technical assistance funding to Forest Service for States to hire additional foresters.	FSA
Provide outreach funds for State foresters.	Forest Service, FSA
Complete organic soils outreach study.	FSA, NRCS

FY 2017

Action	Lead USDA Agency(s)
Enroll 40,000 additional high-carbon acres in wetland and riparian buffer practices.	FSA
Provide technical assistance funding to FS for States to hire additional foresters.	FSA

FY 2018

Action	Lead USDA Agency(s)
Enroll 40,000 additional high-carbon acres in wetland and riparian buffer practices.	FSA

Additional Actions

These proposed mitigation efforts involve targeting and selecting high GHG-emitting soils (organic soils, wetlands, riparian buffers) currently being used for agricultural production and that can respond to conservation actions (principally CRP) or removal from production (easements). This effort will require a coordinated effort between FSA and NRCS and will involve personnel from the national, State, and field offices. There will need to be State-specific targeted initiatives for both CRP and ACEP, and partnerships with States and non-governmental organizations must be strengthened. These partnerships will be very important to increase the number of acres in easements, beyond what can be delivered with existing financial incentives.

NRCS State Conservationists are responsible for developing a State-level ranking process for easements to prioritize all eligible applications and to recommend applicants for funding. Prioritizing the ranking criteria may lead to the selection of more lands with higher GHG emissions or the potential for greater sequestration of carbon. The ranking criteria for the ACEP program is developed with input from the State Technical Committee (composed of agricultural producers, private forestland owners, and other professionals), FSA, U.S. Fish and Wildlife Service, and other partners.

The NRCS Easement Programs Division at National Headquarters will coordinate and develop program outreach materials for eligible partners and landowners. The Regional Conservationists provide oversight to program goals and ensures outreach occurs for all potential partners and landowners. These proposed actions must be conveyed to the Service Center staff who will be responsible for communicating these potential CRP and easements programs to producers. The field offices, as delegated by and with oversight from the State Conservationist, will conduct the local marketing, education, and outreach activities. These marketing activities may be supported by the local Cooperative Extension Service, or with the assistance of non-profit organizations such as The Nature Conservancy or Land Trust.

In addition, FSA is exploring opportunities that can provide greater CRP and CREP GHG mitigation benefits, such as working with State forestry agencies to increase technical assistance and outreach. These activities can increase riparian forest buffer enrollment in CRP and CREP, which will provide substantial GHG mitigation, water quality, and wildlife habitat benefits. A similar effort will be made to increase wetland restoration enrollment.

Grazing and Pasture Lands

Description

The proper management of grazing lands (range and pasture) can both meet individual farm and ranch livestock production goals and play a role in nationwide efforts to increase soil carbon sequestration. Atmospheric carbon fixed by growing forage plants is translocated to roots and incorporated into the soil carbon pool via humification. By far, the most important factor governing the direction and rate of carbon flux in grazing lands is short-term climate variability, particularly rainfall and temperature. Planning to sequester carbon in arid rangelands (<200 mm annual precipitation) is particularly challenging because of the low productivity and high year-to-year variability. In regions where annual rainfall is higher and more reliable, for instance, the northern Great Plains, there is a higher probability that plains will sequester larger amounts of carbon.

The most important management decision affecting carbon sequestration is stocking rate (grazing animals/land unit/year); balancing animal numbers with forage supply ensures optimal plant production and supply of carbon to soil microorganisms to maintain and increase soil carbon. Other adjustments to livestock grazing, such as season of use and distribution, can contribute to improved management, but the amount of available forage consumed by livestock is the overriding management control. Thus, while there is a well-recognized benefit at the local scale in enhancing ecosystem resilience (adaptation), many rangelands may not be suitable locations for managing to increase soil carbon in the context of mitigating climate change.

Soil carbon sequestration can also be increased by restoring degraded land to perennial vegetation. Restoration may either be via seeding native species and then extensively managing as rangeland or by planting improved species and intensively managing as pasture with additions of supplemental water and/or nutrients.

This building block has three separate elements:

1. Increase the application of Prescribed Grazing (NRCS Practice Code 528) to range and pasture lands grazed by domestic livestock;
2. Ensure that land treated with Forage and Biomass Planting (Code 512) is properly maintained and managed; and
3. Ensure that land treated with Range Planting (Code 550) is properly maintained and managed.

Each of these elements is described in detail below:

1. *Increase the application of Prescribed Grazing (528) to range and pasture lands grazed by domestic livestock in appropriate regions.*

Prescribed Grazing is a longstanding NRCS practice with proven positive results. The practice involves NRCS staff working with land managers to adjust livestock numbers (stocking rate), livestock distribution, season of use, and kind of animal into balance with forage supplies. Successful implementation requires at least annual monitoring and adjustment of livestock numbers.

Together range and pasture lands exceed more than 500 million acres in the US Land Inventory. Over the past decade (2005-2014), the amount of land reported annually as being treated with prescribed grazing has varied from 4.5 million acres to more than 18 million acres. Proper management of grazing lands can sequester carbon in the soil, particularly when rainfall is near normal. In arid areas (<20" average annual rainfall), grazing lands can be expected to sequester around 0.14 Mg CO₂e/acre/year, while more mesic areas (20-35" average annual rainfall) can sequester around 0.2 Mg CO₂e/acre/year. Assuming an average of 0.17 Mg CO₂e/acre/year across all lands, sequestration would vary from 765,000 Mg CO₂e/year to 3,060,000 Mg CO₂e/year. NRCS has established a target of 18 million acres of Prescribed Grazing annually on range and pasture lands with a 10-percent increase in acreage applied each year between 2016 and 2025.

Climate analysis and predictions indicate that the most likely place to target for increases in soil carbon increases are the upper Midwest and Northern Great Plains. These regions are projected to have the most reliable growing conditions and the most opportunities for livestock grazing management consistent with soil carbon increases. The Southwest and Southern Plains are projected to see increasing variability and more frequent drought conditions, suggesting less likelihood of sequestering increasing amounts of carbon through livestock grazing management.

2 and 3. *Maintain the application of Range Planting (550) and Forage and Biomass Planting (512) at current levels and increase emphasis on Prescribed Grazing (528)*

Range Planting (550) and Forage and Biomass Planting (512) are land conversion practices and are implemented on relatively few acres annually. Both practices require seedbed preparation, cover crops and seeding with native (range) or improved perennial (pasture) species of grasses and forbs. Combined, both practices were applied on fewer than 250,000 acres annually over the past decade. On average, establishing perennial vegetation for livestock grazing on existing cropland will sequester approximately 1.0 Mg CO₂e/acre/year, resulting in 0.25 Mg CO₂e/year nationally. Although substantial amounts of soil carbon may be gained via the conversion of long-term cropped land to perennial pasture in the Southeast region, high input costs limit the net GHG benefits to similar cropland conversion estimates.

These practices will continue to sequester carbon over a lifespan of about 20 years before they reach equilibrium. Post-equilibrium, they will continue to sequester carbon at the rate of established range or pasture (0.14-0.2 Mg CO₂e/acre/year) if managed appropriately. Because these are land conversion practices and most of the decisions are independent of conservation program incentives, NRCS should establish a target of maintaining the current rate of implementation for Range Planting and for Forage and Biomass Planting.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ¹³
Increase the use of Prescribed Grazing (Practice Code 528), Range Planting (Practice Code 550) and Forage and Biomass Planting (Practice Code 512) from 18 million acres to 27 million acres.	1.6

Partnership Opportunities

The grazing land profession has multiple existing partnerships through which these actions can be enhanced. On rangelands, the Society for Range Management and on pastureland, the American Forage and Grassland Council have a long history of working with other professional organizations and local producers via workshops, field days, and demonstrations to implement conservation practices. The National Grazing Lands Coalition is a nationwide collaborative effort to maintain and improve grazing land conservation. NRCS, NIFA, and ARS have strong connections to State and local Cooperative Extension Service staff and university departments. NRCS has also established strong collaborative partnerships with State and local conservation districts.

¹³ For information on how to interpret this goal, see p. 6.

CASE STUDY

The Trigg family, which operates a 52,000-acre ranch in northeastern New Mexico, understands that good grazingland management benefits more than just livestock production, and they have been implementing these systems for almost 15 years. In 2002, they implemented a grazing management program intended to correct decades of overgrazing, shrub increase, and soil erosion. With financial and technical assistance from NRCS New Mexico staff, the Triggs installed new water developments and fencing to improve livestock distribution and allow for better herd management. Implementing techniques they learned in a Holistic Resource Management short-course, they also implemented a thorough and meticulous monitoring and recordkeeping system. Through stocking rate adjustments and changes in herd management, the Triggs documented increases in vegetation cover and in livestock performance.

Like any good business managers, the Triggs were also interested in finding new sources of income from their land. Generating and selling carbon offsets from rangeland management provided this opportunity. Through practices that they implemented from 2010 to 2015, the Triggs and several of their neighbors were able to sequester more than 100,000 metric tons of carbon dioxide, or the equivalent of removing more than 20,000 cars from the road for 1 year. The Triggs sold the offsets for more than \$100,000, and they were able to reinvest almost 90 percent of that in improving their operation. The Triggs then creatively leveraged their income with the NRCS Environmental Quality Improvement Program (EQIP) to install a variety of conservation practices that furthered their management goals for the ranch.

The Triggs and their New Mexico neighbors were successful in improving their land health, enhancing their income, and contributing to GHG reductions because they had a comprehensive ranch management plan, and they were creative and bold enough to take advantage of new opportunities.



Rotational grazing in New Mexico. Photo courtesy of USDA NRCS.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Identify regions (Major Land Resource Areas) with the greatest potential for carbon sequestration and methane emission reduction via Prescribed Grazing.	NRCS
Implement conservation field trials for organic waste application in California.	NRCS

FY 2017

Action	Lead USDA Agency(s)
Adjust NRCS State Office priorities for providing technical assistance to grazing land managers in high priority regions.	NRCS
Initiate research and development effort to improve enteric fermentation/forage intake estimation model.	NRCS
Enroll an additional 1 million acres into the Prescribed Grazing, Range Planting, and Forage and Biomass Planting Practice Standards (total of 19 million acres).	NRCS

FY 2018

Action	Lead USDA Agency(s)
Enroll an additional 1 million acres into the Prescribed Grazing, Range Planting, and Forage and Biomass Planting Practice Standards (total of 20 million acres).	NRCS

Private Forest Growth and Retention

Description

USDA administers several programs that protect and enhance private forestland. Specifically, the Forest Service administers two grant programs that support the retention of private forestland threatened by development: the Forest Legacy Program (FLP) and the Community Forest and Open Space Conservation Program (CFP). These programs support acquiring conservation easement or fee simple purchases that provide permanent protection for forestland across the country. In addition, NRCS provides technical and financial assistance for a suite of forestry and agroforestry practices.

Forest Legacy Program: The FLP identifies and protects environmentally important forestland threatened by conversion to non-forest use by acquiring conservation easements or fee interest in lands. Projects are selected annually through a two-step competitive process first within participating States, followed by a national panel evaluation. This process results in the selection of high-quality projects that are supported locally and are nationally significant. Projects are evaluated for their importance (which includes economic and environmental criteria), threat of conversion and strategic contribution of the proposed acquisition to the landscape.

Acres that are conserved through the program are protected in perpetuity and managed consistently for the purposes of the FLP. Landowners that participate in the FLP take on the long-term responsibility to manage the land in a manner consistent with the terms specified in the conservation easement and according to a multi-resource management plan that addresses a suite of natural resource elements (soil and water, biological diversity, recreation, timber, threatened and endangered species) where present. In this sense, FLP is not solely a protection program; rather, working forests are encouraged where traditional uses are maintained. Annual monitoring of conservation easements is required to ensure that the specified conservation values are maintained through time.

Community Forest Program: The CFP was authorized in FY 2008 and aims to secure a variety of community benefits through grants to local governments, Tribal governments, and qualified nonprofit organizations to acquire community forests through fee acquisition. In creating these forests, communities and Tribes are able to provide public access and recreational opportunities, protect vital water supplies and wildlife habitat, address the effects of a changing climate, provide demonstration sites for private forestland owners, and derive financial and community benefits from sustainable management. Projects are evaluated for the type and extent of community benefits, contribution to landscape conservation initiatives and the likelihood of conversion.



Clearwater Forest Legacy Program Project. Photo courtesy of USDA.

CFP community forests are managed according to a community forest plan that guides the long-term management and associated community benefits of the community forest. Recipients of community forests grants are required to certify every 5 years that the forest has not been sold or converted to nonforest uses. They are also subject to periodic site visits to ensure conservation values are maintained.

Forest Stewardship Program: The Forest Stewardship Program (FSP) promotes active management of private forest lands through State-directed technical assistance to landowners. This assistance provides landowners with tools and resources to maintain healthy, resilient forest landscapes—including development of forest stewardship management plans, access to State and USDA conservation programs, information on forest certification programs, and connection to existing and new forest product markets.

CASE STUDY

Wisconsin's working forests provide numerous public benefits including wildlife habitat, jobs, recreation opportunities for hiking, hunting and fishing, carbon storage, and clean abundant drinking water for thousands of residents. Located in northwestern Wisconsin, the Brule-St. Croix Forest Legacy Project permanently protects over 21,000 acres of private forest land through a conservation easement held by the State of Wisconsin and funded in part by the Forest Legacy Program. Under the terms of the easement, this stretch of sustainably managed forestland will help to filter and clean drinking water, provide a steady flow of wood products to local mills and protect a shifting mosaic of forest bird habitat. The St. Croix Forest Company will continue to own the land and manage the forest for timber production while ensuring the forest provides vital public benefits for generations to come.

With miles of streams and acres of lakes, ponds, and wetlands, this project protects valuable water resources. Located along the St. Lawrence Continental Divide, the project contains the headwaters of both the St. Croix National Scenic River and the Bois Brule River. These rivers serve as sources of drinking water to nearby towns. The project represents one of the few remaining tracts of private forestland that can be managed to maintain and expand the globally imperiled Pine Barrens forest community. Pine Barrens support an exceptional number of species, including Sharp-Tailed Grouse and 28 species found on the State list of Species of Greatest Conservation Need. Pine Barren habitat is also critical for migratory species such as the federally endangered Kirtland's Warbler; Wisconsin, Michigan, and Ontario, Canada, have the only documented nesting pairs in the world.

The project secures public access and enhances public recreation opportunities for hunting, fishing, trapping, hiking, and cross-country skiing. Centrally located within a complex of protected lands, this property's road and trail networks provide critical links to recreational opportunities on adjoining Forest Service, State, and county land, enhancing recreational opportunities to over 3.5 million people within a 3-hour drive.

Part of a larger conservation initiative, this project ensures the entire Brule-St. Croix Legacy Forest—totaling over 66,000 acres of globally significant Pine Barrens that spans four counties—is now protected under a working forest conservation easement. Large landscape-level conservation initiatives such as the Brule St. Croix Legacy Forest contribute to climate change adaptation and mitigation by keeping forests as forests so they continue to provide benefits such as carbon storage, habitat connectivity, and drinking water protection in the face of a changing climate.

More information on the Brule-St. Croix Legacy Forest can be found at:
<http://www.conservationfund.org/projects/brule-st-croix-legacy-forest>.

As of October 2015, approximately 25 million acres were covered by active Forest Stewardship Management plans. These managed forest landscapes are far less likely to be lost to or degraded by catastrophic wildfire or insect and disease infestations and provide ancillary benefits such as clean air and water, wildlife habitat and recreation opportunities. This program plays an important role in helping to mitigate GHG; however, the associated carbon sequestration is not currently estimated.

NRCS Technical and Financial Assistance: Under the 2008 Farm Bill, most agricultural conservation programs were modified to include forestry activities on non-industrial private forestland, and the use of forestry conservation practices has increased as a result. Financial assistance, mostly through EQIP, has supported an average of 97,000 acres of tree and shrub establishment annually over the past 5 years, and technical assistance has contributed to a further 27,000 acres each year. Nearly 9,000 forest management plans have been developed through the Conservation Activity Plan program during this time period. Windbreaks have been established on over 400 acres; efforts are in place to increase use of this practice for climate adaptation benefits.

Partnership Opportunities

Demand for both the FLP and CFP far exceeds the available resources, a limitation that provides opportunities to leverage non-Federal funds and contributions to maintain private forestland. FLP has been extremely effective at taking advantage of external partnerships and funding. The Forest Service partners with State agencies, landowners, land trusts, and conservation-oriented nonprofit organizations to currently facilitate land transactions, identify potential projects, and contribute considerable cost share. While the program requires a 25-percent non-Federal cost share per project, FLP leverages more than a dollar for each Federal dollar spent in the form of cash, in-kind services, and donation in land and interests in land. Likewise, with a 50-percent cost share requirement, CFP dollars leverage significant funds from other partners and represent a strategic investment in local communities.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ¹⁴
Enroll an additional 1 million acres of private forestland in the FLP and CFP.	4.8
Enroll an additional 1 million acres of nonindustrial private forestland in NRCS Tree/Shrub Establishment and Windbreak/Shelterbelt Establishment Practice Standards.	N/A ¹⁵

¹⁴ For information on how to interpret this goal, see p. 6.

¹⁵ The carbon sequestration of these actions has not been estimated at the time this report was developed. These practices may be established on lands that are also enrolled under the FLP or CFP, leading to possible double-counting of estimated carbon sequestration; USDA is exploring how to account for these actions.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Enroll 90,000 additional acres in FLP.	Forest Service
Enroll 1,775 additional acres in CFP.	Forest Service
Enroll 100,000 additional acres in the Tree/Shrub Establishment Practice Standard.	NRCS
Enroll 70,000 additional feet in the Windbreak/Shelterbelt Establishment Practice Standard.	NRCS

FY 2017

Action	Lead USDA Agency(s)
Enroll 90,000 additional acres in FLP.	Forest Service
Enroll 1,775 additional acres in CFP.	Forest Service
Enroll 100,000 additional acres in the Tree/Shrub Establishment Practice Standard.	NRCS
Enroll 70,000 additional feet in the Windbreak/Shelterbelt Establishment Practice Standard.	NRCS

FY 2018

Action	Lead USDA Agency(s)
Enroll 90,000 additional acres in FLP.	Forest Service
Enroll 1,775 additional acres in CFP.	Forest Service
Enroll 100,000 additional acres in the Tree/Shrub Establishment Practice Standard.	NRCS
Enroll 70,000 additional feet in the Windbreak/Shelterbelt Establishment Practice Standard.	NRCS

Stewardship of Federal Forests

Description

With approximately 766 million acres of forest area – about one-third of land area – the United States is the fourth most forested country in the world. The Forest Service manages over 193 million acres across 44 States and other territories, as well as actively supports the sustainable stewardship of the approximate 445 million acres of private forest, 82.6 million acres of State and municipal forests.

Nineteen percent of all forestland in the United States are national forests. These Forest Service-managed lands provide multiple benefits including timber, wildlife habitat, water quality, and recreational opportunities. The national forests also currently serve as a major carbon sink. In 2013, they contained approximately 10,770 MMTCO₂e in forests and harvested wood products (HWP), approximately 24 percent of the total carbon stocks in U.S. forests and HWP. Together, they annually sequester approximately 32 MMTCO₂e per year; 13.5 percent of total forest stock change, a significant contribution to mitigating climate change.

Our ability to protect forest and grassland resources is now at risk due to drought, invasive species, severe wildfires, and uncharacteristically severe outbreaks of insects and disease, all exacerbated by a changing climate. The Forest Service manages carbon through managing the health and adaptive capacity of our forests in the face of multiple impacts of climate change. The actions within the Stewardship of Federal Forests Building Block are designed to recover, maintain, and enhance the resilience of the carbon sink associated with our national forests through restoration/reforestation.

The Stewardship of Federal Forests Building Block can be broken into two main actions: *Restoration of Resilience* and *Reforestation*.¹⁶

Restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience,¹⁷ and health under current and future conditions.

About 60 million acres in the National Forest System (NFS) have a high to very high risk of severe wildfire and are currently in need of restoration. However, some of these acres may be in wilderness areas or other areas that are not appropriate for treatments. Examples of restoration treatments include: commercial and pre-commercial thinning; hazardous fuels reduction through mechanical treatments and prescribed burning; detection and rapid response to control insects, pathogens, and invasive species; species conversion; watershed restoration; wildlife habitat improvement; and other land management objectives. Restoration projects could offer reduced carbon losses through better or more sustainable management techniques.

Reforestation specifically includes planting areas that are non-forested as a result of stand-replacing wildfire, insects and disease, or other disturbances but have been forested in the recent past. These areas are at risk of either remaining non-forested or of sequestering carbon at a much slower rate than if the areas were planted. This strategy is focused on areas where the Forest Service can take direct action to achieve additional carbon sequestration beyond what would occur through standard business practices. Therefore, this does not include reforestation actions created through commercial harvest, (replanting after harvest is considered standard procedure), nor does it include reforestation through natural regeneration.

A challenge to meeting the goals of this building block is the buildup of areas in need of replanting. At the start of 2015, the Forest Service identified almost 500,000 acres of post-disturbance planting needs. While projects that include regeneration harvests are able to collect and utilize a portion of the forest product value to fund the reforestation process, the harvest of trees killed by fire, or other disturbances, commonly offer insufficient value to meet this need. With over 97 percent of the current reforestation need caused by wildland fire, these 480,000 acres require an alternate funding source. The funding required to reestablish young forests on these lands far exceeds the Forest Service's annual appropriation for reforestation work. Further complicating the reforestation response is the challenge of having adequate staffing always located where the unpredictable disturbance occurs. In order to position skilled reforestation expertise, moving special teams and temporarily sharing staff between national forests or regions is becoming increasingly common, however, given funding limitations and the increased frequency and extent of large disturbances, the options remain limited.

¹⁶ Note: Additional actions may be incorporated over time as part of this building block.

¹⁷ Resilience is defined as: The ability of an ecosystem and its component parts to absorb, or recover from the effects of disturbances through preservation, restoration, or improvement of its essential structures and functions and redundancy of ecological patterns across the landscape.

CASE STUDY

Congress authorized the Collaborative Forest Landscape Restoration Program (CFLR) in the 2009 Omnibus Public Lands Management Act to accelerate restoration on high priority landscapes through collaborative, science-based approaches. In doing so, CFLR aims to promote forest health and resiliency, reduce the risk of catastrophic wildfires, and support economic stability in rural communities.

One project under CFLR, the Southwest Crown of the Continent (SWCC), brings together partners from the forestry industry, environmental advocacy groups, State and local agencies, and other groups to restore over 1.4 million acres of high peaks, aspen glades, conifer forests, rivers, and native grasslands. In order to reduce fire risk to nearby communities and increase forest health and resiliency to threats, the project has leveraged multiple funding sources, including CFLR funds, to treat in areas like the Meadow Smith project, located in the wildland-urban interface on the Flathead National Forest. The project has made use of stewardship contracting authorities, in this case with the Rocky Mountain Elk Foundation, which enable the Forest Service to work closely with communities to restore and maintain healthy forests.

When the Condon Mountain Fire erupted from a lightning strike in July 2012—just four air-miles northeast of the community of Condon—the units that had previously been treated in the Meadow Smith project area successfully served as a fuel break. This fuel break allowed firefighters to reduce their exposure and safely manage the fire and helped preserve large diameter ponderosa pine and larch trees. Without the treatments, it's very likely that the mortality for these trees would have been high.

In FY 2015, the Forest Service and its partners planted 125 acres of Whitebark Pine in wildfire burned areas within the SWCC area, a species that reduces runoff, provides food for over 100 wildlife species, including the threatened grizzly bear, and acts as a “nurse” to allow other vegetation to establish in the harsh conditions at high elevations. Since its inception in 2010, the SWCC project has treated over 21,000 acres for hazardous fuels reduction. Forest Service and its partners have also revegetated and reforested over 10,000 acres, achieving more than double their 10-year goal in half the time.



Fall in a Rocky Mountain national forest. Photo courtesy of USDA.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ¹⁸
Reforest 320,000 acres on NFS lands.	2.5
Treat 27 million acres of NFS lands to sustain or restore watershed function and resilience (2015-2024).	N/A ¹⁹
Treat 17 million acres of high priority fuels in the Wildland Urban Interface on NFS lands (2015-2024).	N/A ¹⁹

¹⁸ For information on how to interpret this goal, see p. 6.

¹⁹ The carbon sequestration of these actions is not estimated in this framework due to insufficient data. Forest restoration activities may not result in a net increase in carbon sequestration by 2025. However, by 2050, some activities may see a small net increase over no action alternatives. The activities that could show a net gain in carbon storage by 2050 would be those with a small initial carbon impact such as prescribed burning, understory thinning, or thinning treatments to reduce losses from insects and disease. These treatments remove small trees and brush that contain only a small percentage of the total carbon on site. The remaining forest stand is healthier and more resilient to wildfire, insects, and disease. On productive sites, the remaining trees could capture enough carbon to create a small net gain in 30 years or so. The far greater impact from these treatments would be the increased health and resiliency and the stands' ability to provide multiple environmental benefits including, but not limited to, wildlife habitat, recreation, and watershed protection.

Due to long-term growth of biomass on forestlands, carbon sequestration will continue to grow beyond 2025. USDA estimates that the additional reforestation of NFS lands will sequester 21.9 MMTCO₂e per year in 2050 and 77.6 MMTCO₂e in 2100.

Partnership Opportunities

There are numerous opportunities to form partnerships with stakeholders to maintain and enhance carbon sequestration on NFS lands. For example:

- The Arbor Day Foundation, American Forests, and National Forest Foundation are key reforestation partners; there is potential to expand to new partners through organizations like the Forest Climate Working Group;
- The Nature Conservancy (TNC) is working collaboratively with Federal, Tribal, State and local partners to effectively use prescribed fire for restoration around and within communities;
- State governments now have the ability to conduct restoration work on NFS lands through the extension of the Good Neighbor Authority in the 2014 Farm Bill;
- The USDA Regional Climate Hubs can help provide region-specific climate change adaptation and mitigation training to Forest Service region and forest-level personnel; and
- The Collaborative Forest Landscape Restoration Program (CFLR) encourages the cooperative, science-based ecosystem restoration of priority forest landscapes. Partners in CFLR include a diverse array of Federal, Tribal, State, local, private, nonprofit, industry, and environmental groups.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Reforest 32,000 acres of post-disturbance NFS lands.	Forest Service
Develop regional reforestation strategies.	Forest Service
Treat 2.7 million acres to sustain or restore watershed function and resilience.	Forest Service
Treat 1.7 million acres of high-priority fuels in the Wildland Urban Interface on NFS lands.	Forest Service

FY 2017

Action	Lead USDA Agency(s)
Reforest 32,000 acres of post-disturbance NFS lands.	Forest Service
Treat 2.7 million acres to sustain or restore watershed function and resilience.	Forest Service
Treat 1.7 million acres of high-priority fuels in the Wildland Urban Interface on NFS lands.	Forest Service

FY 2018

Action	Lead USDA Agency(s)
Reforest 32,000 acres of post-disturbance NFS lands.	Forest Service
Treat 2.7 million acres to sustain or restore watershed function and resilience.	Forest Service
Treat 1.7 million acres of high-priority fuels in the Wildland Urban Interface on NFS lands.	Forest Service

Promotion of Wood Products

Description

Wood is a readily available and renewable building material that creates jobs and stimulates the economy. It can be used in urban or rural settings to build energy-efficient houses, buildings, and other needed infrastructure. Advanced wood products are becoming the latest innovation in tall building construction. Products like cross laminated timber (CLT) are flexible, strong, and fire resistant. In construction, wood products can be used as a successful and sustainable alternative to concrete, masonry, and steel. Using wood also reduces GHG emissions by storing carbon and simultaneously offsetting emissions from conventional building materials. By some estimates, the near term use of CLT and other emerging wood technologies in buildings 7-15 stories could have the same emissions reduction as taking more than 2 million cars off the road for 1 year.

To reduce GHG emissions and sequester carbon in building products, USDA will encourage both conventional wood construction technologies (e.g., wood frame construction) and new construction materials and techniques (e.g., CLT). CLT presents an historic opportunity to introduce a well-established technology that has profound climate implications. It has been demonstrated worldwide to be a cost-effective sustainable alternative to conventional concrete and steel construction particularly in the mid-rise to low high-rise building spaces. Most building construction in those ranges emits considerable amounts of carbon, mainly in the creation of concrete. CLT buildings have been evaluated as being carbon negative for decades, meaning their construction sequesters more carbon than they release.

In FY 2015, the Forest Service provided a \$1 million grant to WoodWorks, an organization that provides outreach and technical support for architects and engineers to encourage the use of wood products as a replacement for more GHG-intensive building materials. That year, the partnership supported 440 wood construction projects, which reduced GHG emissions by 1.2 MMTCO₂e through carbon stored in the wood products and the substitution of wood for steel or concrete.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ²⁰
Increase the number of wood building projects supported annually through technical assistance from 440 in 2015 to 900 in 2025.	19.5 ²¹

Partnership Opportunities

To encourage the production and use of CLT, the Forest Service is:

- Sponsoring a feasibility analysis by SmartLam in Montana to look at adding an architectural grade CLT line to its current industrial matting CLT line;
- Funding an Oregon State University assessment of the use of small diameter material for CLT production, which could increase commercial demand for wood harvested from hazardous fuels treatments;
- Working with Clemson University to determine the behavior of southern yellow pine in CLT applications;
- Underwriting and helping design a wide-ranging national conference on “Mass Timber” in Portland, Oregon, in March 2016 (Mass Timber includes CLT and related technologies);
- Retaining partners to conduct “dynamic blast tests” to complement computer-modeled blast testing already conducted on behalf of the Department of Defense which could open up defense-related applications of CLT;
- Creating, in partnership with the Softwood Lumber Board, the first interactive database on CLT research with an eye to making current knowledge more accessible to specific audiences such as developers and code officials. This database work was initiated after a global conference of CLT researchers in November 2015, in Madison, Wisconsin, with the goal of identifying the status of current research and research needs;
- Providing primary underwriting to WoodWorks which in turn provides training and project-specific technical assistance to architects, engineers, developers, and code officials;

²⁰ For information on how to interpret this goal, see p. 6.

²¹ The GHG benefits of wood building products can be split into two major categories: long-term carbon sequestration in the wood itself and reductions from substituting wood for more GHG-intensive building materials, including concrete and steel. Of the 19.5 MMTCO₂e reduction, 5.9 MMTCO₃e is sequestered in the wood, and the remaining 13.6 MMTCO₂e is reduced through substitution.

CASE STUDY

In September 2015, USDA, in partnership with the Softwood Lumber Board and the Binational Softwood Lumber Council, announced the winners of the U.S. Tall Wood Building Prize Competition. The two winning development teams were granted a combined \$3 million in funding to support the development of tall wood demonstration projects in New York and Portland, Oregon.

“The U.S. wood products industry is vitally important as it employs more than 547,000 people in manufacturing and forestry, with another 2.4 million jobs supported by U.S. private-forest owners,” said U.S. Secretary of Agriculture Tom Vilsack. “By embracing the benefits of wood as a sustainable building material, these demonstration projects have the ability to help change the face of our communities, mitigate climate change, and support jobs in rural America.”

Next-generation lumber and mass timber products are flexible, strong, and fire resistant, and can be used as a safe and sustainable alternative to concrete, masonry, and steel. Using wood helps to reduce GHG emissions by storing carbon and simultaneously offsetting emissions from conventional building materials. Wood can also help struggling rural forest communities. During the Recession, the drop in new construction and decline in home remodeling had a deep impact on wood manufacturing. However, if next-generation wood products can penetrate just 5 to 15 percent of the non-residential North American market, it would mean roughly 0.8 to 2.4 billion board feet of lumber consumed annually. To put that in real-world context, roughly 35 jobs are created for each million board feet of wood processed.

The two winning proposals showcase the safe application, practicality, and sustainability of a minimum 80-foot structure that uses mass timber, composite wood technologies, and innovative building techniques. More information on the Competition can be found at: <http://www.tallwoodbuildingcompetition.org/>.



West coast winner of the U.S. Tall Wood Building Prize Competition: A 12-story building with retail, offices, and workforce housing. Photo courtesy of Lever Architecture.

- Hosting a California specific CLT conference to look at the potential for modifying existing mills in California to produce CLT targeted at the need for earthquake resistant retrofitting in that State;
- Continuing engagement and support of the U.S. Tall Wood Building Competition process, now that two winning proposals have been announced;
- Initiating documentation of the mass timber building movement in the United States and creating communication pieces related to CLT and mass timber building systems;
- Exploring ways to engage organizations such as the Whole Building Design Guide;
- Sponsoring an exhibition on Tall Wood with the National Building Museum, starting September 2016 and running for several months. The exhibition will generate a number of outreach materials that Forest Service can use beyond the context of the exhibit itself; and
- Continuing using the Wood Innovations Program as a mechanism to support the expansion of mass timber products in the United States.

**Proposed Actions
FY 2016**

Action	Lead USDA Agency(s)
Provide technical assistance for 475 wood building projects.	Forest Service, in partnership with WoodWorks
Organize and host a national conference on mass timber (including CLT and related technologies).	Forest Service, in partnership with the Forest Business Network

FY 2017

Action	Lead USDA Agency(s)
Provide technical assistance for 525 wood building projects.	Forest Service, in partnership with WoodWorks

FY 2018

Action	Lead USDA Agency(s)
Provide technical assistance for 575 wood building projects.	Forest Service, in partnership with WoodWorks

Urban Forests

Description

In FY 2012, the USDA Forest Service made an investment of \$1 million in the design and launch of the Arbor Day Foundation's Energy-Saving Trees Program. This program provides a research-based, easy-to-use online mapping tool to help homeowners decide where to plant trees in order to provide the greatest energy and money savings benefits. When planted properly, a tree can save homeowners up to 20 percent on their energy costs while simultaneously reducing stormwater runoff, improving air quality, reducing urban heat island effects, absorbing carbon, and increasing curb appeal and property values.

The tool, developed by the Davey Tree Company and the Arbor Day Foundation and funded in part by the UPS Foundation, is powered by i-Tree, a peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. i-Tree Tools help communities of all sizes to strengthen their urban forest management and advocacy efforts by quantifying the structure of community trees and the environmental services that trees provide.

The Arbor Day Foundation has partnered with utility companies across the country to allow homeowners to select best placement and species for their yards and to provide them with reduced or no-cost trees. Through this program, the Forest Service and Arbor Day plan to plant 100,000 trees over the next decade. Over 10 years, these trees will sequester 0.1 MMTCO₂e (equivalent to removing more than 3,000 cars from the road for 1 year), save 23 million kWh of electricity (equivalent to the electricity use of more than 2,000 homes for 1 year) and 155,000 therms of energy in natural gas offsets (equivalent to the electricity use of more than 110 homes for 1 year), treat 133 million gallons of stormwater (equivalent to the water used in 7.7 million showers), and absorb nearly 131,000 pounds of air pollutants. Taking into account property value increase, stormwater retention value, value of air quality improvements, and energy savings, these trees will net more than \$5 million in economic value over their lifetime.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ²²
Plant 100,000 additional trees in urban areas.	0.1

Partnership Opportunities

Currently the Arbor Day Foundation is working with 24 utility partners across the country to implement the Energy-Saving Trees Program, including 4 new partnerships established in FY 2016. FY 2016 also marked the launch of the first statewide initiative in Florida. The Arbor Day Foundation is actively working to grow the program by cultivating relationships with new utilities and potentially other types of organizations as well. Once these new relationships are established, there could be a role for nonprofit partners in promoting and marketing the program if the main utility or other organization partners are interested in that type of support.

In addition, there is room to grow partnerships with State forestry agencies, particularly around the selection of appropriate tree species to offer homeowners. After trees are planted, State agencies and nonprofit partners could also play a key role in the maintenance and monitoring of tree health over time, helping homeowners to learn to properly care for their trees.

The Forest Service's Urban and Community Forestry program is also pursuing interagency partnerships that will lead to more tree plantings in communities across the country. For example, working with the Environmental Protection Agency's Office of Water, the Forest Service is piloting partnerships in three States that will direct Clean Water State Revolving Funds (SRF) to Green Infrastructure and tree planting work. In most of these pilots, State Urban and Community Forestry personnel will serve as technical experts, helping applicants for the SRF integrate green infrastructure work into otherwise gray infrastructure projects. Through this partnership, municipalities and partners planning tree planting and green infrastructure work will have access to the roughly \$1 billion appropriated into the SRF each year, funds previously not used or under-utilized for tree planting.

²² For information on how to interpret this goal, see p. 6.

CASE STUDY

In addition to the Energy-Saving Trees Program, the Forest Service and its partners are engaged in a wide variety of initiatives to encourage tree planting in urban areas. One of those, the MillionTreesNYC campaign, was launched in 2007 as a public-private partnership to plant and care for 1 million new trees across New York City. At the outset of creating the city's long-term sustainability plan, the City of New York Department of Parks and Recreation leveraged USDA Forest Service research science to make the case to the NYC Mayor's Office that planting trees was a sound investment that would make the city more livable and therefore more attractive to residents and businesses alike. By growing the urban forest, the City hopes to cool surface temperatures, enhance public space, and help advance long-term sustainability. One of the key pivot points for public officials and decision-makers was learning that there had been scientific research on the economic and environmental value of New York City's trees conducted by the USDA Forest Service, including application of the i-Tree Eco and Streets models. NYC Parks also used the Forest Service's Urban Tree Canopy research to help provide a context for these numbers and to determine where there was space across the densely built city to plant all of these new trees.

Representing a transformative investment in the urban forest, more than \$400 million in municipal capital funds were committed to the tree planting initiative via the city's sustainability plan. A formal public-private partnership was formed between NYC Parks and the New York Restoration Project. Through this partnership, public funding was matched by several more million dollars from corporate sponsors, private philanthropists, foundations, and individuals that were attracted through social networks, professionalized connections, and savvy outreach and marketing of the campaign. In addition, the leaders of the campaign created an advisory committee of more than 400 individuals from 109 organizations to provide insight and guidance to the implementation of the campaign. A natural resource manager reflected on the role of this network of advisors, "I think the advisory board serves several purposes: breadth and also longevity. So, the advisory board allows us to be able to say in a very real way that it's not just about tree planting; that we want MillionTreesNYC to be about creating...an urban forestry movement for planting and care and awareness."

MillionTreesNYC also launched a Stewardship Corps program to help educate and cultivate citizen stewards. This later evolved into the TreeLC program that offered trainings and mini-grants directly to community-based stewardship groups. Existing Forest Service research on civic stewardship was used to help support this program, as the STEW-MAP database of stewards in New York City provided a list of potential partners to MillionTreesNYC. A decision-maker in a public agency noted the transformative impact of the campaign, saying "the investment we were able to make into research, the improvements to our technology, the connections that we've made to academia, other government agencies, and other practitioners in the field have just been extraordinary."

In the fall of 2015, the millionth tree was planted ahead of schedule. In total, trees in New York City remove more than 38,000 metric tons of carbon dioxide from the atmosphere each year, the equivalent of eliminating more than 6,700 cars from the road. More information on MillionTreesNYC can be found at: <http://www.milliontreesnyc.org/>.



Volunteers work during a MillionTreesNYC fall planting day in New York City. Photo courtesy of New York City Department of Parks and Recreation and Malcolm Pinckney.

Proposed Actions

FY 2016

Action	Lead USDA Agency(s)
Plant 10,000 additional trees in urban areas.	Forest Service, in partnership with the Arbor Day Foundation

FY 2017

Action	Lead USDA Agency(s)
Plant 10,000 additional trees in urban areas.	Forest Service, in partnership with the Arbor Day Foundation

FY 2018

Action	Lead USDA Agency(s)
Plant 10,000 additional trees in urban areas.	Forest Service, in partnership with the Arbor Day Foundation

To further encourage investment in growing and maintaining the urban canopy, the Forest Service, in partnership with American Forests, will develop a Web platform that informs policy- and decision-makers about the role of trees in enhancing key services and systems, including but not limited to: human health; transportation systems; storm water capture and treatment; social equity, and infrastructure investment. This Web platform will include a succinct synthesis of state-of-the-art science

around each topic area, as well as case studies and policy examples that can be easily replicated in other communities. Guiding policy- and decision-makers in integrating trees into other facets of city management may increase investment in the urban canopy, helping to maintain the health of existing trees and plant more trees that will sequester and store GHG into the future. An initial version of the Web platform will be launched in late 2016.

Energy Generation and Efficiency

Description

Under Title IX of the Agricultural Act of 2014, commonly known as the Energy Title, USDA has several authorities that encourage the adoption of renewable energy and energy efficiency technologies. In addition, Title II (the Conservation Title), allows USDA to support a variety of energy efficiency improvements on farm operations through NRCS's EQIP. Together, these authorities and programs provide a tremendous opportunity to reduce GHG emissions from energy generation and use throughout rural America.

This building block has four separate parts:

1. Energy efficiency improvements on farm operations through EQIP's National On-Farm Energy Initiative (NOFEI);
2. Energy generation, energy efficiency improvements, and bio-based products;
3. Energy efficiency improvements in rural housing; and
4. Utility-scale energy generation and efficiency improvements.

Each of these parts is discussed in more detail below:

1. *Energy efficiency improvements on farm operations through the National On-Farm Energy Initiative*

Through the EQIP-NOFEI, NRCS provides financial assistance for site-specific energy audits and installation of energy efficiency measures for stationary farm equipment and building systems. Energy audits estimate the type and amount of fuel and electricity used at the farm level by specific equipment and systems. The baseline information is then used to recommend specific technologies and practices that can improve the energy efficiency of those systems. Efficiency improvements can be achieved on a farm by:

- Increasing efficiency of equipment, such as motors, pumps, or lighting;
- Decreasing consumption of energy through improvements of building heating, cooling, and ventilation systems;
- Avoiding the use of energy through better control of systems using timers, sensors, and variable speed drives; and,
- Change in management or timing of farm equipment operations.

2. *Energy generation, energy efficiency improvements, and bio-based products*

RBS has several programs that help reduce GHG emissions. The biggest RBS program included in the building blocks framework is the Rural Energy for America Program, which utilizes energy efficiency and renewable energy technologies to reduce emissions. Projects use solar, wind, geothermal, biomass, hydro, and other eligible commercially available technologies to generate low carbon and zero emission renewable energy. REAP provides grants and guaranteed loans for energy efficiency projects, lighting upgrades, retrofits, and process improvements.

In addition to REAP, other programs that can support this building block include:

- The Advanced Biofuel Payment Program, which provides incentive payments for producers of biodiesel, biogas, and other advanced biofuels that are alternatives to fossil fuels;
- The Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program, which provides loan guarantees for companies commercializing products using renewable biomass in their production;
- The Repowering Assistance Program, which provides incentive payments to eligible biorefineries using renewable biomass to replace fossil fuels; and
- The Business and Industry Guaranteed Loan Program, which may also provide loan guarantees for energy projects that reduce GHG emissions.

3. *Energy efficiency improvements in rural housing*

USDA's Rural Housing Service (RHS) offers a variety of programs to build or improve housing and essential community facilities in rural areas. USDA's Single Family Housing (SFH) Section 502 programs provide direct loans or loan guarantees to help low- and moderate-income rural Americans buy safe, affordable housing in rural areas. The SFH programs encourage energy-efficient building methods and technologies in several ways. First, they require new construction funded under the programs to meet current energy and thermal standards (currently the 2009 International Energy Conservation Code). In addition, applicants purchasing homes constructed under a specific energy efficiency program (e.g., Energy Star, LEED, and Challenge Home) may have flexibility to increase the debt- and income-ratio requirements. Finally, the SFH programs provide home repair loans and grants to support energy saving materials, equipment, or construction methods.

In addition to single family housing, USDA's Multi-Family Housing Programs offer loans to provide affordable rental housing for very-low-, low-, and moderate-income residents, the elderly, and persons with disabilities. Direct loans and loan guarantees made through these programs can be used for new construction, renovation, and preservation of multi-family properties, including energy conservation and efficiency features.

A third set of programs provide loans, grants, and loan guarantees for essential community facilities (CF) in rural areas. Priority is given to health care, education, and public safety projects. Typical projects include hospitals, health clinics, schools, fire houses, community centers, first responder vehicles and equipment, and many other types of community facility projects. CF program regulations do not specifically incentivize renewable energy generation and energy efficiency, but these are always eligible loan purposes when part of an eligible project submitted by an eligible borrower. RHS has issued guidance on funding renewable energy systems in relation to essential CF projects.

4. Utility-scale energy generation and efficiency improvements

The availability of affordable power has been a cornerstone of America's rural development strategy for over 80 years. The Rural Utilities Service (RUS) – successor of the Rural Electrification Administration – has administered programs that provide long-term, low-cost financing for much-needed infrastructure or infrastructure improvements to rural communities as well as limited grant funds for communities with excessively high electricity rates.

The RUS Electric Program (EP) provides capital and leadership to maintain, upgrade, and modernize America's vast rural electric infrastructure. Funds from loans made or guaranteed by RUS are provided to eligible borrowers to finance the new construction or system improvements of electric generation, transmission, and distribution facilities in rural areas. The EP also provides funding to support demand-side management, energy efficiency (EE) and conservation programs, and on-grid and off-grid renewable energy systems under the Energy Efficiency and Conservation Loan Program (EECLP). Additionally, the EP administers for the RUS the High Energy Cost Grant Program (HECGP) which provides grant funds for various projects to reduce the high energy cost at eligible communities.

Under this building block, RUS will target GHG reductions through three major elements:

1. Reductions in emissions from utility-scale energy generation facilities funded through the RUS EP;
2. Demand-side energy efficiency improvements financed under EECLP; and
3. Renewable energy resources financed under HECGP.

First, to support the reduction of GHG emissions from electric facilities owned by RUS borrowers, much of the funding provided by EP is expected to be used to replace the aging fleet of fossil fuel-fired electric generation facilities with generation plants that operate more cleanly and efficiently. The construction of new renewable energy resources and new natural gas-fired combined cycle units are both expected to play an integral role in replacing old coal-fired plants as well as in meeting growth in the demand of electricity. These actions will modify the energy supply portfolio of RUS EP borrowers to include more zero and low GHG-emitting resources.

Second, EECLP provides new financing opportunities for RUS borrowers to invest in renewable energy resources and implement EE programs that directly benefit end users in rural areas. Eligible projects include, but are not limited to, weatherization of buildings, HVAC upgrades, energy efficient lighting, ground source heat pumps, small-scale renewable energy systems, energy audits, and consumer education and outreach programs.

Finally, HECGP is designed to provide adequate and reliable energy services and lower the energy cost of persons in extremely high-energy-cost communities. Under the program, grant funds are provided to entities serving homes and businesses in eligible communities. These funds are used to acquire, construct, extend, upgrade, and otherwise improve energy generation, transmission, or distribution facilities serving the eligible community. Activities that are eligible to receive grant funds include, but are not limited to, new or upgraded electric facilities (generation, transmission, or distribution), natural gas distribution and storage facilities, petroleum product storage and handling facilities, on-grid and off-grid renewable energy facilities, and energy efficiency programs and initiatives.

CASE STUDY

American Hmong farmers in the Ozarks who purchased outdated poultry operations face high energy costs and struggle to meet performance goals set by their integrators. Their difficulties as new farmers are exacerbated by cultural differences and language barriers that hinder access to USDA services available to help.

A 3-year NIFA Beginning Farmer and Rancher Development grant to improve energy efficiency and farm sustainability provided a springboard for other USDA agencies to formulate a collaborative approach to address the problems of 400 farmers in the region to ensure their long-term viability, and achieve positive environmental outcomes. Within the first 3 months of the grant, NRCS, RD, and FSA State leaders and technical staff participated in five meetings and workshops coordinated by the Hmong National Development, Inc., and their partner, EnSave, Inc., to strengthen support for the Hmong community.

Based on detailed energy audits completed for the first round of Hmong farmers, NRCS EQIP financial resources have been approved to implement facility improvements that will achieve more than 35 percent savings of fuel and electricity use when installed and reduce annual GHG emissions. These facility upgrades will increase production efficiency, resulting in a better financial bottom line.

Over the next few months, Hmong farmers will be helped to diversify their operations using RD grants and FSA loans to expand production of specialty crops and renewable energy and biofuels opportunities of their farms.

USDA agencies are finding creative ways to amplify their assistance for the Hmong by increasing technical assistance through agreements with energy businesses, providing translation services with the help of nonprofit organizations, and expanding recruitment in the Hmong community for agency interns. Expected overall project outcomes include:

- A more vibrant rural community;
- Stimulus for rural businesses providing support green-energy services to agricultural customers;
- Improvement of livestock health and farm biosecurity through improvement of confined feeding operation facilities;
- Increased opportunities to engage farmers as resource stewards;
- Reduction of inherent program barriers by increasing agency interaction and cross-promotion of USDA programs;
- Stronger transparency and coordination of agency funding decisions; and
- A model that can be applied to other USDA initiatives.



Poultry farmer Kao Her houses 235,000 broiler chickens in 6 poultry houses in Noel, MO. Photo courtesy of USDA NRCS.

Greenhouse Gas Reduction Goal

Goal	GHG Reduction Goal (MMTCO ₂ e per year by 2025) ²³
Provide financial assistance for site-specific energy audits and installation of energy efficiency measures for stationary farm equipment and building systems through EQIP-NOFEI.	1.0
RBS - Reduce GHG emissions through:	
<i>Rural Energy for America Program</i>	34.0
<i>Advanced Biofuel Payments</i>	2.9
<i>Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program</i>	3.0
<i>Repowering Assistance Program</i>	0.8
Rural Housing Service	N/A ²⁴
RUS Electric Program - Reduce GHG emissions through:	
<i>Utility-scale energy generation facilities funded through the RUS Electric Program</i>	16.0
<i>Demand-side energy efficiency programs financed under EECLP</i>	0.5
<i>Renewable energy resources funded through the HECGP</i>	2.0
Total	60.2

²³ For information on how to interpret this goal, see p. 6.

²⁴ Estimated GHG reductions from RHS programs are not available at this time due to data limitations. As noted below, RHS is exploring how to gather this information.

Partnership Opportunities

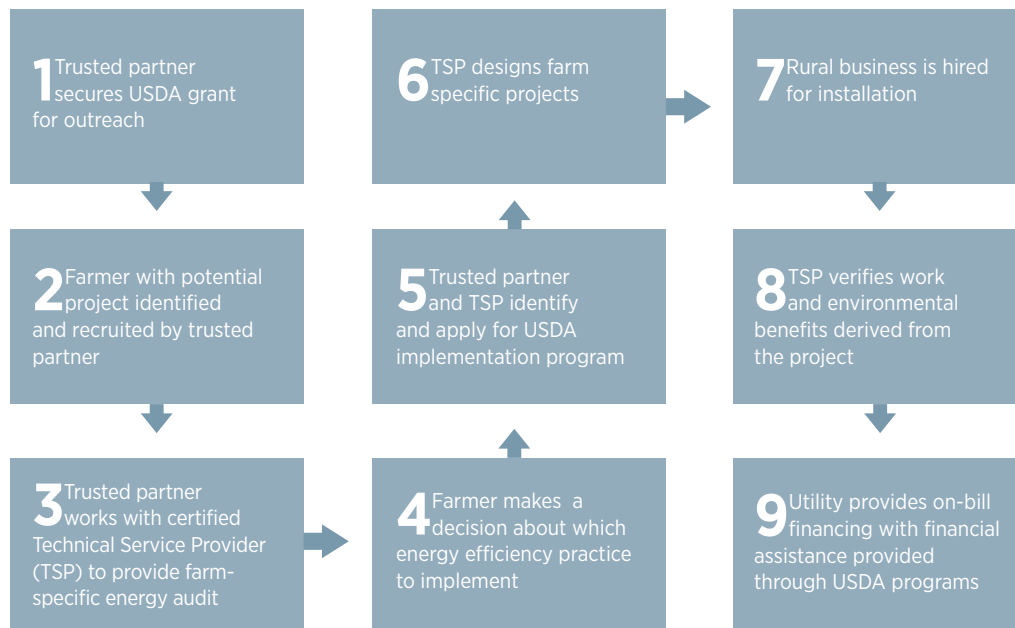
On-farm Energy Efficiency

Through collaboration, USDA and its agencies can deliver a successful on-farm energy efficiency program that provides:

- Outreach and education to potential recipients;
- Project planning, design, and implementation through qualified local businesses;
- Verification of results for utilities and environmental markets;
- Project oversight to meet industry standards; and
- Energy savings that provides a reasonable return on investment.

Working through an existing relationship that a farmer has with a farm commodity organization or other nonprofit organization helps establish a line of communication that helps with recruitment for program implementation. This “trusted partner” of the farmers can also serve as program recipients and administrators of USDA grants. The figure below shows a pathway for this type of interagency-outside partner cooperation.

Interagency Model for Energy Efficiency Collaboration



Notes:

1. A trusted partner is usually a nonprofit organization, commodity group, or farm cooperative.
2. Trusted partners may have established relationships for societal reasons, for instance historically underserved groups, or for economic reasons, such as milk cooperatives.
3. TSPs have been vetted for experience and quality of product by NRCS. An audit can be funded through USDA programs, rural electric cooperatives, or State agency programs, but must meet established standards.
4. The energy audit provides a sound basis for economic and environmental decisions.
5. USDA agencies have a variety of opportunities to structure cooperation to support a farm implementation. An interagency framework for cooperation is being developed.
6. Agencies can streamline and simplify the process by adopting the same design requirements.
7. Opportunities for creation of rural business and job creation are strengthened when USDA provides consistency between programs, and effective delivery of financial assistance through grants, payments, or loans.
8. Agencies will cooperate to increase quality control, program integrity, and reporting of environmental benefits.
9. Recipient pays back loan through on-bill financing engaging utility providers and State agencies with regulatory oversight.

NRCS and RD have executed a Memorandum of Understanding that establishes a structure to coordinate energy efficiency activities. Cooperation is intended to:

- Offer interchangeable on-farm energy audits through REAP, EECLP, and EQIP.
- Offer a coordinated response to clients for energy efficiency upgrades and energy-producing installations involving the installation of digesters and gasifiers.
- Establish collaboration with training and outreach.

Energy efficiency improvements in rural housing

There are several opportunities to partner with other public, nonprofit, and private organizations to improve the energy efficiency of rural housing. For example, RUS is exploring partnerships with:

- Rural utilities to expand energy efficiency loans for multi-family properties;
- The Regional Rural Development Centers (funded through NIFA) to provide outreach to rural communities on residential energy retrofits; and
- EPA, ENERGY STAR, and the Partnership for Sustainable Communities to work with communities on smart growth principles and fund outreach for residential energy retrofits.

Utility-scale energy generation and efficiency improvements

The RUS EP maintains a variety of mechanisms to encourage outreach and maintain partnerships with rural electricity stakeholders. The Office of Loan Origination and Approval includes three teams of General Field Representatives (GFR), which assist borrowers with the development of loan applications, support materials, and the submission of loan applications. By maintaining relationships across the country, the GFRs serve as the local information conduit for borrowers and headquarters staff.

The EP also maintains a relationship with RD State offices. The RD State offices, along with the GFRs, are the local resources for providing outreach and delivering information about Electric Program initiatives as well as for providing feedback from both existing and potential borrowers and on events that may impact the Electric Program at the State level.

Electric Program outreach efforts and partnerships extend beyond those involved with the GFRs and RD State offices and directly meeting with individual borrowers:

- EP staff regularly attend annual and semi-annual meetings organized by rural electric stakeholders to exchange information and educate attendees.
- The RUS accountant staff organizes and hosts a seminar twice a year to give updates on the EP and to educate the borrowers on new policies, procedures, and programs.
- The EP also maintains a strong relationship with the National Rural Electric Cooperative Association, an organization that represents the interests of over 900 electric cooperatives in the United States.
- The EP participates in the Federal Smart Grid Task Force to ensure awareness, coordination, and integration of the diverse activities of the Federal Government related to smart grid technologies, practices, and services. The Task Force is composed of 11 Federal agencies including USDA. The Task Force will promote the modernizing of the electrical grid and foster projects to demonstrate new technologies that improve grid functions.
- EP staff provide outreach to inform and support potential borrowers as they become familiar with EECLP, including presenting at national conferences and meetings of key electric sector stakeholders.

**3-Year Work Plan
FY 2016**

Action	Lead USDA Agency(s)
Develop a baseline data collection plan for Multi-family Preservation and Revitalization Demonstration Program and Farm Labor Housing that apply for funds and receive points for green building techniques. These data will help determine the amount of energy savings and associated GHG emissions reduction as a result of this initiative.	RHS
Roll out a national multi-family energy efficiency study and pilot energy efficiency retrofits in 3 RHS-financed properties. Use pilot to identify most cost-effective energy efficient improvements in various climates and property types, as well as exploring funding options to finance improvements such as partnerships with cooperatives to utilize EECLP.	RHS, RUS
Roll out new eTool for Capital Needs Assessment. This tool will facilitate data queries on housing trends related to materials and technology, energy efficiency improvements to properties, and construction cost comparisons and analysis.	RHS
Explore inclusion of incentives to encourage inclusion of energy efficiency improvements across the RHS loan, grant, and guarantee portfolio.	RHS
Explore tracking of number of single family direct loans that include green or energy efficiency features along with loan performance.	RHS
Explore tracking of CF loans that include energy efficiency features in essential community facilities.	RHS
Develop training for RD field staff on energy efficiency requirements and opportunities across the RHS portfolio.	RHS
Market energy efficiency incentives available through RHS programs to owners/purchasers and other stakeholders.	RHS
Emphasize renewable energy and energy efficiency programs and educate both existing and potential new borrowers on the types of programs and funding under the RUS EP.	RUS
Prioritize, for timely consideration and approval, loan applications for new renewable resources, demand-side energy efficiency programs, and system improvement projects at existing facilities that are needed to meet environmental compliance standards.	RUS
Identify potential rural electric cooperative to develop an agricultural energy efficiency program with on-bill financing program.	RUS
NIFA, NRCS, RBS, and RUS collaborate on a pilot to deploy the Partner Collaboration Framework to a targeted agricultural segment.	NRCS, RBS, RUS, and NIFA
Analyze and refine framework for interagency communication and program delivery for energy efficiency improvements.	NRCS, RBS, RUS, and NIFA
Identify and pilot additional interagency coordination projects. Existing State projects which need additional financial and technical support include those in Colorado, Florida, Alabama, and Puerto Rico. StrikeForce counties offer additional potential for collaborative efforts.	NRCS, RBS, RUS, and NIFA
Support REAP and building block implementation through research and data related to biomass feedstock production and harvest.	ARS, NIFA

FY 2017

Action	Lead USDA Agency(s)
Analyze completed interagency projects for potential renewable energy installation and distributed energy projects.	NRCS, RBS, RUS, and NIFA
Increase implementation rate of energy efficiency projects through expanded technical assistance.	NRCS
Support REAP and building block implementation through research and data related to biomass feedstock production and harvest.	ARS, NIFA

FY 2018

Action	Lead USDA Agency(s)
Increase implementation rate of energy efficiency projects through expanded technical assistance.	NRCS
Support REAP and building block implementation through research and data related to biomass feedstock production and harvest.	ARS, NIFA

Next Steps

In addition to the actions that USDA and its agencies will be taking to advance individual building blocks, there are several overarching next steps that support the framework as a whole, including:

- Measuring progress;
- Leveraging research, education, and extension;
- Describing the co-benefits of these actions; and
- Maintaining the building blocks as an adaptive framework.

Measuring Progress Toward the Building Block Goals

Consistent metrics and measures will be needed to track progress under each the building blocks. These metrics should be suitable to assess both USDA agency program activities and the GHG benefits of those activities.

Specifically, there are three types of metrics that USDA will evaluate:

- *Direct Support:* Through financial or technical assistance, USDA programs directly support practices and technologies that reduce GHG emissions, and agencies often track that support. For example, NRCS tracks the number of acres covered by a variety of conservation practice standards that reduce GHGs or increase carbon sequestration. Likewise, FSA tracks the number of acres enrolled in CRP and is able to estimate the GHG benefits directly associated with that program. However, this type of program data does not necessarily reflect regional or national adoption of these conservation practices.
- *Legacy Effect:* Once direct support from USDA ends, farmers, ranchers, and forestland owners may continue to use the particular technology or practice for which they received technical or financial assistance.



Native grasses and trees in a conservation buffer along Bear Creek in Story County, IA. Photo courtesy of USDA NRCS.

- *Multiplier Effect:* When farm and land managers successfully utilize a USDA program to implement a new practice, they often influence their neighbors. These neighbors may adopt similar management practices without direct USDA support, or with assistance from seed suppliers, crop advisors, or the broader community.

Accounting for these trends will allow the agricultural and forestry communities to take credit for the work they are doing to reduce the GHG footprint of their activities. USDA is developing a framework to estimate the adoption of these conservation practices and technologies. These metrics will be shared to track progress toward meeting the building block goals, and they will be incorporated into the U.S. GHG inventory process and other reporting requirements (e.g., the U.S. Biennial Report).

Leveraging Research, Education, and Extension

Additional research, education, and extension will be essential to achieving the building block goals. Outreach through USDA and our partners can encourage greater adoption of existing practices and technologies to reduce GHG emissions and increase carbon sequestration. USDA's research programs and partners can also explore new and innovative technologies and practices and quantify their GHG benefits. USDA will be revisiting its *Climate Change Science Plan* to lay out a roadmap for these efforts that can help farmers, ranchers, and forestland owners respond to climate change.

The USDA Regional Climate Hubs can also help achieve the building block goals. They have developed networks of expertise on GHG reduction technologies and practices, and they hosted workshops to consider how the various building blocks can be implemented within each region. In addition, the Hubs are working with Cooperative Extension and technical service providers to create educational materials for farmers, ranchers, and forestland owners on these technologies and practices and options for USDA incentives and support.

Describing Co-Benefits

The practices and technologies included under each building block have numerous co-benefits in addition to reducing GHG emissions and increasing carbon sequestration. For example, the benefits of proper nutrient management extend beyond reducing N₂O emissions. The potential for nutrient runoff is reduced, resulting in improved local water quality. Proper management also improves nutrient use efficiency, reducing the amount of fertilizer that needs to be applied and improving the producer's financial bottom line without impacting yield.

USDA will continue to describe and quantify these co-benefits to highlight the broader environmental, conservation, and financial benefits that these technologies and practices can have. Doing so encourages the involvement of stakeholders who place a premium on these additional positive impacts.

Maintaining the building blocks as an adaptive framework

The building blocks are not a static approach to reducing GHG emissions and increasing carbon sequestration in agriculture and forests. Rather, it is an adaptable framework that USDA, in coordination with its partners, will regularly reevaluate to ensure that it is incorporating the latest practices and technologies. Individual building blocks may be broadened, or new building blocks may be added to the original 10. For example, USDA is considering how agroforestry practices (e.g., alley cropping, riparian forest buffers, and windbreaks) and reductions in N₂O emissions from rice cultivation practices can be incorporated into this initiative. In addition, the GHG reduction goals may also be revised to reflect these changes in practices and technologies. The Paris climate change agreement lays out an ambitious agenda for updating commitments and reporting accomplishments beyond the timeframe that is laid out here. USDA will respond to these initiatives and continue to make the U.S. agriculture and forest sectors leaders in reducing GHG emissions and increasing carbon sequestration.

USDA is encouraged by the interest and involvement of its stakeholders, and we are looking forward to continuing our work with them to ensure that farmers, ranchers, and forestland owners have the tools they need to respond to climate change.

Building Block Contacts

The following is a list of USDA and agency-level staff who may be contacted to answer questions regarding the Building Blocks for Climate Smart Agriculture and Forestry.

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Abbreviations

4Rs	Right source, right rate, right time, right place
ACEP	Agricultural Conservation Easement Program
ARS	Agricultural Research Service
CBF	Chesapeake Bay Foundation
CEO	Colorado Energy Office
CFP	Community Forest and Open Space Program
CIG	Conservation Innovation Grant
CLT	Cross laminated timber
CPS	Conservation Practice Standard
CRP	Conservation Reserve Program
CREP	Conservation Reserve Enhancement Program
EE	Energy efficiency
EECLP	Energy Efficiency Conservation Loan Program
EP	Electric Program
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERS	Economic Research Service
FLP	Forest Legacy Program
FSA	Farm Service Agency
FY	Fiscal year
GFR	General Field Representative
GHG	Greenhouse gases
HECGP	High Energy Cost Grant Program
HEL	Highly erodible lands
MMTCO ₂ e	Million metric tons of carbon dioxide equivalent
MOU	Memorandum of Understanding
N ₂ O	Nitrous oxide
NOFEI	National On-Farm Energy Initiative
NRCS	Natural Resources Conservation Service
RBS	Rural Business-Cooperative Service
REAP	Rural Energy for America Program
RD	Rural Development
RHS	Rural Housing Service
RUS	Rural Utilities Service
SHMS	Soil health management systems
TSP	Technical Service Provider
USDA	U.S. Department of Agriculture

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