



Programmatic Environmental Assessment for Partnerships for Climate-Smart Commodities

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1. Introduction

This Programmatic Environmental Assessment (EA) has been prepared to address the effects of projects under the Partnerships for Climate Smart Commodities. These projects are anticipated to be funded through the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), using funds provided by the Commodity Credit Corporation (CCC). This EA has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), and the Natural Resource Conservation Service (NRCS) NEPA regulations (7 CFR Part 650).

Partnerships for Climate-Smart Commodities is a voluntary USDA funding opportunity made available through NRCS for partnerships to support the production and marketing of climate-smart commodities. USDA NRCS typically administers a variety of programs under the Farm Bill to help agricultural landowners and producers plan and implement conservation practices to address natural resource concerns on agricultural land, nonindustrial private forest land, and Tribal land. Partnerships for Climate-Smart Commodities is designed to use the funds and authorities of the CCC to support the production and marketing of agricultural commodities using agricultural (farming, ranching, or forestry) practices that reduce greenhouse gas emissions or sequester carbon, hereafter “climate-smart commodities.” Project proposals will be prioritized for funding based on their potential benefits associated with the production of climate-smart commodities; climate-smart agriculture and forestry market development for climate-smart commodities; equity, environmental justice and Minority Serving Institutions reach; and project management and technical proposals. Diversity of applications, including geographic diversity and size and scale of projects, will be considered when making award decisions. USDA is committed to selecting a variety of projects such that this emerging marketplace starts out with robust competition and options for producers. USDA is committed to equity and environmental justice in program delivery and explicitly seeks to ensure that all projects provide direct, meaningful benefits to a representative cross-section of production agriculture, including small and/or historically underserved producers.

NEPA requires that Federal agencies prepare Environmental Impact Statements (EISs) for major Federal actions significantly affecting the quality of the human environment. When a proposed Federal action is not likely to result in significant impacts requiring an EIS, but the activity has not been categorically excluded, an agency can prepare an Environmental Assessment (EA) to document environmental impacts and assist in determining whether there is a need for an EIS. A “programmatic” NEPA document is a broad or high-level NEPA review that assesses the environmental impacts of proposed policies, plans, programs, or projects under which subsequent actions will be implemented. NRCS regulations state that “[a] program EA may also be prepared to aid in NRCS decision-making and to aid in compliance with NEPA.” 7 CFR 650.8(c)(2). USDA NRCS has decided to prepare this programmatic EA to review at a broad, national scale the effects of activities that will occur when Partnerships for Climate-Smart Commodities is implemented. Funded projects and site-specific actions may then be tiered to this programmatic analysis, when appropriate, for purposes of complying with NEPA.

CEQ has indicated that because an EA is a concise document, the purpose of which is to determine the need for an EIS, it should not contain long descriptions or detailed data which the agency may have gathered. Rather, it should contain a brief discussion of the need for the

proposal, alternatives to the proposal, the environmental impacts of the proposed action and alternatives, and a list of agencies and persons consulted.¹ In addressing these requirements, this programmatic EA also incorporates by reference relevant analyses from the 2016 and 2020 Environmental Quality Incentives Program (EQIP) Programmatic EAs, the 2009 and 2020 Conservation Stewardship Program (CSP) Programmatic EAs, the 2016 and 2020 Agricultural Conservation Easement Program (ACEP) Programmatic EAs, the 2020 Regional Conservation Partnership Program EA, the 2006 Healthy Forests Restoration Program (HFRP) Programmatic EA, and the 2014 Conservation Reserve Program (CRP) Supplemental Programmatic EIS, as well as other existing analysis cited within this document.

1.1 Background

Partnerships for Climate-Smart Commodities seeks to drive the production and expansion of climate-smart commodities and their markets, particularly through an approximately \$1 billion or more funding opportunity announced on February 7, 2022, to provide funding for projects that will build markets and invest in climate-smart farming, ranching, and forestry. For the purposes of the Partnerships for Climate-Smart Commodities, a “climate-smart commodity” is defined as an agricultural commodity that is produced using agricultural (farming, ranching, or forestry) practices that reduce greenhouse gas emissions or sequester carbon. Adoption of these practices are expected to produce other associated environmental benefits. Through Partnerships for Climate-Smart Commodities, USDA-NRCS will support a set of pilot projects that provide voluntary incentives through partners to producers and landowners that will:

- Implement climate-smart agricultural production practices, activities, and systems on working lands;
- Measure/quantify, monitor, and verify the carbon and greenhouse gas benefits associated with those practices; and
- Develop markets and promote the resulting climate-smart commodities.

Partnerships for Climate-Smart Commodities projects will be awarded through either of two funding pools:

- (1) Proposals from \$5 million to \$100 million to include large-scale pilot projects that emphasize the greenhouse gas benefits of climate-smart commodity production and include direct, meaningful benefits to a representative cross-section of production agriculture, including small and/or historically underserved producers.
- (2) Proposals from \$250,000 to \$4,999,999 are in the second funding pool and are limited to particularly innovative pilot projects. These projects place an emphasis on enrollment of small and/or underserved producers and/or monitoring, reporting and verification activities developed at minority-serving institutions.

Partnerships for Climate-Smart Commodities allows for innovation in grant proposals to expand and develop climate-smart markets and provides flexibility in the administration of these agreements with partners.

¹ Council on Environmental Quality, Executive Office of the President, National Environmental Policy Act Implementing Regulations. 40 CFR 1501.5 Environmental Assessments.

1.2 Authority

The authority for Partnerships for Climate Smart Commodities is the Commodity Credit Corporation Charter Act (15 U.S.C. 714 *et seq*). The funding opportunity leverages the authorities under Section 5 of the Commodity Credit Corporation Charter Act at 15 U.S.C. 714c with particular emphasis on the following subsection:

“(e) increase the domestic consumption of agricultural commodities (other than tobacco) by expanding or aiding in the expansion of domestic markets or by developing or aiding in the development of new and additional markets, marketing facilities, and uses for such commodities.”

1.3 Purpose and Need

The need for new or expanded markets for climate-smart commodities provides an opportunity and a challenge for U.S. farmers, ranchers, and forest landowners. Domestic and international consumers are demonstrating a preference for agricultural commodities produced using climate-smart agriculture and forestry (CSAF) practices, creating new market opportunities for producers. Markets for climate-smart commodities include sustainable supply chain initiatives and internal corporate commitments where companies are pledging to reduce emissions within their own supply chains and production facilities. Opportunities also include markets for low-carbon biofuels and renewable energy. Agricultural producers and landowners also have opportunities to market greenhouse gas emissions (GHG) reductions generated as a part of climate-smart commodity production.

Despite this need for climate-smart commodities, there are barriers that have prevented these new markets from reaching scale. The barriers include:

- The lack of standard definitions of climate-smart commodities;
- Lack of clear standards for measurement of climate benefits of CSAF practices;
- Potential for double-counting benefits;
- High transaction costs;
- Limited ability for small producer participation;
- Lack of efficient supply chain traceability; and
- High risk of market entry.

USDA’s purpose under Climate-Smart Agriculture and Forestry (CSAF) strategy (86 FR 14403, (March 16, 2021)) is to begin to resolve some of these barriers. As demonstrated in Executive Order (EO) 14008, tackling the climate crisis at home and abroad will require a whole-of-government approach, and agriculture and forestry play an important role in that strategy. USDA’s 90-day progress report² on the CSAF strategy emphasized that a successful CSAF strategy relies on a multi-pronged approach. One of the prongs in that approach is Partnerships for Climate-Smart Commodities.

- The purpose of Partnerships for Climate-Smart Commodities is to promote innovation in the production and marketing of climate-smart commodities that help reduce GHGs

² Climate-Smart Agriculture and Forestry Strategy: 90-day Progress Report. USDA. May 2021.
<https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

and sequester carbon. The following are indicators of actions that move towards this goal, and the program will fund projects that demonstrate the following potential outcomes to meet the purpose of the program; although no single project is required to demonstrate all of these potential outcomes: Increased markets (supply and demand) for climate-smart commodities.

- Increased adoption of CSAF practices and systems that reduce agricultural greenhouse gas emissions and/or increase carbon sequestration from the agricultural sector.
- Demonstration of scalable and low-cost measurement/quantification, monitoring, reporting, and verification (MMRV) systems.
- Increased innovation and consistency in measuring/quantifying farm-level GHG benefits.
- Testing and evaluation of efficient traceability through supply chains from production of commodity to delivery to the consumer.
- Improved understanding and communication of economic and adaptation benefits, as well as ancillary environmental benefits.
- Equitable administration that includes small and underserved producers as well as early adopters (i.e., producers who have already used some climate-smart approaches).
- Understanding of marketability advantages for a variety of farm types.
- Empowerment of farmers, ranchers, and forest landowners to drive CSAF markets and practice adoption.
- Development of additional public-private partnerships to foster and develop CSAF markets.

2. Alternatives

2.1 Scoping and Public Involvement

On March 16, 2021, USDA published a *Federal Register* notice to request comments on the Climate-Smart Agriculture and Forestry (CSAF) strategy (86 FR 14403). Based on public comments received and ongoing stakeholder engagement activities, a progress report was published in May 2021 on the CSAF strategy.³ As one element of the CSAF strategy, the public was then invited to comment on USDA's consideration of actions to expand the use of climate-smart farming practices and aid in the marketing of agricultural commodities. An announcement of what was then identified as the Climate-Smart Agriculture and Forestry Partnership Program was published on September 29, 2021 (USDA Press Release No. 0199.21), and a notice requesting information and public comments was published in the *Federal Register* on September 30, 2021 (86 FR 54149). The Notice asked for feedback and included eight specific questions intended to inform program development, eligibility, structure, and design.

Nearly 400 comments were received from a wide range of organizations and individuals, which informed the design and structure of the new Partnerships for Climate-Smart Commodities

³ Climate-Smart Agriculture and Forestry Strategy: 90-day Progress Report. USDA. May 2021. <https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

funding opportunity. In all, there was broad support expressed for the overall concept and approach. Commenters addressed several categories of concerns:

- USDA has a role to play in promoting transparency and consistency across climate-smart practice implementation and recognition.
- Partnerships for Climate-Smart Commodities should complement, not detract from, existing private sector markets and efforts.
- Partnerships for Climate-Smart Commodities should include a wide range of practices and activities to address multiple sources of GHG emissions and account for sequestration opportunities across operations of all sizes and in all geographies, including historically disadvantaged producers.

More specifically, commenters proposed a range of areas that pilot projects could explore, including research, protocol development and standardization, data management, technical assistance, financial assistance and innovative financial products, and certification and labelling schemes. Many details were also offered on aspects of program design, including how USDA should handle price discovery and whether to offer a set payment per ton; GHG credit ownership; criteria that should be considered in evaluating proposals; and approaches to monitoring, reporting, and verification. In all, while commenters expressed concerns about economic risks, there was general support for the potential environmental benefits of the program and no significant concerns about adverse environmental effects.

In 2022, there have been three public presentations through webinars to explain the Partnerships for Climate-Smart Commodities and the specific funding opportunities: February 16, March 3, and March 25. These webinars were recorded and are available on the USDA public website for Partnerships for Climate Smart Commodities at: <https://www.usda.gov/climate-solutions/climate-smart-commodities>. A Fact Sheet and FAQ were also developed and can be accessed on the public website as well.

2.2 Alternative 1: No Action—Partnerships for Climate-Smart Commodities is not implemented.

Under the No Action alternative Partnerships for Climate-Smart Commodities would not be implemented, and no proposals or partnership grant agreements would be funded to target climate-smart agriculture and/or forestry practices on a large scale. Conservation Practice Standards would continue to be implemented to further conservation solutions under other USDA-administered programs.

2.3 Alternative 2: Proposed Action—Fund Grants through Partnerships for Climate-Smart Commodities

USDA-NRCS is proposing to fund grants through Partnerships for Climate-Smart Commodities. The primary focus of the Partnerships for Climate-Smart Commodities projects is on-farm production of climate-smart commodities, with another focus on developing markets for such commodities. Commodities must be produced using verifiable and quantifiable climate-smart practices (farming, ranching, or forestry). Climate-smart forest products are included, so applicants also may propose and justify innovative forestry projects that generate climate-smart forest commodities. Projects must focus on verifiable on-farm (or forest) GHG emissions and carbon sequestration benefits.

Projects will include agricultural and forestry practices or combinations of practices, and/or practice enhancements that provide GHG benefits and/or carbon sequestration. More specifically, practices may include but are not limited to the following:⁴

- Cover crops
- Low-till or no-till
- Nutrient management
- Enhanced efficiency fertilizers
- Manure management
- Feed management to reduce enteric emissions
- Buffers, wetland, and grassland management, and tree planting on working lands
- Agroforestry and afforestation on working lands
- Afforestation/reforestation and sustainable forest management
- Planting for high carbon sequestration rate
- Maintaining and improving forest soil quality
- Increase on-site carbon storage through Forest Stand Management
- Alternate wetting and drying on rice fields
- Climate-smart pasture practices, such as prescribed grazing or legume interceding
- Soil amendments, like biochar

Projects will be planned and implemented by the Partners. Climate-smart practices and activities implemented may incorporate NRCS Conservation Practice Standards (CPSs) associated with other USDA programs while emphasizing benefits for GHG and carbon sequestration. Projects utilizing NRCS CPSs will be implemented by the Partner according to NRCS standards. However, practices and enhancements to existing practices are not limited to those under existing USDA-NRCS practice standards. Some of these practices and/or other activities under Partnerships for Climate-Smart Commodities may not involve ground-disturbing activities and would not be expected to have adverse impacts on the human environment—these could include, but are not limited to, marketing, educational, or outreach activities. Compliance and reporting activities will likely be more complex for ground-disturbing practices without existing NRCS practice standards.

3. Affected Environment

Partnerships for Climate-Smart Commodities proposals may cover any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, U.S. Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and any agency or instrumentality thereof exclusive of local governments. The contiguous 48 States, Hawaii, Puerto Rico, and the U.S. Virgin Islands cover over 1.94 billion acres of land and water; about 71 percent of this area is non-Federal rural land—nearly 1.4 billion acres. In 2017, the major non-Federal rural land uses were rangeland at 404 million acres (21 percent of U.S. total); forest land

⁴ Notice of Funding Opportunity for Partnerships for Climate-Smart Commodities: <https://www.grants.gov/web/grants/view-opportunity.html?oppId=337878>

at 418 million (21 percent); and cropland at 368 million acres (19 percent). Figure 1 depicts these land uses, for the entire United States and the 48 contiguous States, based on the 2017 National Resources Inventory Summary Report.⁵ The National Resources Inventory (NRI) program collects information on the status, condition, and trends of land, soil, water, and related resources on the Nation's non-Federal lands. The NRI sample is a stratified area sample of 49 States (excludes Alaska), Puerto Rico, and the Virgin Islands. Detailed data on soil properties and land use are collected at a random sample of points. The resulting database is a longitudinal data set containing variables from 1982, 1987, 1992, 1997, and annually from 2000 through 2017.

NRI data show cropland acreage increased by about 5.6 million acres from 2012 to 2017. It had steadily declined between 1982 until 2007, when it began increasing every year. Most of the gain (80%) came from land coming out of the Conservation Reserve Program with some cropland converted to pasture, counterbalanced to some degree by losses of cropland to development and other rural land.⁶

About 44 million acres of land was newly developed between 1982 and 2015, bringing the total to about 116 million acres; a 61-percent increase. However, as the population has increased, the acres developed per person has dropped off. Most land for development (about 19.1 million acres) was converted from forest land. Cropland converted to development totaled about 11.4 million acres while about 6.0 million acres of rangeland was developed.

⁵ U.S. Department of Agriculture. 2020. Summary Report: 2017 National Resources Inventory, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/results/>

⁶ *ibid*

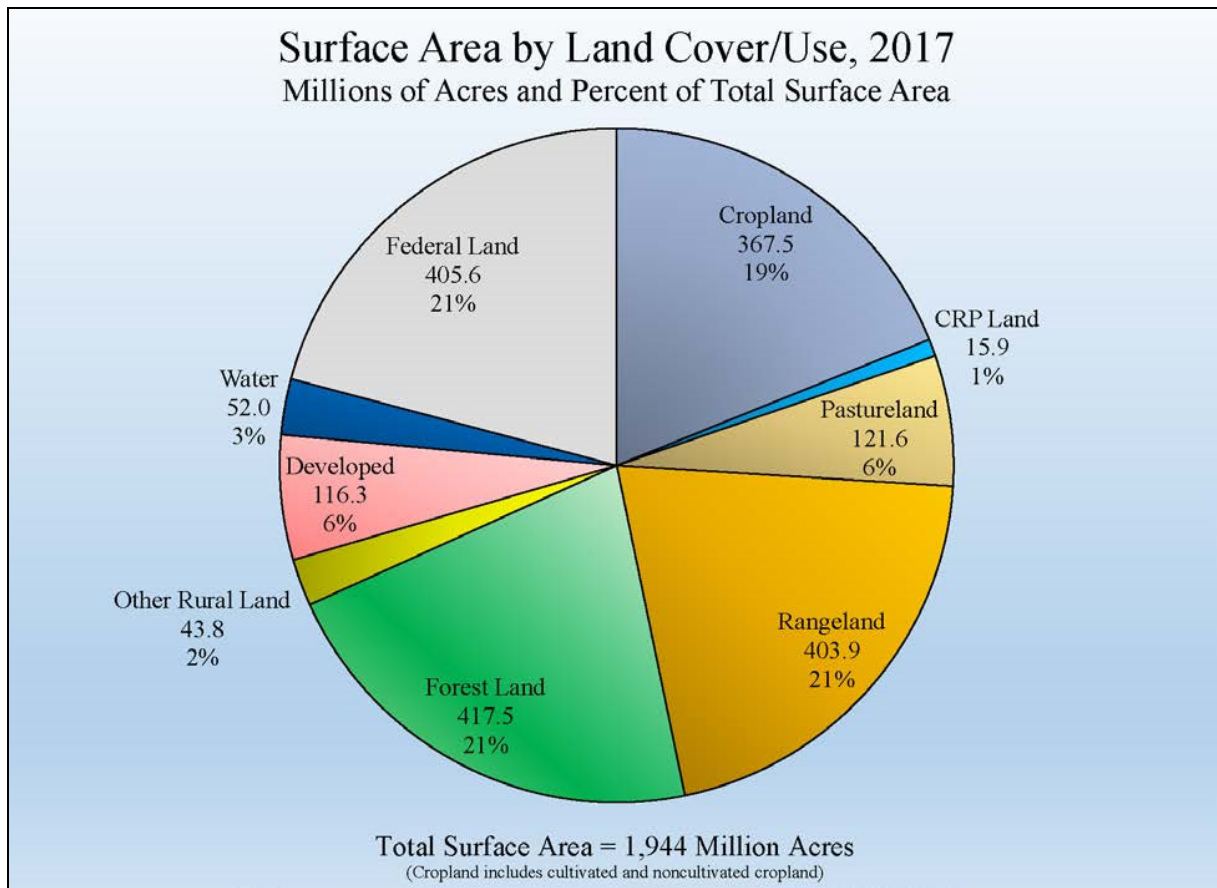


Figure 1. Surface Area by Land Cover/Use, 2015 (source: Summary Report: 2018 National Resources Inventory, http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1422028.pdf)

Figure 2 depicts the distribution of the four primary rural land types (forest, rangeland, cropland, and pasture) across the 48 contiguous States, Hawaii, and the Caribbean territories. Agricultural and forestry operations can have impacts, both beneficial and adverse, on natural resources and resource concerns including soil, water, air, plants, animals, humans, and energy. For more specific characterizations and baseline information on each of these resources, see section 3.2 of the January 2009 EQIP Programmatic EA,⁷ which is incorporated herein by reference.

Agriculture is viewed as both source of GHG emissions and a sink for carbon, and has a key interest in reducing greenhouse gas emissions due to the potential for impacts. Among other predicted results of climate-change, the Fourth National Climate Assessment by the U.S. Global Change Research Program describes anticipated declines in food and forage production due to shifting precipitation patterns and associated high temperatures.⁸ The primary sources of greenhouse gases in agriculture are the production of nitrogen-based fertilizers; the combustion of fossil fuels such as coal, gasoline, diesel fuel and natural gas; and waste management. Also, the fermentation that takes place in the digestive systems of livestock results in methane

⁷ USDA, NRCS. Environmental Quality Incentives Program. Programmatic Environmental Assessment. January 2009. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ecosciences/ec/?cid=nrcs143_008451

⁸ USGRP. 2018. Fourth National Climate Assessment. <https://nca2018.globalchange.gov/>

emissions. Agriculture sinks of greenhouse gases are reservoirs of carbon that have been removed from the atmosphere through the process of biological carbon sequestration.⁹

Carbon sequestration in the agriculture sector refers to the capacity of agriculture lands and forests to remove carbon dioxide from the atmosphere. Carbon dioxide is absorbed by trees, plants and crops through photosynthesis and stored as carbon in biomass in tree trunks, branches, foliage and roots and soils. Forests and stable grasslands are referred to as carbon sinks because they can store large amounts of carbon in their vegetation and root systems for long periods of time. Soils are the largest terrestrial sink for carbon on the planet. The ability of agriculture lands to store or sequester carbon depends on several factors, including climate, soil type, type of crop or vegetation cover and management practices.¹⁰ According to the U.S. Environmental Protection Agency, agriculture has about an 11 percent domestic contribution to GHG emissions; this is further described in Section 4.3.3 of this document.¹¹

Historically, NRCS has addressed soil, water, air, plant, animal, and energy resource concerns using conservation practices and systems of practices within the nine-step NRCS conservation planning process. The NRCS National Handbook of Conservation Practices¹² contains national standards for each conservation practice. These standards are included in the handbook only after the public has had the opportunity to comment on them.¹³ State technical staffs then localize the standards to fit conditions in each State and establish quality and quantity requirements (specifications) for applying each conservation practice. Standards for conservation practices are detailed in section IV of the local FOTG.¹⁴

Conservation practice standards, planning criteria,¹⁵ and local resource data are maintained in the FOTG to provide detailed information for planners to plan and design practices in a manner consistent with local conditions and resource concerns. Commonly, suites of conservation practices are planned and installed together as part of a conservation management system designed to enhance soil, water, and related natural resources for sustainable use. While NRCS offers a broad suite of voluntary conservation practices, the agency identifies a subset of these practices as critical to climate change mitigation, and many of these agricultural practices may be used as climate-smart practices under Partnerships for Climate-Smart Commodities (see section

⁹ Jeff Schaheznski. 2009 (Updated 2022). Agriculture, Climate Disruption, and Carbon Sequestration. ATTRA Sustainable Agriculture. National Center for Appropriate Technology.

¹⁰ Ibid

¹¹ U.S. Environmental Protection Agency. Sources of Greenhouse Gas Emission. August 2022.

<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

¹² For additional information on the National Handbook of Conservation Practices (450-NHCP-Amend. 16, September 2015) and individual conservation practices, see <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/>

¹³ For a description of how NRCS develops its conservation practice standards, see NRCS General Manual Title 450, Part 401, Subpart B, at the NRCS Electronic Directives System web site, <https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=19430>

¹⁴ Local FOTG information is available at the electronic FOTG web site, <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/>

¹⁵ NRCS planning criteria are quantitative or qualitative statement of a treatment level required to achieve a minimum level of treatment for a given resource concern for a particular land area; established in accordance with local, State, Tribal, territorial, and Federal programs and regulations in consideration of ecological, economic, and social effects; and are found in section III of each State's electronic FOTG, <https://efotg.sc.egov.usda.gov/#/>

4.2). When applied appropriately, these practices may deliver quantifiable reductions in greenhouse gas emissions and/or increases in carbon sequestration. Additional information on GHG reductions from climate-smart practices more broadly is provided in Section 4.3.3 of this document. Many offer co-benefits and ancillary benefits that help operations build climate change resilience while addressing other natural resource concerns such as soil health, water quality, pollinator and wildlife habitat and air quality. All conservation practice standards and State-specific conservation practice specifications include considerations that ensure the minimization of potentially adverse impacts to associated resources. NRCS has developed network effects diagrams that depict typical impacts of conservation practices. These diagrams are discussed in detail in Appendix A.

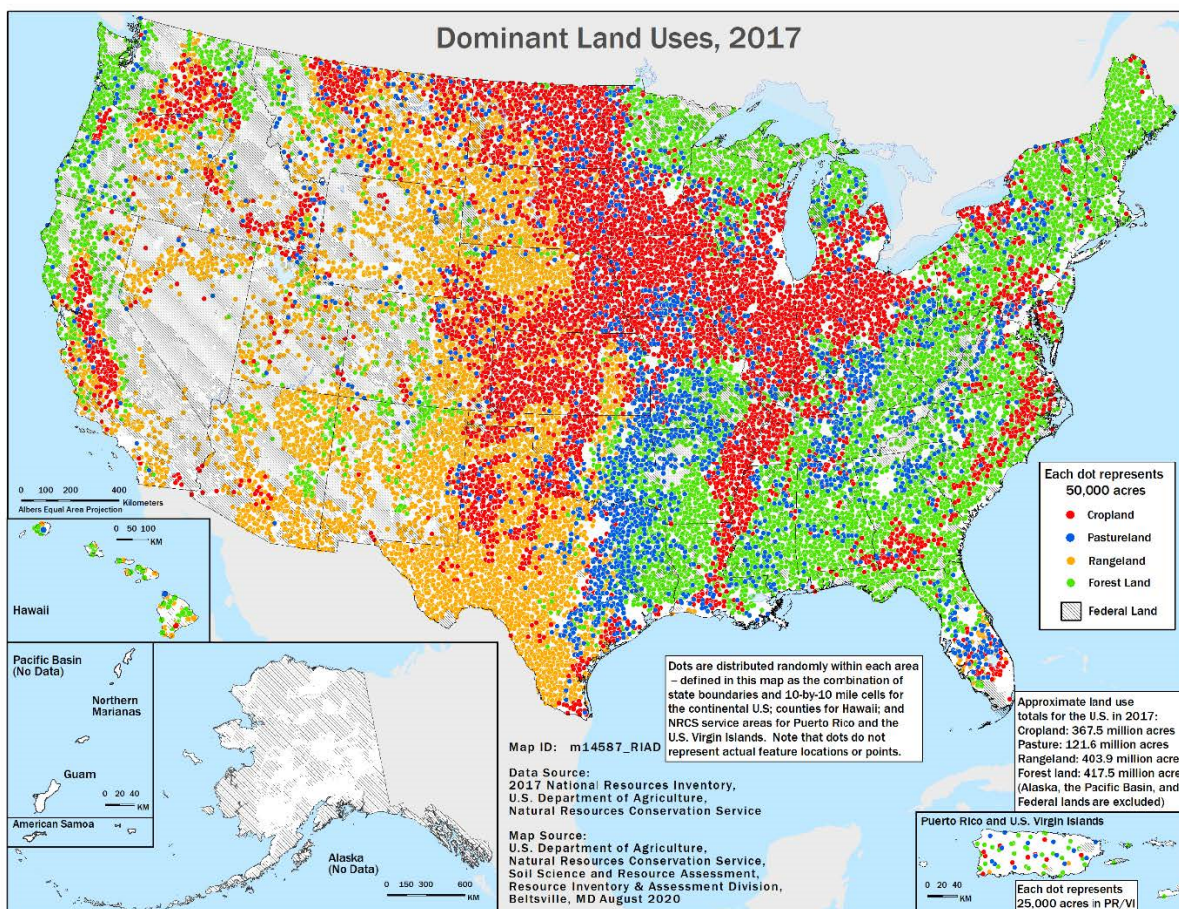


Figure 2. Dominant Land Uses, 2015 (source: Summary Report: 2015 National Resources Inventory, http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1422028.pdf).

3.1 Soil Resource Concerns

Estimated water (sheet and rill) erosion on cropland in 2015 was 990 million tons per year, and erosion due to wind was 700 million tons per year.¹⁶ Soil erosion can occur on any land where

¹⁶ Summary Report: 2015 National Resources Inventory, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1422028.pdf

soil is exposed and, therefore, is susceptible to erosion due to climatic factors, soil characteristics, landscape features, and cropping practices. However, soil erosion rates on cropland have decreased 34 percent between 1982 and 2015. The water (sheet and rill) erosion rate declined from 3.82 tons per acre per year to 2.71 tons per acre per year, and the erosion rate due to wind decreased from 3.21 tons per acre per year to 1.91 tons per acre per year. Erosion also occurs from the concentrated flow of water, in ephemeral and classic gullies.

Conservation practices that have traditionally been used to reduce soil erosion are summarized in Appendix B. Activities to reduce soil erosion generally involve covering the soil with live vegetation, crop residues, or other materials to prevent soil detachment; creating barriers to wind or water to reduce detachment and transport; creating channels or other barriers to redirect and slow water runoff; and creating detention areas to promote sedimentation.

Soil quality describes how well soil functions to sustain biological productivity, regulate and partition soil water and solutes, filter and buffer organic and inorganic materials, store and cycle nutrients and carbon, and provide stability and support for plants or structures for human habitation (modified from Seybold et al. 1998).¹⁷ Soil quality is evaluated using inherent and dynamic soil properties.

Inherent soil properties are generally not affected by human management and include soil texture, depth to bedrock, clay type, cation exchange capacity, and drainage class. In contrast, dynamic soil properties can change over months to years in response to management and land use. Dynamic soil properties include organic matter, soil structure, infiltration, and water- and nutrient-holding capacity.

Soil organic matter is a dynamic property of particular interest due to soils' ability to "sequester" carbon. Model simulations¹⁸ have estimated that an average of 58 tons of soil organic carbon is present per cropland acre. Soil organic carbon levels vary considerably among cropland acres, both by region and by crop within regions. Simulations found the upper Midwest region to have the highest soil organic carbon, averaging 71 tons per cropland acre. The lowest levels, 43 and 44 tons per acre, were in the southern Great Plains and south-central regions respectively. Legume hay consistently had the highest soil organic carbon levels in every region, while cotton and peanuts had the lowest soil organic carbon levels in regions where those crops are grown.

Soils covered by permanent vegetation in forests and rangelands can also provide long-term carbon storage. The National Resource Ecology Lab at Colorado State University has estimated that private grassland and shrubland soils in the United States gained 1.6 million metric tons per year in the 1990s (Negra et al. 2008).¹⁹

¹⁷ Seybold, C.A., M.J. Mausbach, D.L. Karlen, and H.H. Rogers. 1998. Quantification of soil quality. In *Soil Processes and the Carbon Cycle*. R. Lal, J.M. Kimble, R.F. Follett, and B.A. Stewart, eds. CRC Press, Boca Raton, FL.

¹⁸ Potter, Steven R., et al. 2006. Model Simulation of Soil Loss, Nutrient Loss, and Change in Soil Organic Carbon Associated with Crop Production. USDA-NRCS Conservation Effects Assessment Project (CEAP). https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/na/?cid=nrcs143_014128

¹⁹ Negra, Christine, et al. 2008. Indicators of Carbon Storage in U.S. Ecosystems: Baseline for Terrestrial Carbon Accounting. *Journal of Environmental Quality* 37:1374–82

3.2 Water Resource Concerns

Disturbance of soil cover and of the soil itself can produce wind- and water-induced soil erosion and associated sedimentation. Agriculture operations apply inorganic and organic fertilizers, primarily nitrogen, phosphorus, and potassium to promote plant growth. Herbicides, insecticides, and fungicides are also applied to control pests that may reduce plant and animal growth and productivity. Offsite movement of soil, nutrients, and pesticides into surface and ground waters can degrade water quality. Some contaminants are adsorbed to soil particles (e.g., phosphate), so are typically transported with eroded sediments. Other contaminants are more soluble and typically transported in runoff waters and through infiltration (e.g., nitrate).

Sampling by the U.S. Geological Survey (USGS) (2008)²⁰ for the National Water Quality Assessment Program (NAWQA) during the period 1991 to 2002, found 13 percent of streams draining agricultural lands and just over 20 percent of ground water wells sampled in agricultural landscapes to have nitrate concentrations exceeding Federal drinking water standards (10 parts per million). However, only 2 percent of samples from grasslands and shrublands exceeded the standards. Nitrate concentrations in all forested sites that were sampled were less than 6 parts per million in both ground and surface waters. One hundred percent of streams sampled for NAWQA were found to have detectable levels of pesticides, with more than 85 percent of the streams sampled having five or more pesticides detected. Of these streams, 13 percent had pesticide levels exceeding human health benchmarks for at least one pesticide. When compared to aquatic life benchmarks, approximately 57 percent of streams in agricultural watersheds were found to have one or more pesticides that exceeded benchmarks.

A new USGS study²¹ identified trends between 1992 and 2012 in concentrations of nutrients, sulfate, and salinity at 633 river and stream sites in the conterminous United States and related them to land use in the context of water-treatment practices and regulatory actions. The study found significant decrease in concentrations of nitrogen and phosphorus in urban streams and attributed the cause to upgrades to urban wastewater treatment systems. Changes in nitrogen concentrations in agricultural areas were small and inconsistent however, and in agricultural areas more sites had increases in phosphorus concentration than decreases. These results suggest that efforts to reduce nutrients in agricultural areas have not been fully successful, but it remains unknown whether agricultural nutrient reductions have not been large enough or widespread enough to result in downward trends or whether past application of nutrients is causing significant lags in the response of surface waters to improved management. Ammonium did decrease broadly across all land uses. Ammonium can be highly toxic to aquatic organisms and is associated with wastewater, manure from livestock operations, and atmospheric deposition. The broad reduction in ammonium concentrations indicate that efforts to reduce these sources of ammonium have largely been successful.

A striking trend in the dataset was the substantial increase in salinity—measured as specific conductance—in streams in urban and agricultural areas, and areas with a mix of the two.

²⁰ Wilson, J.T., et al. 2008. Methods and sources of data used to develop selected water-quality indicators for streams and ground water for the 2007 edition of The State of the Nation's Ecosystems report with comparisons to the 2002 edition: U.S. Geological Survey Open-File Report 2008-1110. 61 p., plus 1 oversized table and 25 appendixes.

²¹ Landscape drivers of dynamic change in water quality of U.S. rivers. Stets, E.G., Sprague, L.A., Oelsner, G.P., Johnson, H.M., Murphy, J.C., Ryberg, K., Vecchia, A.V., Zuellig, R.E., Falcone, J.A., and Riskin, M.L. Environmental Science and Technology, <https://dx.doi.org/10.1021/acs.est.9b05344>.

Elevated salinity levels are linked to loss of stream biodiversity and can cause metals to be released from streambed sediments and water-distribution facilities and plumbing.

The 2008 USGS study also detected one or more pesticides in 61 percent of ground water wells sampled, but only 1.3 percent exceeded human health benchmarks. Table 1 contains a comparison of results from the 2008 NAWQA study for stream and ground water samples in agricultural landscapes.

Table 1. Results from 2008 NAWQA study for streams and ground water.

Contaminant	Nitrate			Pesticides			
		Level	Detected	Detected	Human Health(1)	Human Health	Aquatic Health (1)
	>10	Detected	Detected	Human Health(1)	Human Health	Aquatic Health (1)	Aquatic Health
	Ppm	1 or more	5 or more	1 mor more	2 to 3	1 or more	4 or more
Streams (5)	13	100	85	13	4	57	12
Ground water (5)	20	61	10	1.3	0	n/a	n/a

⁽¹⁾ Note: “Human health” and “Aquatic health” refer to the exceedance of established benchmark criteria.

A more recent USGS study of ground water quality includes information for 15 of the most heavily used aquifers in the Nation.²² The study focused on ground water used for drinking, sampling nearly 1,100 public supply wells and analyzing the samples for hundreds of water quality constituents related to human health. Nitrate was the only constituent from manmade sources that exceeded human-health standards, typically in a low percentage of samples (1 or 2 percent). Nitrate comes from animal and human organic wastes as well as nitrogen-containing inorganic fertilizers. The exceedances occurred in the Floridan aquifer system, the Glacial aquifer system, the Rio Grande aquifer system, and the Valley and Ridge and Piedmont and Blue Ridge carbonate-rock aquifers as shown in Figure 3 below.

²² Musgrove, M. 2020. The Quality of Our Groundwater—Progress on a National Survey. USGS, Texas Water Science Center. https://www.usgs.gov/center-news/quality-our-groundwater-progress-a-national-survey?qt-news_science_products=1#qt-news_science_products

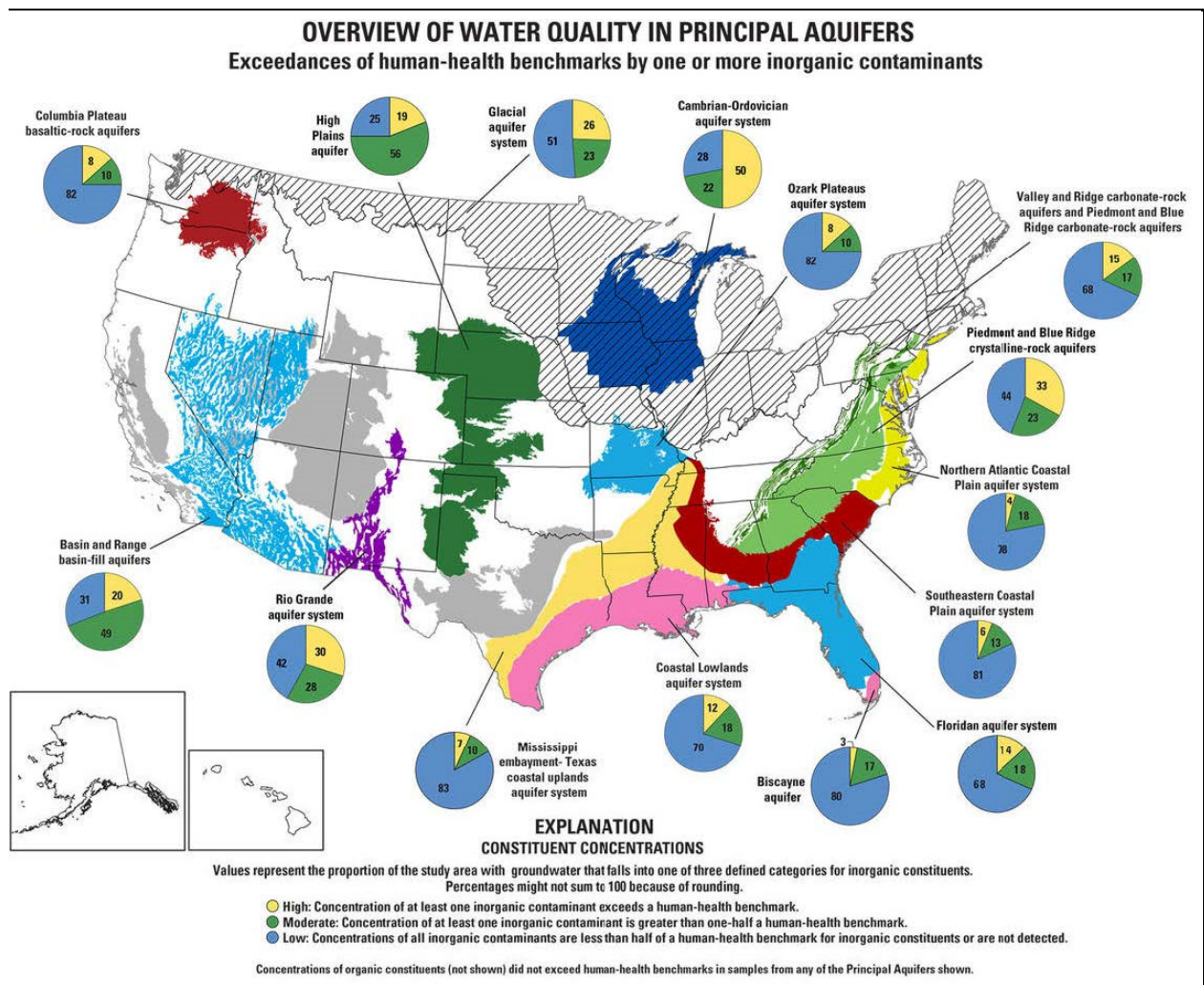


Figure 3. Overview of Water Quality in Principal Aquifers.

Pathogens and pharmaceuticals from livestock operations are emerging water quality issues. With an increasing trend in the size and concentration of livestock operations, concerns about potential water quality issues from these sources have also increased. Pathogens and other contaminants from livestock may reach surface waters through both point and nonpoint pathways. In some cases, contamination of ground waters may occur as well.

Conservation activities on agricultural and forested land improve water quality by—

- Reducing erosion and associated transport of sediment-born contaminants (e.g., establishing a resource conserving crop rotation to reduce water erosion).
- Controlling or redirecting surface water runoff and associated soluble contaminants and pathogens (e.g., managing livestock access to streams, ditches, and other waterbodies to reduce pathogens in surface water).
- Providing vegetation to filter contaminants and pathogens from runoff (e.g., extending existing filter strips or other buffers).

- Changing management to apply nutrients and pesticides at appropriate agronomic rates only when needed (e.g., improving nutrient uptake efficiency and reducing risk of nutrient losses to surface water).

Specific practices that have traditionally been used to improve water quality concerns are summarized in Appendix B. Management of manure on livestock operations can also be used to improve water quality.

Water use in the United States in 2015 was estimated to be about 322 billion gallons per day (Bgal/d), which was 9 percent less than in 2010 (Dieter et al. 2018).²³ The 2015 estimates put total withdrawals at the lowest level since before 1970, following the same overall trend of decreasing total withdrawals observed from 2005 to 2010. Agricultural uses of water include irrigation, livestock, and aquaculture.

Surface water withdrawals (60.9 Bgal/d) accounted for 52 percent of the total irrigation withdrawals, about 8 percent less than in 2010. Ground water withdrawals for irrigation were 57.2 Bgal/d in 2015, about 16 percent more than in 2010. About 63.5 million acres were irrigated in 2015, an increase from 2010 of about 1,130 thousand acres (2 percent). The number of acres irrigated using sprinkler and micro-irrigation systems accounted for 63 percent of the total irrigated lands in 2015. Eighty-one percent of total U.S. irrigation withdrawals were in the 17 conterminous Western States (west of the solid line in Fig. 4.)

Excessive water can also be a resource concern. Ponding, flooding, seasonal high-water tables, and seeps, resulting from surface water or poor subsurface drainage restricts land use and management goals. Wind-blown snow can accumulate around and over surface structures restricting access to humans and animals.

Conservation activities are used to address excessive water by removing, redirecting, or retaining this water to improve plant productivity. On irrigated land, a variety of activities are available to improve the efficiency of water application (e.g., automated intermittent flood irrigation of rice fields), reduce evaporation (e.g., establishing a no-till system to increase plant-available moisture), and to maximize use of available water supply (e.g., advanced automated irrigation water management using soil moisture or water level monitoring).

Specific conservation practices that have traditionally been used to address water quantity concerns including insufficient supply, excessive quantities, and inefficient use are summarized in Appendix B.

NRCS evaluates conservation trends and effects on cultivated cropland through the multiagency Conservation Effects Assessment Project (CEAP). CEAP uses natural resource and farmer survey data and physical process modeling to estimate the environmental effects of conservation practices on cultivated cropland. USDA's National Agricultural Statistics Service conducted the first set of farmer surveys in 2003–06 (CEAP I) with reports released from 2010 through 2014.

²³ Dieter, C.A., Maupin, M.A., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2018, Estimated use of water in the United States in 2015: U.S. Geological Survey Circular 1441, 65 p., <https://doi.org/10.3133/cir1441>. Irrigation withdrawals were 118 Bgal/d in 2015, an increase of 2 percent from 2010 (116 Bgal/d) but were approximately equal to withdrawals estimated in the 1960s. Irrigation withdrawals accounted for 42 percent of total freshwater withdrawals for all uses and 64 percent of total freshwater withdrawals for all uses excluding thermoelectric power. Aquaculture withdrawals accounted for 2 percent of the total withdrawals and livestock about one percent of total freshwater withdrawals in 2015.

Now, comparison data from farmer surveys conducted for 2013–16 (CEAP II) make it possible to estimate shifts in conservation adoption and effects between the CEAP survey periods.

The agricultural landscape is dynamic, shaped by public policy, technology, and natural resource drivers among others, which together affect farmer decisions and conservation trends. Between the CEAP surveys, increased demand and higher prices for commodities encouraged production expansion in nearly all regions of the country.

A warming climate, longer growing season, and advances in seed technology and higher yielding crop varieties drove cropping pattern shifts, most notably in the northern and southern plains where corn and soybean production replaced wheat and other close-grown crops that had lower average nutrient needs and fallow periods. Between CEAP I and CEAP II, farmers’ adoption of conservation practices resulted in more cultivated cropland meeting loss thresholds for erosion, sediment, surface nitrogen and sediment-transported phosphorus. While use of advanced nutrient technologies increased, by CEAP II more cultivated cropland exceeded loss thresholds for subsurface nitrogen and soluble phosphorus, reflecting the growth in high-nutrient-demand crop varieties, the increase in conservation tillage systems, and the decline in nutrient incorporation. Nevertheless, most cultivated cropland in the United States is under moderate and high levels of conservation treatment, and opportunities exist to improve conservation performance using currently available tools.

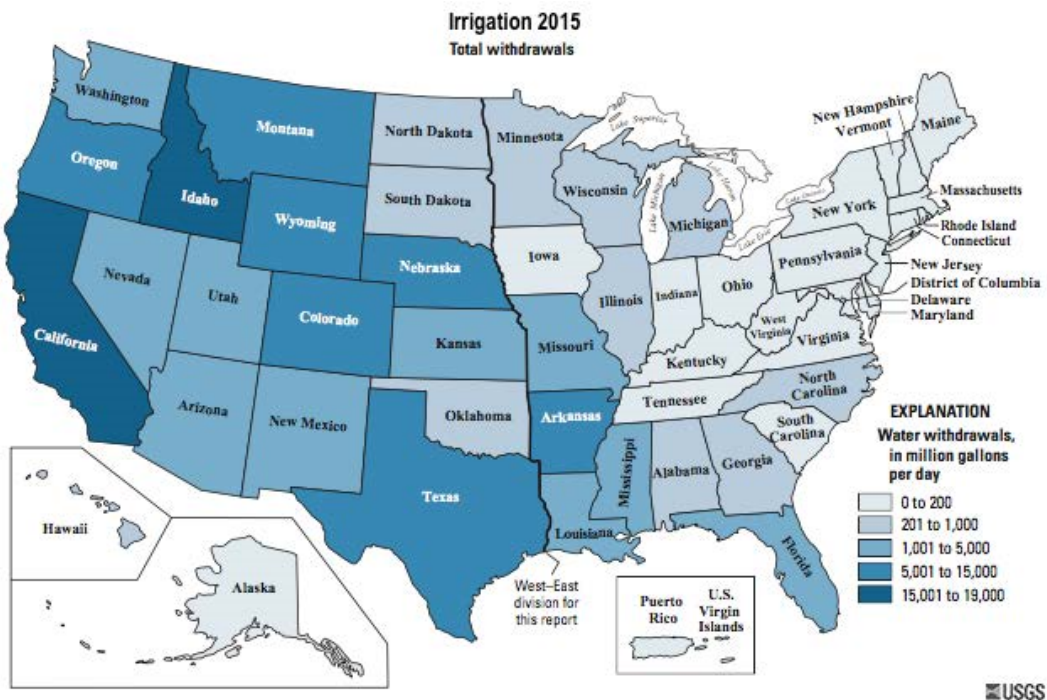


Figure 4. 2015 Irrigation Withdrawals by Source and State (from Dieter et al. 2018, see <https://pubs.er.usgs.gov/publication/cir1441>).

3.3 Air Resource Concerns

Air quality impacts resulting from agricultural and forestry operations tend to involve four types of emissions: particulate matter (PM) and PM precursors, ozone (O₃) precursors, greenhouse gases (GHG), and objectionable odors. Conservation practices that have traditionally been used to address these air quality issues are summarized in Appendix B, and specific examples are provided below.

Agricultural operations can contribute to PM and ozone concentrations through emissions of direct PM, volatile organic compounds (VOC), oxides of nitrogen (NO_x), and ammonia. All biological organisms emit VOC, and VOC are also emitted during the breakdown or combustion of biological materials. NO_x is generally associated with combustion including farm vehicle, tractor, and irrigation engines, and with agricultural and forestry burning. PM may be either emitted directly (e.g., as dust or smoke) or formed in the atmosphere from other pollutants, such as ammonia from animal operations or fertilizer applications. Conservation activities that may be used to reduce PM generation include establishing a no-till system to reduce tillage-induced particulate matter, modifying tillage or harvest operations to reduce particulates by at least 20 percent below required levels, and enhancing existing field borders to a width of at least 40 feet and establishing a mixture of species along the edges of fields. Activities that reduce the production of ozone-utilizing integrated pest management (IPM) include prevention, avoidance, monitoring, and suppression (PAMS) techniques to reduce ozone precursor emissions related to pesticides.

GHG emissions are a global concern. While agricultural emissions of GHGs are minor compared to other sectors such as industry, transportation, and electric generation, agriculture is also both a source and an important means of reducing GHGs. Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are the primary GHG of concern from agricultural operations. However, agriculture and forestry are also an important means of reducing GHG through soil and biomass carbon sequestration. Anthropogenic sources of CO₂ in agriculture are combustion processes and soil tillage. N₂O is emitted from nitrogen conversion processes in the soil and manure piles, while methane is primarily from animal production and manure storage. Planting tree species, managing livestock grazing for higher plant growth to increase the rate of carbon sequestration (capture), and managing nutrient applications are some activities used to address GHG emissions.

Another air quality issue related to agriculture is odor. The main classes of odorous compounds produced by agricultural sources are VOCs, odorous sulfur compounds, and ammonia. Agricultural odors typically arise from animal operations, manure management, and land application of manure. Conservation activities such as feed management, nutrient management, manure management, and lagoon covers can reduce the production and emission of odorous compounds.

3.4 Plant Resource Concerns

Plants provide food, fiber, and energy for people and livestock; and food, cover, and shelter for wildlife. A main objective of agricultural or forestry operations is to grow healthy, productive plants. Depending on the land use, this may involve planting annual crops, planting or managing native or introduced vegetation, or some combination of these. Healthy plant communities on rangeland, native and naturalized pastures, and forest lands protect and improve soil quality,

reduce soil erosion, improve water quality, provide forage for livestock and wildlife, provide habitat for wildlife, provide fiber and energy, and sequester carbon.

Where vegetation has been planted on agricultural lands, historically stands of monocultural, even aged and often introduced grasses and trees have predominated. During recent years, efforts have been undertaken to reintroduce diverse vegetative communities of native species. The emphasis on longleaf pine (*Pinus palustris*) and reestablishment of longleaf pine ecosystems in the Southeast under CRP is one example.

NRCS has encouraged and facilitated this process through the development of ecological site descriptions that describe how disturbance affects a specific native plant community and help planners and landowners to understand the processes that may be needed to restore the historic native plant community.

Noxious and invasive plant and animal species, and a host of introduced diseases, are a growing concern across the Nation. Once a nonnative, invasive species has been introduced, monitoring and control can be a monumental task. Invasive plants may crowd out native plants, make areas more susceptible to catastrophic fire, degrade habitat for native wildlife, and may harm economic, environmental, and human health. Noxious, invasive species reduce productivity (e.g., spongy moth), and may even threaten the continued existence of native species and, ultimately, change the historic vegetative composition of entire ecosystems (e.g., chestnut blight and more recently redbay ambrosia beetle). The economic impact of these species on the United States economy is estimated in the billions of dollars,²⁴ and agricultural, forest, and other private landowners spend millions of dollars for control of noxious and invasive species each year.

Over 13,000 species of native plants are considered to be “at risk” in the United States.²⁵ Of these, 943 plant species are currently listed as threatened or endangered (Table 1). The distribution of at-risk plant and animal species across the United States is shown in Figure 5. The major risks to plants include many of the same factors that result in declining animal population such as destruction or alteration of habitat, spread of invasive species, emergence of lethal disease, and changes in climate.²⁶

Conservation activities address plant natural resource concerns by removing and replacing invasive plants, changing management, and otherwise maintaining and improving habitat. On pasture and range lands, activities may involve improving the availability of forage and management of livestock, controlling or managing access, controlling noxious and invasive species, enhancing wildlife food and cover, and enhancing plant biodiversity. On forest land, activities often involve planting and/or managing trees and shrubs to promote productivity, health and vigor; improving wildlife food and cover; controlling noxious and invasive species; and enhancing plant biodiversity. Specific conservation practices that have traditionally been used to address plant natural resource concerns are summarized in Appendix B.

²⁴ Westbrooks, R.G. 1998. *Invasive Plants: Changing the Landscape of America*. Fact book produced by the Federal Interagency Committee for the Management of Noxious and Exotic Weeds. Washington, D.C. 107 pp.

²⁵ For more information on at-risk species, see NatureServe, 2018, <https://www.natureserve.org/about-us/annual-reports/natureserves-2018-annual-report/>.

²⁶ Steni, B.A. and K. Gravuer, 2008. *Hidden in Plain Sight: The Role of Plants in State Wildlife Action Plans*. NatureServe, <https://www.natureserve.org/biodiversity-science/publications/hidden-plain-sight-role-plants-state-wildlife-action-plans>.

3.5 Animal Resource Concerns

Agricultural lands provide important habitat for many aquatic and terrestrial wildlife species. Like all animals, fish and wildlife need food, water, and cover/shelter/structure. Connectivity of habitats, space, and balance among populations are important, and fish also need appropriate water quality. When people use the land, whether it is for agriculture, forestry, industry, or urban and suburban development, they change the quantity and quality of the wildlife habitat. As a result, the types and numbers of wildlife that can live on the land and in the associated waters change as well.

Currently, 718 species of animals in the United States are listed as threatened or endangered by the U.S. Fish and Wildlife Service (Table 1). Approximately one-third of wildlife species have been designated by the individual states as being “at risk” or “species of concern.” The geographic distribution of these species in the United States is shown in Figure 5. The percentage of native at-risk wildlife is higher in fresh waters (37 percent) than in forests (19 percent) or grasslands and shrublands (18 percent) (Heinz Center 2008).²⁷ Declines in migratory bird species in particular have been documented around the world.²⁸ These declines may be due to a number of factors, including habitat conversion and fragmentation, changes in land management and use, herbicide and pesticide use, and threats to wintering and migratory habitats. Many of these same factors impact other wildlife species as well.

Table 2. Numbers of Animals and Plants Listed as Threatened or Endangered in the U.S. (from U.S. Fish and Wildlife Service <https://ecos.fws.gov/ecp0/reports/box-score-report>, as of Thursday, 05 Mar 2020, 19:13:02 GMT)

Group	Endangered	Threatened	Total Listings
Amphibians	21	15	36
Arachnids	12	0	12
Birds	77	22	99
Clams	76	15	91
Corals	0	7	7
Crustaceans	24	4	28
Fishes	94	73	167
Insects	74	13	87
Mammals	66	28	94
Reptiles	16	29	45
Snails	40	12	52
Animal Totals	500	218	718
Plant Totals	772	171	943

²⁷ H. John Heinz III Center for Science Economics and the Environment. 2008. The State of the Nation’s Ecosystems: Focus on Wildlife. Washington, D.C.

²⁸ For information and examples related to the decline of migratory bird species, see <https://www.scientificamerican.com/article/silent-skies-billions-of-north-american-birds-have-vanished/>, and U.S. Fish & Wildlife Service Migratory Bird Program, <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>.

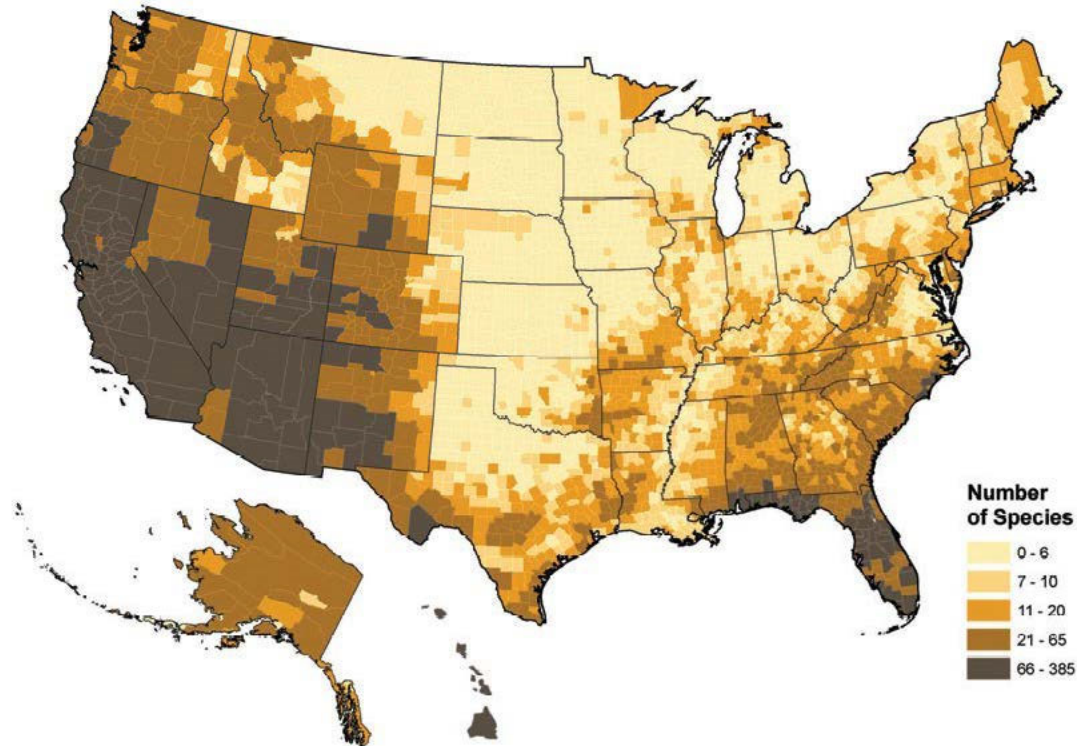


Figure 5. Geographic Distribution (by County) of At-Risk Species (from Flather, et. al 2013)²⁹

Pollinators are another important subset of terrestrial wildlife critical to the reproduction of many plant species upon which humans and wildlife depend. Native bees, which number more than 4,000 species in North America, are thought to be declining in number due to habitat loss, pesticide use, and disease among other factors.³⁰

Conservation activities can address fish and wildlife natural resource concerns by changing food availability; improving water availability and quality; and protecting, improving, or manipulating habitat to benefit specific species. Many activities involve the establishment or management of vegetation, although a few involve structural measures such as fence modifications. Specific conservation practices that have traditionally been used to address fish and wildlife natural resource concerns are summarized in Appendix B.

Resource concerns associated with livestock include feed and forage imbalance, inadequate shelter, and inadequate quantity or quality of water. To reduce stress and mortality and maximize productivity, livestock producers must provide adequate food, water, and cover. They also must handle overall health care, reproduction, and manure management.

Conservation activities are used to address livestock resource concerns by: (1) managing forage production through manipulation of the intensity, frequency, duration, distribution, and season of grazing; (2) incorporating native grasses and legumes into the forage base; (3) improving livestock shelter and water supplies and systems; and (4) managing livestock manure. Because

²⁹ Flather, Curtis H.; Knowles, Michael S.; Jones, Martin F.; Schilli, Carol. 2013. Wildlife population and harvest trends in the United States: A technical document supporting the Forest Service 2010 RPA Assessment. Gen. Tech. Rep. RMRS-GTR-296. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 94 p.

³⁰ For more information, see the Xerces Society, <http://www.xerces.org/pollinator-conservation/>.

the presence and management of livestock may impact natural resources such as soil and water quality, consideration of the impacts of livestock and any planned management upon these resources must be considered. Specific conservation practices that have traditionally been used to address livestock resource concerns are summarized in Appendix B.

3.6 Energy Resource Concerns

Energy-related costs are a significant agricultural operating expense. On-farm energy conservation saves money for the farmer, reduces overall national energy consumption, and reduces air pollution and GHG emissions. In some cases, on-farm energy generation is possible through the production of biogas and capture of wind, solar, and geothermal energy. Agriculture and forestry can also be sources of biomass for renewable energy generation.

Conservation activities to address energy concerns include those that increase efficiency, for example, by reducing the number of trips made by a tractor across a field or the amount of irrigation water that must be pumped. Other activities may assist producers in collecting, storing, and utilizing biogas produced on the farm or generating other forms of renewable energy. Specific conservation practices that have traditionally been used to conserve energy are shown in Appendix B.

3.7 Socioeconomic Considerations

The planning and environmental evaluation process includes consideration of economic, social, and cultural resource factors. Some of the economic aspects that are addressed in formulating and evaluating conservation plans include: cost effectiveness, financial condition, markets, levels of inputs and management required, base acreage, USDA program eligibility, and sustainability. Social considerations include public health and safety, values, client characteristics, risk tolerance/aversion, and tenure. Cultural considerations include absence or presence of cultural resources, significance of cultural resources, effects of conservation activities on cultural resources, and any necessary mitigation of adverse effects.

Agricultural and forest lands provide income for operators and landowners. In turn, local economies benefit from the income and operating expenses that flow through the community. Communities are also impacted by offsite effects of agricultural operations on natural resources such as soil, water, and air and social values such as scenic beauty.

NRCS conducts outreach to help historically underserved groups participate in conservation programs.³¹ These groups include socially disadvantaged and beginning farmers and ranchers. In the “2017 Census of Agriculture,” socially disadvantaged farmers and ranchers were found to number 204,510 or 10 percent of all farmers in the United States, while 597,377 (29.3 percent) were listed as being on their present farm or ranch for less than 10 years, (i.e., beginning farmers and ranchers).³² Figures 6 and 7 illustrate the general locations of socially disadvantaged and beginning farmers across the United States. Greenhouse gas and/or carbon sequestration benefits and equity are key criteria for Partnerships for Climate-Smart Commodities—projects will center

³¹ See Section 2708 of the 2008 Farm Bill for information on incentives for historically underserved groups.

³² 2017 Census of Agriculture,

https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Race,_Ethnicity_and_Gender_Profiles/cpd99000.pdf

around benefits to producers and will be evaluated on the meaningful inclusion of small and historically underserved producers.

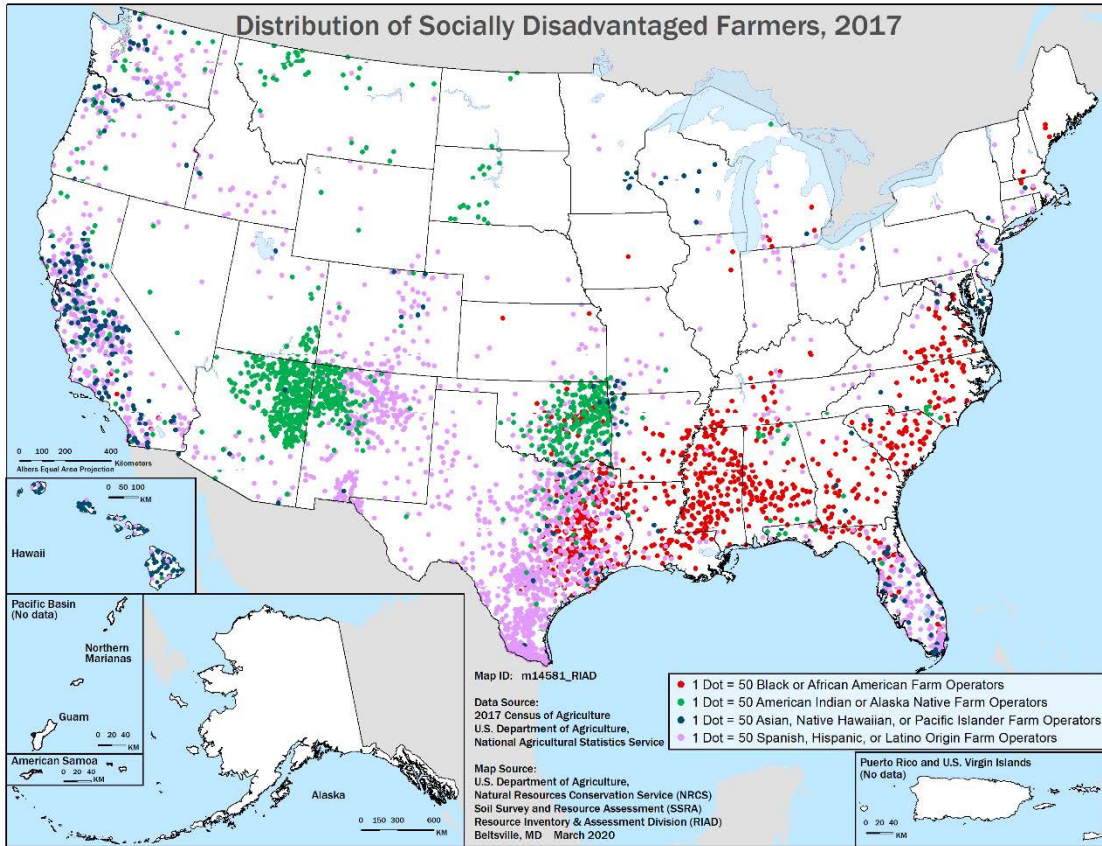


Figure 6. Geographic Distribution of Socially Disadvantaged Farmers and Ranchers.

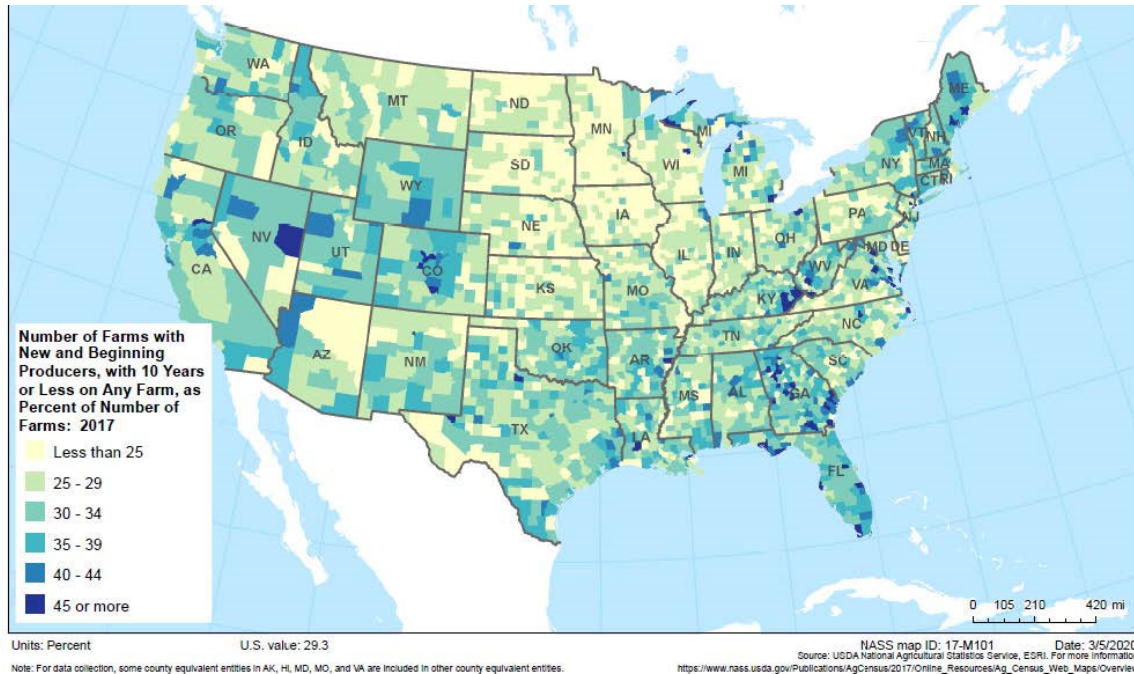


Figure 7. Geographic Distribution of Beginning Farmers.

4. Environmental Effects

4.1 Approach to Impact Analysis

The purpose of Partnerships for Climate-Smart Commodities is to promote environmentally beneficial agricultural and forestry practices that will reduce GHG emissions or sequester carbon. Therefore, while implementation of Partnerships for Climate-Smart Commodities could have some minor short-term or local adverse impacts at specific sites, it is expected overall to have beneficial effects on the environment.

The implementation of Partnerships for Climate-Smart Commodities projects may involve the application of one or more NRCS climate-smart practices on private agricultural and nonindustrial forest lands. Practices are typically implemented under a plan of operations that involves a system of practices to address multiple resource concerns. The potential impacts of the most common practices planned and implemented under NRCS programs are well-known and are summarized in Appendix B for cropland, grazing land, forest land, and animal feeding operations. When applied appropriately, a subset of these practices (see section 4.2) also may deliver quantifiable reductions in greenhouse gas emissions and/or increases in carbon sequestration. Many offer co-benefits and ancillary benefits that help operations build climate change resilience while addressing other natural resource concerns such as soil health, water quality, pollinator and wildlife habitat and air quality.

NRCS policy requires that NRCS conservation planners must minimize adverse impacts to environmental resources when providing technical and financial assistance. As such, the planning process is intended to implement conservation practices that address, improve, and mitigate for environmental resources concerns. Generally, partners will follow the NRCS planning policy and procedures, especially for those projects where NRCS CPSs are being applied. NRCS will specify within the grant agreement terms and conditions, which policies

need to be followed and the associated reporting requirements. All conservation practice standards and State-specific conservation practice specifications include considerations that ensure the minimization of potentially adverse impacts to associated resources. NRCS has developed network effects diagrams that depict typical impacts of conservation practices (see Appendix A). While all activities under Partnerships for Climate-Smart Commodities are anticipated to be environmentally beneficial by design, implementation of ground-disturbing activities other than NRCS conservation practice standards may have impacts beyond those anticipated and described herein. Non-ground-disturbing activities including, but not limited to, marketing, educational, and outreach would not be expected to have adverse impacts on the human environment.

Conservation practice standards applicable to the planning and implementation of each practice are found in the National Handbook on Conservation Practices Standards and Section IV of the electronic Field Office Technical Guide (eFOTG) for each State. The environmental benefits—including increasing soil carbon storage—of conservation practices are evaluated in detail in *Conservation Practices on Cultivated Cropland*³³ (p. 46, How Did Conservation Adoption Affect Resource Concerns and p. 99 Soil Carbon) and *Fish and Wildlife Response to Farm Bill Conservation Practices*³⁴ are incorporated by reference. Activities implemented under the Partnerships for Climate-Smart Commodities Partnership funding opportunity are expected to provide the same benefits as traditional conservation practices if planned and implemented in line with the existing conservation practice standards. NRCS has also summarized general effects of each conservation practice upon natural resource concerns in the Conservation Practices Physical Effects (CPPE). Network diagrams have also been developed for each of these conservation practices that depict the chain of natural resource effects resulting from practice implementation. Network diagrams for all the conservation practices are available on the NRCS website,³⁵ are discussed in Appendix A, and are hereby incorporated by reference. The practice standards, CPPE information, and network diagrams³⁶ are incorporated by reference into the following discussion of impacts for each alternative. Appendix B provides a table of the most common conservation practices to address resource concerns.

4.1.1 Programmatic Analysis

The analysis that follows provides information from a broad programmatic or national perspective on the potential impacts on the human environment associated with implementation of Partnerships for Climate-Smart Commodities. This Programmatic EA identifies the effects that are a reasonably foreseeable result of proposed action and no action alternatives. These qualitative assessments are based on a review of the best available scientific studies and methodological approaches, as well as professional judgment. In assessing impacts, consideration has been given to:

³³ Conservation Practices on Cultivated Cropland: A Comparison of CEAP I and CEAP II Survey Data and Modeling. March 2022. CEAP National Report. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1893221.pdf

³⁴ Fish and Wildlife Response to Farm Bill Conservation Practices. September 2007. The Wildlife Society. Technical Review 07-1. https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/PDF/full_report.pdf

³⁵ NRCS Conservation Practices Website, includes for each Conservation Practice the Standard Document, Practice Overview, CPPEs, and Network Effects Diagrams:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/neps/>

³⁶ Ibid

- Permanence of an impact.
- Potential for natural attenuation of the impact.
- Uniqueness or replaceability of the resource.
- Abundance or scarcity of the resource.
- Potential mitigation measures that can offset or reduce the anticipated impact.

The potential environmental effects are analyzed according to soil, water, air, plants, animals, energy, and human resources (SWAPA+EH). Additionally, special environmental concerns (SECs) identified in NRCS regulations, 16 environmental laws, and Executive Orders are included in the SWAPA+EH analysis, as appropriate, and include:

- Prime and unique farmlands.
- Clean Water Act.
- Floodplain management.
- Wetlands.
- Wild and scenic rivers.
- Coastal Zone Management Act.
- Coral reefs.
- Clean Air Act.
- Endangered and threatened species.
- Noxious and invasive species.
- Essential fish habitat.
- Migratory birds.
- Riparian areas.
- Natural areas.
- Scenic beauty.
- Cultural resources/historic properties.
- Environmental justice

The analysis concentrates on the environmental impacts of climate-smart practices likely to be implemented under the Proposed Action alternative and the resource concerns most likely to be addressed. While Partnerships for Climate-Smart Commodities targets climate-smart commodities, the implementation of climate-smart practices utilizing the traditional NRCS conservation practice standards for this purpose is expected to address substantively similar resource concerns to other NRCS programs. Many of the climate-smart practices likely to be implemented under Partnerships for Climate-Smart Commodities will utilize the same NRCS Conservation Practices Standards as those for several Farm Bill programs, so the practice and activity impacts for those programs are incorporated by reference, as follows: Chapter 3 in the 2009 EQIP Programmatic EA, Chapter 5 in the 2016 EQIP Programmatic EA, and Chapter 4 in

the 2020 EQIP Programmatic EA;³⁷ Chapter 4 in the 2009 CSP Programmatic EA and Chapter 4 in the 2020 CSP Programmatic EA;³⁸ Chapter 5 in the 2016 ACEP Programmatic EA and Effects of Alternatives (p. 14-22) in the 2020 ACEP Programmatic EA.³⁹ This Programmatic EA also incorporates by reference the findings of the RCA Appraisal: Soil and Water Resources Conservation Act (RCA), and the Conservation Effects Assessment Project (CEAP) findings described in a series of CEAP cropland, wildlife, wetlands, and grazing lands assessment reports.⁴⁰ Based on the results identified in these program NEPA documents, on the network effects diagrams associated with NRCS conservation practices, and results discussed in CEAP studies, beneficial impacts under the proposed action are expected as follows: soil erosion will decrease; soil, air, and water quality will improve; water will be used more efficiently; plant condition and wildlife habitat will improve; energy will be used more efficiently; and, of course, reductions in GHGs and increases in carbon sequestration are expected as well.

NRCS has developed network effects diagrams to illustrate the chain of expected direct, indirect, and cumulative effects of applying each conservation practice according to the standard for the land use on which it is intended. Network effects diagrams also include other practices to be considered in conjunction with the primary practice. Copies of the network effects diagrams are available on the NRCS website.⁴¹ The methodologies used to develop the network effects diagrams and determine the effects of NRCS conservation programs are described in Appendix A.

4.1.2 Environmental Evaluation

Activities implemented through the Partnership for Climate-Smart Commodities funding opportunity may be the same as those associated with the other NRCS programs, emphasizing those conservation practices with benefits for GHG and carbon sequestration. This programmatic analysis is mainly based upon implementation of NRCS conservation practice standards and planning, which have well-known impacts when implemented correctly in normal farming, ranching, and forestry contexts. In addition to this programmatic review, NRCS undertakes environmental reviews at subsequent stages of program implementation consistent with NEPA requirements, other statutory requirements for protection of the environment, and NRCS regulations. This additional tiered review as necessary includes conducting an environmental evaluation (EE) with successful Partnerships for Climate-Smart Commodities partner applicants before practices are implemented.

³⁷ USDA, NRCS. Environmental Quality Incentives Program: Programmatic Environmental Assessment. May 2020, March 2016, and January 2009.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ecosciences/ec/?cid=nrcs143_008451

³⁸ USDA, NRCS. Conservation Stewardship Program: Programmatic Environmental Assessment. April 2020 and June 2009.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ecosciences/ec/?cid=nrcs143_008451

³⁹ USDA, NRCS. Agricultural Conservation Easement Program: Programmatic Environmental Assessment. May 2020 and September 2016.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ecosciences/ec/?cid=nrcs143_008451

⁴⁰ CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. CEAP website: <https://ceap-nrcs.opendata.arcgis.com/>

⁴¹ Practice Network Effect Diagrams are available at

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/neps/?cid=nrcs143_026849

The EE is a project-specific consideration of direct and indirect impacts related to conservation practice implementation. The EE identifies relevant resource concerns and alternatives, evaluates potential impacts, and determines needed mitigation for soil, water, air, plant, animal, and human resources that may exist on sites. The EE also determines if there is a potential for planned activities to impact protected resources by addressing, as appropriate, “special environmental concerns” including the Clean Air Act; Clean Water Act; coastal zone management areas; coral reefs; cultural resources; endangered and threatened species; environmental justice; essential fish habitat; floodplain management; invasive species; migratory birds; natural areas; prime and unique farmlands; riparian areas; scenic beauty; wetlands; wild and scenic rivers; and any applicable State or local concerns, laws, ordinances, or other regulations. NRCS guidance on the EE process and definitions of protected resources can be found in the NRCS National Environmental Compliance Handbook (2016).⁴²

It also documents consideration of the cumulative effects that result when impacts from conservation practice implementation are added to other past, present, and reasonably foreseeable future actions by federal or non-federal agencies/organizations. The EE assesses the effects of conservation alternatives and provides information used by the Responsible Federal Official to determine the need for consultation under other laws (i.e., NHPA, ESA, CWA, etc.) and/or to develop an additional EA or EIS consistent with NEPA and NRCS regulations.

Further, when a conservation practice or activity may result in adverse impacts to the condition of another resource, additional conservation practices or other mitigation measures are integrated to avoid creating new resource concerns. This EE process helps to ensure that all potential impacts to natural resources are identified, and appropriate alternatives and practices are available for avoiding adverse impacts. The results of these analyses are documented on an EE worksheet before funding is provided.

Partnerships for Climate-Smart Commodities also provides flexibility for partners to propose innovative approaches that may not use NRCS’ conservation practice standards. Project-specific documentation of ground-disturbing impacts under NEPA will be required for Partnerships for Climate-Smart Commodities projects that will not use NRCS’ CPSs, unless all of the proposed activities can be categorically excluded from the requirement under USDA ([7 CFR Parts 1b, 7 CFR 650](#)).

4.1.3 Conservation Effects Assessment Project (CEAP)

Although supporting the production and marketing of climate-smart commodities is the primary goal of Partnerships for Climate-Smart Commodities, this will be accomplished through implementing climate-smart production practices, activities, and systems on working lands; measuring, monitoring and verifying carbon and greenhouse gas (GHG) benefits associated with those practices; and marketing and promoting the resulting climate-smart commodities. Since many of the climate-smart practices potentially align with existing NRCS Conservation Practice Standards (CPSs), a look at CEAP provides some broad insight into the those practices. With most cultivated cropland in the United States under moderate to high levels of conservation

⁴² NRCS National Environmental Compliance Handbook. 2016. Available through the NRCS electronic directives system at: <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=39475.wba>

treatment, the Conservation Effects Assessment Project (CEAP)⁴³ assessment data indicates that opportunities exist to improve conservation performance using currently available tools. NRCS evaluates conservation trends and effects on cultivated cropland through the multiagency CEAP. CEAP uses natural resource and farmer survey data and physical process modeling to estimate the environmental effects of conservation practices on cultivated cropland. USDA's National Agricultural Statistics Service conducted the first set of farmer surveys in 2003–06 (CEAP I) with reports released from 2010 through 2014. Now, comparison data from farmer surveys conducted for 2013–16 (CEAP II) make it possible to estimate shifts in conservation adoption and effects between the CEAP survey periods.

The agricultural landscape is dynamic, shaped by public policy, technology, and natural resource drivers among others, which together affect farmer decisions and conservation trends. Between the CEAP surveys, increased demand and higher prices for commodities encouraged production expansion in nearly all regions of the country.

A warming climate, longer growing season, and advances in seed technology and higher yielding crop varieties drove cropping pattern shifts, most notably in the northern and southern plains where corn and soybean production replaced wheat and other close-grown crops that had lower average nutrient needs and fallow periods. Between CEAP I and CEAP II, farmers' adoption of conservation practices resulted in more cultivated cropland meeting loss thresholds for erosion, sediment, surface nitrogen and sediment-transported phosphorus. While use of advanced nutrient technologies increased, by CEAP II more cultivated cropland exceeded loss thresholds for subsurface nitrogen and soluble phosphorus, reflecting the growth in high-nutrient-demand crop varieties, the increase in conservation tillage systems, and the decline in nutrient incorporation. These trends provide evidence of the types of beneficial environmental impacts projected below and that may be expected from Partnerships for Climate-Smart Commodities.

4.2 Effects of Alternative 1: No Action – Partnerships for Climate-Smart Commodities is not implemented

If Partnerships for Climate-Smart Commodities did not fund any climate-smart projects, benefits in GHG reductions and carbon sequestration discussed for Alternative 2 would not be realized. NRCS would continue to implement conservation practice standards through its financial assistance under various Farm Bill programs. A subset of the common practices implemented by NRCS have positive effects on climate variables—these climate-smart agriculture and forestry mitigation practices are divided into mitigation categories, as follows:

- **Soil Health** – Reducing emissions and enhancing soil carbon sequestration.
- **Improved Nitrogen Management** – Implementing the 4Rs of nitrogen management and reducing nitrous oxide, a potent greenhouse gas. The 4Rs are Right Source, Right Rate, Right Time and Right Place.
- **Improved Livestock Waste Management Systems** – Reducing potent methane emissions from manure.

⁴³ CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. CEAP website: <https://ceap-nrcs.opendata.arcgis.com/>

- **Enhanced Grazing Land Management** – Reducing emissions and building soil carbon stocks in grazing systems.
- **Improved Agroforestry, Forestry and Upland Wildlife Habitat** – Building carbon stocks in perennial biomass and soils.
- **Restored Disturbed Lands** – Improving the quality of previously mined or degraded lands to increase soil and perennial biomass carbon stocks.
- **Precisely Managed Water on Rice Fields** – Reducing methane emissions from rice fields by minimizing methane production during the growing season.

Even if practices in these categories are not always targeted for the specific purpose of GHG reduction and/or carbon sequestration, there would be continued indirect benefits for climate change when they are implemented for other primary purposes. However, without a targeted focus on reducing GHGs and carbon sequestration, it is likely that these benefits would be minor when compared with potentially substantial beneficial impacts under Alternative 2.

Given the well-known impacts and standards of implementation for conservation practice standards, it is likely that adverse impacts associated either alternative would not be meaningfully different. Any adverse impacts of implementing conservation practices under either Alternative 1 or Alternative 2 are expected to be local and/or temporary minor effects that would be mitigated through the EE process.

4.3 Effects of Alternative 2: Proposed Action – Implement Partnerships for Climate-Smart Commodities

Implementing the proposed action means establishing funding partnerships as described in the introduction to implement climate-smart activities that reduce GHGs or sequester carbon, with the resulting production of such commodities and establishment of markets for them. Partners could implement a wide variety of climate-smart projects with these beneficial impacts, as well as benefits to small and historically underserved producers. Associated adverse impacts are possible on a short-term and/or local basis at specific sites, but if conservation practice standards are utilized, these impacts are expected to be minor and would be evaluated through and mitigated under planning and tiered analysis in EEs.

4.3.1 Soil, Water, Air, Plant, Animal, and Energy Resources

Partnerships for Climate-Smart Commodities participants may install and adopt climate-smart practices and enhance existing practices in place on the operation to achieve climate-smart goals. Partnerships for Climate-Smart Commodities may build upon practices implemented through EQIP, CSP, or other programs to help the producer achieve further reductions in GHGs and carbon sequestration. These climate-smart practices, though meant to support climate-smart markets and produce climate benefits, also are likely to have positive effects on soil, water, air, plant, animal, and energy resources.

Approximately 169 NRCS conservation practices are available at the national level to address common natural resource concerns.⁴⁴ Examples of conservation practices commonly used by

⁴⁴ See National Handbook of Conservation Practices (450-NHCP-620, Amend. 18, September 2019) and individual conservation practices, <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/>, for information on specific conservation practices approved for use at the national level.

program participants to address natural resource concerns on crop, range, pasture, and forest lands under the 2008 and 2014 Farm Bill programs are provided in Table 3.

Table 3. Examples of NRCS Conservation Practices and Applicability by Land Use.

Practice Name	Code	Crop	Pasture	Range	Forest
Brush Management	314		X	X	X
Conservation Crop Rotation	328	X			
Residue & Tillage Management, No-Till	329	X			
Prescribed Burning	338		X	X	X
Cover Crop	340	X			
Critical Area Planting	342	X	X	X	X
Residue Management, Reduced Till	345	X			
Windbreak/Shelterbelt Establishment/Renovation	380/650	X	X	X	
Fuel Break	383		X	X	X
Woody Residue Treatment	384				X
Field Border	386	X			
Riparian Herbaceous Cover/Forest Buffer	390/391	X	X	X	
Filter Strip	393	X			
Fire Break	394		X	X	X
Stream Habitat Improvement & Management	395	X	X	X	X
Irrigation Water Management	449	X	X		
Forage Harvest Management	511		X		
Forage & Biomass Planting	512		X		
Prescribed Grazing	528		X	X	X
Range Planting	550			X	
Tree/Shrub Establishment	612				X
Restoration/Mgmt of Rare & Declining Habitats	643	X	X	X	X
Wetland Wildlife Habitat Management	644	X	X	X	X
Upland Wildlife Habitat Management	645	X	X	X	X
Early Successional Habitat Development/Mgmt	647	X	X	X	X
Road/Trail/Landing Closure and Treatment	654				X
Forest Trails & Landings	655				X
Tree/Shrub Pruning	660				X
Forest Stand Improvement	666				X

There are indirect effects associated with application of conservation activities. For example, activities associated with reducing soil erosion on cropland have indirect effects that include decreased sediment and turbidity in surface waters, improved aquatic habitat, improved air quality, improved crop productivity, and often improved energy efficiency. Similar impacts result from improved management of livestock and vegetation on pasture and range lands.

Activities applied on forest land may indirectly improve water quantity and quality, improve air quality, and restore or enhance wildlife habitat. Wildlife activities may indirectly improve air and water quality and often result in the creation of potential recreational opportunities. An overview of the potential impacts of applying conservation practices on cropland, grazing lands, and forests is provided in Appendix A (and incorporated herein by reference) of the 2009 EQIP Programmatic EA.⁴⁵

While practices are being implemented, there can be short-term and localized impacts during installation of practices that, on balance in the long-term, are beneficial for the environment. The locations and extent of those impacts cannot be determined at the national level. This is one of the reasons the site-specific EE process, discussed earlier, is so valuable. This process ensures those site-specific impacts are fully evaluated relative to their local environment and community. Those impacts are also disclosed at broader scales in the network effects diagrams.

Soil, water, air, plant, animal, and energy resources are expected to improve under the proposed action, while providing associated benefits for climate. In general, implementation of

⁴⁵ USDA, NRCS. Environmental Quality Incentives Program. Programmatic Environmental Assessment. January 2009. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ecosciences/ec/?cid=nrcs143_008451

conservation practices for Partnerships for Climate-Smart Commodities projects would decrease soil erosion; improve soil, water, and air quality; more efficiently use water and energy; improve plant conditions; and improve food, water, and shelter needs for livestock and wildlife. Associated reductions in GHGs and increases in carbon sequestration will occur when specific climate-smart practices are implemented.

Broader Purposes

The NFO for Partnerships for Climate-Smart Commodities expands potential partner activities beyond traditional NRCS conservation practice standards to further the potential for conservation benefits associated with reductions in GHGs and carbon sequestration. NRCS has always considered impacts of existing management and planned conservation practices on the whole gamut of environmental resources as part of its EE process described above.

The program adds purposes to encourage the flexible and streamlined delivery of technical assistance to producers through grant agreements that engage producers and eligible partners in climate-smart projects to achieve greater environmental outcomes and benefits than would otherwise be achieved. This is expected to make it easier for more partners and more producers to participate in Partnerships for Climate-Smart Commodities. Environmental benefits from reducing GHGs and carbon sequestration are anticipated to increase as a result.

4.3.2 Socioeconomic Concerns

USDA conducts outreach to prevent limiting producer participation because of size or type of operation or production system. Outreach efforts have targeted historically underserved producers, specialty crop and organic producers, and other groups identified at the State and local levels. Under Partnerships for Climate-Smart Commodities, historically underserved producers will be a primary target inherent in funding decisions.

As noted previously, agricultural operations can have direct, indirect, and cumulative impacts on the human environment. Implementation of climate-smart activities on these operations also produces benefits both onsite (to the farm and the farmer) and offsite (to the community and environment) as natural resource concerns are addressed.

Economic Market Expansion. There are expected impacts on national, state, and local markets as the opportunity intends to build markets and invest in America's climate-smart farmers, ranchers, and forest owners to strengthen U.S. rural and agricultural communities. Funding is anticipated for a variety of projects such that this emerging marketplace starts out with robust competition and options for producers. The result of this is anticipated to be more climate-smart products in the market-place and more associated income for producers. USDA will support the production and marketing of climate-smart commodities through a set of pilot projects that provide voluntary incentives through partners to producers and landowners.

4.3.3 Climate Change

Through Partnerships for Climate-Smart Commodities, USDA will support the production and marketing of climate-smart commodities through a set of pilot projects that provide voluntary incentives through partners to producers and landowners, including early adopters, to:

- a. implement climate-smart production practices, activities, and systems on working lands,

b. measure/quantify, monitor and verify the carbon and greenhouse gas (GHG) benefits associated with those practices, and

c. develop markets and promote the resulting climate-smart commodities.

Among other reporting elements, USDA will require each project to report greenhouse gas and carbon sequestration benefits accrued and associated with the production of climate smart commodities.

Climate change presents real threats to U.S. agricultural production, forest resources, and rural economies. These challenges are complex as agriculture generates 11% of GHG emissions in the U.S. (Figure 8) through sources such as livestock, agricultural soils, and rice production. However, land use, land-use change, and forestry in the U.S. are together a net sink and remove approximately 13% of GHG emissions.⁴⁶ There are substantial implications for farmers, ranchers, and forest landowners. Land managers across the country are already feeling the pressures of a changing climate and its effects on weather. As these risks continue and amplify, producers will be faced with the challenges of adapting.

⁴⁶ Environmental Protection Agency. 2022. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020. EPA 430-R-22-003. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

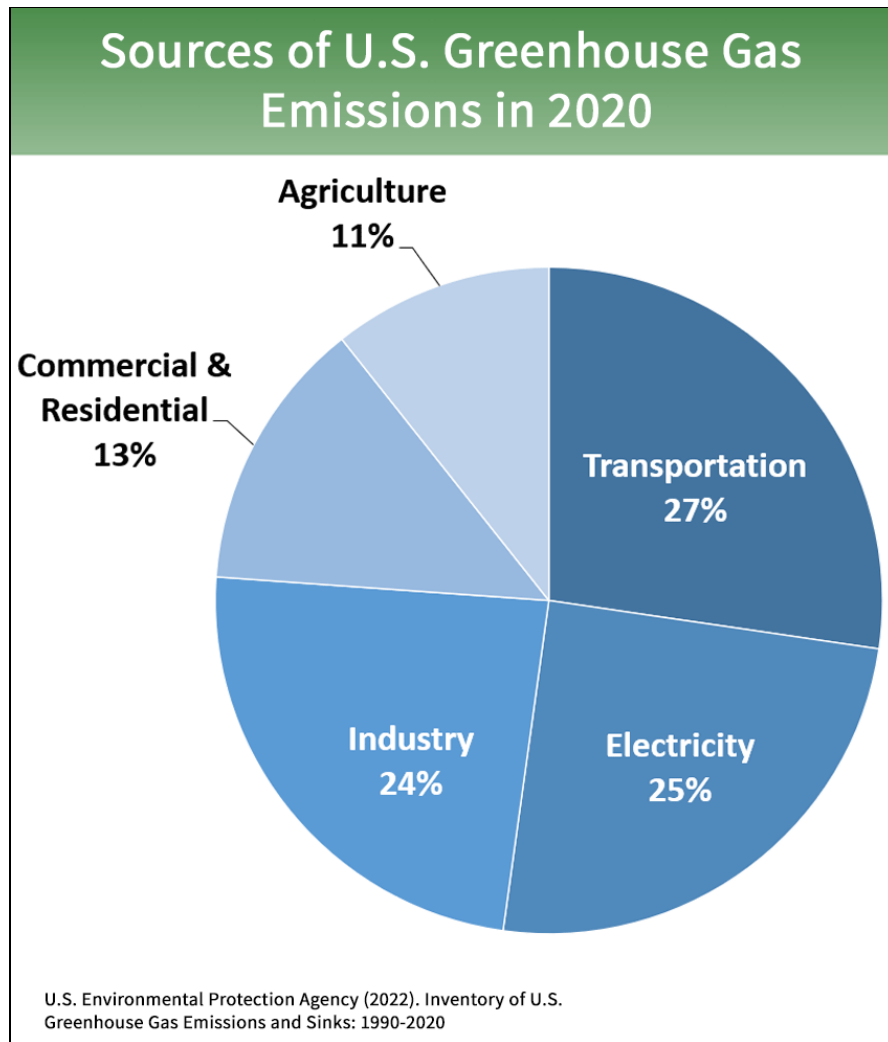


Figure 8. Sources of U.S. Greenhouse Gas Emissions in 2020.

The USDA has supported research⁴⁷ showing reductions in greenhouse gas emissions and carbon sequestration can occur through a variety of agriculture practices. Schahczenski suggested several farming practices and technologies that can reduce greenhouse gas emissions and prevent climate change by enhancing carbon storage in soils; preserving existing soil carbon; and reducing carbon dioxide, methane, and nitrous oxide emissions. These practices include avoiding forest conversion and promoting reforestation; avoiding grassland conversion; agroforestry; optimizing grazing intensity; biochar; cover cropping; integrating legumes into pastures and grazing lands; irrigation and water management; and biofuels.

Broader studies have begun to document how to quantify the reductions of greenhouse gas emissions from agriculture and forestry when climate-smart practices are applied. One of these studies is a USDA report on quantifying greenhouse gas fluxes in agriculture and forestry.⁴⁸ This USDA report recommends methods to estimate changes in GHG emissions and carbon

⁴⁷ Jeff Schahczenski. 2009 (Updated 2022). Agriculture, Climate Disruption, and Carbon Sequestration. ATTRA Sustainable Agriculture. National Center for Appropriate Technology.

⁴⁸ USDA. 2014. Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory. https://www.usda.gov/sites/default/files/documents/USDATB1939_07072014.pdf

storage at the entity-scale for croplands, grasslands, livestock, forestry, wetlands, and land use change. An ICF International report prepared for USDA in 2016 also presents an analysis of the GHG mitigation potential associated with changes in U.S. agricultural management practices as well as Marginal Abatement Cost Curves for each practice.⁴⁹

More recently, in 2020, the International Panel on Climate Change provided the following:

“Practices that contribute to climate change adaptation and mitigation in cropland include increasing soil organic matter, erosion control, improved fertilizer management, improved crop management, for example rice management, and use of varieties and genetic improvements for heat and drought tolerance. For livestock, options include better grazing land management, improved manure management, higher-quality feed, and use of breeds and genetic improvement. Different farming and pastoral systems can achieve reductions in the emissions intensity of livestock products.”⁵⁰

4.3.4 Special Environmental Concerns

It is not anticipated that the types of activities implemented under Alternative 2 would result in adverse impacts to special environmental concerns, particularly those protected by law, Executive order, or agency policy. Partnerships for Climate-Smart Commodities implementation under the proposed action would not result in adverse impacts to prime and unique farmlands, floodplain management, natural areas, or scenic beauty. Activities conducted under Partnerships for Climate-Smart Commodities are not expected to result in significant increases in new land being brought into agricultural production, intensification of unsustainable agricultural or forestry production, construction of new structures without additional environmental review, or land being converted to nonagricultural uses. Many practices are designed to improve conditions for special environmental concerns, and should result in beneficial impacts to wetlands, wild and scenic rivers, waters of the United States, coastal zone management areas, coral reefs, essential fish habitat, riparian areas, migratory birds, endangered or threatened species, cultural resources, and historic properties. It is also unlikely that project activities would result in a spread of noxious or invasive species; violations of the Clean Air Act or Clean Water Act; or a disproportionately high and adverse effect on the human health or environment of low-income, minority, or Indian populations (environmental justice). In fact, historically underserved producers are a specific focus under Partnerships for Climate-Smart Commodities, resulting in benefits to this group and a reduction in resource concerns on their lands.

The effects of climate-smart practices may vary somewhat depending on the local ecosystems, landscape position, methods of installation, and scope or magnitude of the activity. Impacts are evaluated at a more localized level through additional State and local NEPA analyses when needed and use of a site-specific EE prior to practice implementation as appropriate. State and local regulatory agencies are contacted and consulted, as needed and as appropriate, to ensure

⁴⁹ ICF International. 2016. Managing Agricultural Land for Greenhouse Gas Mitigation within the United States. https://www.usda.gov/sites/default/files/documents/White_Paper_WEB_Final_v3.pdf

⁵⁰ International Panel on Climate Change (IPCC). 2020. Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SPM_Updated-Jan20.pdf

that actions do not adversely affect resources protected by law. NRCS also implements activities in a manner that is consistent with NRCS policy to minimize adverse effects, through appropriate avoidance or other mitigating measures, to the extent feasible.⁵¹ The use of the site-specific EE and other established agency procedures and policies for compliance with two specific regulatory authorities, the National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA), are discussed below.

National Historic Preservation Act

To ensure compliance with section 106 of the NHPA⁵² and associated authorities, NRCS primarily follows the procedures developed in accordance with a nationwide prototype programmatic agreement between NRCS, the Advisory Council on Historic Preservation (ACHP), and the National Conference of State Historic Preservation Officers,⁵³ which called for NRCS to develop consultation agreements with State historic preservation officers (SHPOs) and federally recognized Tribes, or their designated Tribal historic preservation officers (THPOs). These State-level consultation agreements focus historic preservation reviews on resources and locations that are of special regional concern to these parties. Importantly, these consultation agreements also streamline the more inclusive section 106 regulations of the NHPA⁵⁴ by exempting certain types of undertakings from review. For example, conservation activities like planting a cover crop on existing cropland would have little likelihood of affecting historic properties. Such projects would not require consultation if a State-level agreement with SHPOs or Tribes determines the NRCS CPS Cover Crop (Code 340) is not an undertaking when implemented on existing cropland. However, historic preservation review with consulting parties would be necessary under these consultation agreements for undertakings that would likely impact historic properties. In cases where there are no State-level agreements or Tribal consultation protocols for Tribes that have an interest in the activity, NRCS must comply with the provisions of the NHPA Section 106 regulations prior to proceeding to implementation of the action.

A site-specific EE and section 106 review and consultation identifies the likely presence or absence of historic properties that need further consideration under NHPA. In such cases, historic preservation professionals who meet the Secretary of Interior's professional qualification standards conduct onsite identification and evaluation studies as needed to determine whether there are or are not historic properties within the area of potential effects. If historic properties are present, these same historic preservation professionals must report to NRCS whether there would be an effect and define the nature of the effect. If there is an adverse effect, NRCS must determine whether the undertaking (conservation activity or system) may be moved or modified to avoid effects.

If a historic property would be affected by the proposed conservation activity or system (undertaking), the State Conservationist, SHPO, American Indian Tribes/THPOs, and other consulting parties consult on the need for site-specific mitigation measures or treatments, including avoiding adverse effects by relocation or redesign of the conservation activity or

⁵¹ See NRCS Environmental Policy, NRCS General Manual Title 190, Part 410, Subpart A, <https://directives.sc.egov.usda.gov/viewerFS.aspx?id=666>

⁵² 16 U.S. Code 470, as amended.

⁵³ 50ACHP Prototype Programmatic Agreements, https://www.achp.gov/program_alternatives/prototype_pa

⁵⁴ 36 CFR 800.

system, if feasible. If an adverse effect is anticipated, NRCS must submit documentation to the ACHP as part of the section 106 process, and preparation of an EA or EIS may also be warranted. Documentation may include comments from all the consulting parties and a proposed memorandum of agreement agreed upon by all the consulting parties that outline the steps that will be taken to avoid, treat, minimize, or mitigate the adverse effects and afford the ACHP an opportunity to participate in resolution of any potential adverse effects.

Endangered Species Act

For ESA compliance involving Partnerships for Climate-Smart Commodities activities, NRCS would conduct section 7(a)(2) interagency consultation with the appropriate regulatory agency (U.S. Fish and Wildlife Service and the National Marine Fisheries Service (the Services)), as necessary when endangered or threatened species may be affected, or critical habitats may be destroyed or adversely modified. Through the section 7 process, determinations will be made regarding whether the proposed action is “not likely to adversely affect,” or is “likely to adversely affect” endangered or threatened species. When they are present, determinations will also be made regarding impacts to designated critical habitats.

In some States, NRCS has undertaken section 7 programmatic consultations and has a programmatic agreement in place that outlines an agreed-upon process. Certain practices or activities may have been predetermined to be within a category of actions having “no effect” or “may affect, not likely to adversely affect” (including beneficial effects) endangered or threatened species. However, a section 7 programmatic agreement with the Services may also specify measures that are required to be implemented in conjunction with the proposed conservation activities to apply a “no effect” and “may affect, not likely to adversely affect” determination. If such practices or actions are implemented according to the programmatic agreement between the agencies, there may be no further need to consult under section 7 of the ESA.

If a section 7 programmatic agreement is not in effect and the action has the potential for effects (beneficial or adverse), or if the programmatic agreement has predetermined that a conservation activity is “likely to adversely affect” an endangered or threatened species, a site-specific section 7 consultation is needed. This may involve additional analysis and documentation through informal or formal consultation as required by the ESA. In such circumstances, preparation of an EA or EIS may also be warranted under NEPA.

4.3.5 Mitigation and Adaptive Management

In general, as part of the development and planning process for the grant agreements or beneficiary contracts, a project level and/or site-specific EE is prepared and any adverse effects related to natural resource concerns are identified and addressed. NRCS recognizes that an activity designed and intended to improve one resource concern may have unintended adverse consequences that can result in the degradation of one or more other resource concerns. The network effects diagrams described in Appendix A include mitigating practices in those situations where unintended adverse impacts have been identified. NRCS staff and project partners can use these diagrams to assist them in determining the potential for unintended adverse effects and identification of appropriate mitigating actions to comply with NRCS policy to minimize adverse effects, through appropriate avoidance or other mitigating measures, to the

extent feasible.⁵⁵ Programmatic agreements also exist in some States that identify appropriate mitigating measures as discussed above in section 4.5.3.

Adaptive management can also be part of the planning process. Partners may maintain contact with producers and landowners throughout the life of the Partnerships for Climate-Smart Commodities beneficiary contracts and follow-up to ensure that practices are applied to address priority natural resource concerns as agreed to under the beneficiary's contract. Grant agreements or contracts may be drafted consistent to include the chosen alternatives of the environmental reviews, as necessary, to obtain the desired outcomes.

4.3.6 Permits and Permitting

If permits are needed to implement a practice, Partnerships for Climate-Smart Commodities participants are responsible for obtaining them. Grant funding may not be used to fund activities until necessary permits are obtained.⁵⁶

4.3.7 Cumulative Impacts

CEQ regulations stipulate that a cumulative effects analysis be conducted to consider the potential environmental impacts resulting from “the incremental impacts of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency or person undertakes such other actions.”⁵⁷ Cumulative effects most likely arise when a relationship exists between a proposed action and other actions expected to occur in a similar location or during a similar period. An action which overlaps with or is in proximity to other proposed actions would be expected to have more potential for a cumulative effect on the same resources than actions that are more geographically separated. Similarly, actions that coincide, even partially, in time tend to have potential for cumulative effects.

Cumulative impacts have been identified on the network effects diagrams for NRCS conservation practices. Individual conservation activities and systems result in cumulative effects upon soil, water, air, plants, animals, energy, and humans. Soil erosion reductions are additive. Improvements in water quality are produced by a variety of practices on all land uses. Plant productivity increases from the application of a variety of practices on cropland, pastureland, and forest land. Wildlife benefits occur from practices on all land uses. Enhancements require more than the minimum criteria in conservation practice standards be met, and therefore, result in more cumulative benefits than those described in the network effects diagrams for associated practices.

Income stability from agricultural or forest production, community economic returns, and often human health and safety also tend to improve on a cumulative level when practices are applied across the landscape.

Cumulative impacts from other Federal, State, Tribal, and local entities might result from—

- Regulatory mandates and statutory requirements.

⁵⁵ See NRCS Environmental Policy, NRCS General Manual Title 190, Part 410.3, <https://directives.sc.egov.usda.gov/viewerFS.aspx?id=666>

⁵⁶ Compliance with Laws and Regulations, NRCS General Manual Title 450 Part 405.1, <https://directives.sc.egov.usda.gov/RollupViewer.aspx?hid=17079>.

⁵⁷ CEQ Regulations for Implementing NEPA, 40 CFR Part 1508.7, http://energy.gov/sites/prod/files/NEPA-40CFR1500_1508.pdf

- Technical assistance provided by NRCS or partners without financial assistance.
- Financial and technical assistance provided through other conservation or agricultural programs.

The cumulative total of environmental impacts associated with implementation of Partnerships for Climate-Smart Commodities is difficult to measure and varies depending upon the location and timing of application of activities across the landscape. Overall, Partnerships for Climate-Smart Commodities is anticipated to have a cumulative positive benefit to the environment both on and off the site where conservation activities are implemented. All projects will be designed to benefit resource concerns related to climate change specifically to reduce GHGs and increase sequestration of carbon.

There are other voluntary conservation programs that help to conserve, enhance, protect, and improve working lands. A brief overview of the relevant Federal programs is provided below. Other programs could be used on the same or adjacent agricultural and forestry lands and, therefore, may result in overlapping cumulative effects. These cumulative effects include beneficial impacts of implementing climate-smart agriculture and forestry mitigation practices (see subsection 4.2, above). Some NRCS programs that may potentially contribute to beneficial cumulative effects are:

Agricultural Conservation Easement Program

The Agricultural Conservation Easement Program (ACEP) is a voluntary easement program comprised of an agricultural land easement (ALE) component on farms and ranches that protects them from development and a wetland reserve easement component (WRE) for restoring and protecting wetlands that have previously been impacted by agricultural practices. The 2014 Farm Bill created the ACEP by merging the Farm and Ranch Lands Protection Program, the Grassland Reserve Program, and the Wetlands Reserve Program, each of which was in effect during the period of the 2008 Farm Bill.

Conservation Reserve Program

The Conservation Reserve Program (CRP) pays producers to establish vegetative cover on environmentally sensitive cropland and marginal pastureland. The intent of the program is to temporarily retire from production croplands and other lands that also contribute considerable amounts of pollutants to surface waters when used for agricultural production or provide important wildlife benefits if idled with appropriate vegetative cover, or both.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to landowners and operators to voluntarily address resource concerns on working agricultural and forestry lands through the installation or implementation of structural and management practices. Payments representing up to 75 percent of the average incurred costs and income foregone of certain conservation practices and activities are provided. NRCS promotes CSP and EQIP as complementary programs. EQIP is used by potential CSP participants to reach stewardship thresholds.

Healthy Forests Reserve Program

The Healthy Forests Reserve Program (HFRP) helps forest landowners to restore, enhance, and protect forest lands. The purposes of the voluntary program are to promote the recovery of threatened and endangered species, improve biodiversity, and enhance carbon sequestration. Like ACEP-WRE, landowners are offered a variety of easement options, and financial assistance is provided to implement practices needed to achieve the purposes of the program. Land enrolled in HFRP is eligible for CSP.

Federal and State Forestry Programs

The U.S. Forest Service, through its State and Private Forestry (S&PF) mission area provides expert advice, technology, and financial assistance to help landowners and resource managers sustain the Nation's forests and protect communities and the environment from wildland fires. Through grants and cooperative agreements, State forestry agencies and other partners deliver the majority of this landowner assistance through three State and Private Forestry "umbrella" program areas that receive annual Federal appropriations: Forest Health Management, Cooperative Fire Protection, and Cooperative Forestry Programs.

- **Forest Health.** Forest Health Management assistance includes conducting suppression, prevention, and management activities on native and nonnative insect and disease forest pests and invasive plants.
- **Cooperative Fire.** Cooperative Fire Protection programs focus on the urgent need to reduce the threat of wildland fires in wildland-urban interface areas. Assistance is provided to complete community wildfire protection plans and to implement high priority hazard-mitigation projects identified in those plans, which often includes nonindustrial private forestlands.
- **Cooperative Forestry.** Cooperative Forestry Programs include the Forest Stewardship Program and the Forest Legacy Program. The Forest Stewardship Program provides technical and financial assistance to States to encourage the long-term stewardship of nonindustrial private forestland. Long-term multi-resource forest stewardship plans provide landowners with the information they need to achieve their unique objectives while sustaining a variety of environmental goods and services including clean air and water, biodiversity, and wildlife habitat. Forest stewardship plans enable landowners to keep their forests in a healthy condition to reduce the risk of wildfire and pest/disease infestations. Forest stewardship plans also contribute to the future supply of forest products from private lands and thus, the health of our rural economies. The Forest Legacy Program helps protect environmentally important Forest areas that are threatened by conversion to nonforest uses. The program uses conservation easements and other mechanisms to conserve private forests and operates on a "willing seller and willing buyer" basis. Eminent domain or adverse condemnation is not authorized.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program (RCPP) encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. Through the program, NRCS and its partners help producers install and maintain conservation activities in selected project areas. Partners leverage RCPP funding in project areas and report on the benefits achieved.

Conservation Stewardship Program

The Conservation Stewardship Program (CSP) offers technical and financial assistance to help agricultural and forest producers enhance their conservation efforts. The program is designed to compensate agricultural and forest producers who agree to increase their level of conservation by adopting additional conservation activities and maintaining their baseline level of conservation. CSP may provide many benefits, including increased crop productivity, decreased inputs, wildlife habitat improvements and increased resilience to weather extremes.

4.4 Unavoidable Adverse Impacts

The proposed action (Alternative 2) is not anticipated to cause any direct adverse effects on any resources due to the nature of the national programmatic activities being considered. Alternative 2 is also not anticipated to result in any indirect or cumulative adverse effects on any resources based on the implementation of climate-smart activities. NRCS policy also requires that plans avoid or mitigate unintended adverse environmental impacts to natural resources for practices applied according to CPSs. Additionally, any such impacts would be evaluated as part of the project or site-specific processes (see section 4.3) for other Partnerships for Climate-Smart Commodities-funded activities.

4.5 Relationship of Short-Term Use and Long-Term Productivity

The proposed action (Alternative 2) would have few, if any, adverse short-term impacts to resources. However, unintended short-term adverse impacts would be mitigated to the maximum extent possible and would lead to a higher level of long-term productivity for natural resources. The long-term productivity would result from planning efforts and activities designed to enhance soil, water, air, plant, animal, and energy resources. These considerations would all be factored into the site-specific EE process or alternative project level environmental assessments.

4.6 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effect that the use of these resources has on future generations. Irreversible effects primarily result from the use or destruction of a specific resource that cannot be replaced within a reasonable timeframe. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored because of the action. USDA does not anticipate any irreversible and irretrievable commitments of resources resulting from implementation of Partnerships for Climate-Smart Commodities under the proposed action.

5. Persons and Agencies Contacted

The following persons contributed to the development and review of this document:

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- Scott Blackburn – National Discipline Lead, NEPA and Environmental Compliance, Natural Resources Conservation Service Headquarters, USDA, Washington, D.C.

Appendix A: Conservation Network Effects Diagrams

To assist in the analysis of environmental impacts, NRCS has developed conservation network effects diagrams depicting the chain of natural resource effects resulting from the application of each conservation practice. Each of the diagrams first identifies the typical setting to which the practice is applied. This includes identification of the predominating land use and the environmental resource concerns that trigger use of the conservation practice. The diagrams then identify the conservation practice(s) used to mitigate or address the resource concerns. One network effects diagram for the NRCS Conservation Practice Standard Nutrient Management (Code 590) is provided below. All of the available network effects diagrams are incorporated by reference and can be viewed at the following website:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/>

Following identification of the conservation practice, there is a description of the physical activities that are carried out to implement the practice. From there, the diagrams depict the occurrence of the direct, indirect, and cumulative effects of the practice. Effects are qualified with a “+” or “-“ which qualitatively denotes an increase (“+”) or decrease (“-”) in the effect. Pluses and minuses do not equate to good and bad or positive and negative. Impacts are characterized in this manner because site-specific conditions can influence the degree or intensity of the potential environmental impact. Only the general effects that are considered the most important ones from a national perspective are illustrated.

Additional information on the process used to develop the network effects diagrams is available in the NRCS Watershed Science Institute Report CED-WSSI-2002-2, “Analyzing Effects of Conservation Practices – A Prototypical Method for Complying with National Environmental Policy Act (NEPA) Requirements for Farm Bill Implementation.” This document is included in the NRCS National Environmental Compliance Handbook, Subpart H, Section 610.127, and is available through the NRCS electronic directives system at

<https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=39475.wba>

Nutrient Management



Conservation Practice Overview

May 2019

Nutrient Management (Code 590)

Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.

Practice Information

Nutrient management may be used on any area of land where plant nutrients and soil amendments are applied. Nutrient management may be used to improve crop productivity and improve soil organic matter while reducing environmental impacts. Sources of nutrients include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, estimated plant available soil nutrients, and irrigation water.

Nutrients are managed based on the 4Rs of nutrient stewardship—apply the right nutrient source at the right rate at the right time in the right place—to improve nutrient use efficiency by the crop and to reduce nutrient losses to surface water and groundwater and to the atmosphere.

Operation and maintenance provide that nutrient management plans must be reviewed and revised, as needed, with each soil test cycle; changes in manure management, volume or analysis, plants and crops; or plant and crop management. Records must be maintained for at least 5 years to document plan implementation.

All nutrient management activities must adhere to national, State and local water quality regulations.

Common Associated Practices

NRCS Conservation Practice Standard Nutrient Management (Code 590) is commonly applied with CPSs such as Residue and Tillage Management, No Till (329), Residue and Tillage Management, Reduced Till (345), Conservation Crop Rotation (Code 328), Filter Strip (Code 393), Cover Crop (Code 340), Contour Farming (Code 330), and Contour Buffer Strips (Code 332).

For further information, contact your local NRCS field office.



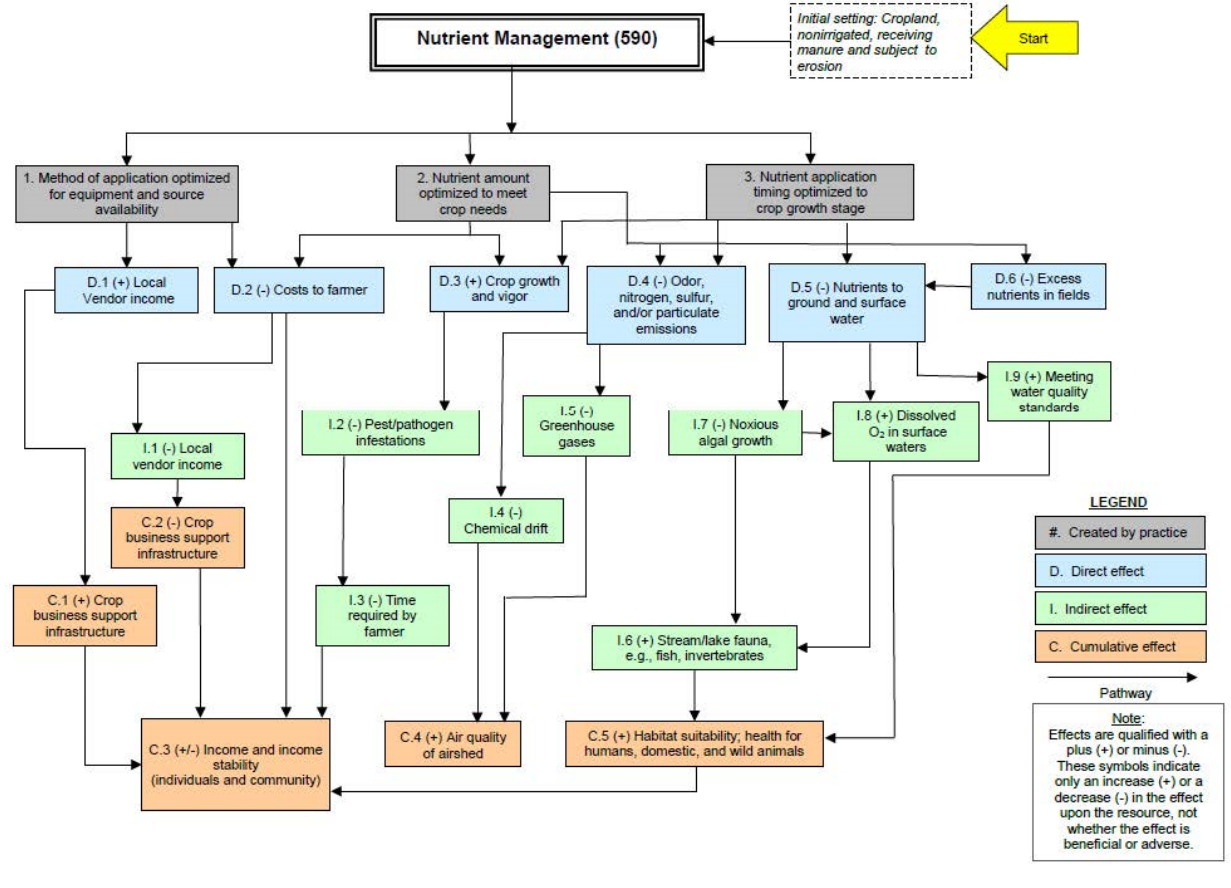
Natural Resources Conservation Service

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NRCS CONSERVATION PRACTICE EFFECTS - NETWORK DIAGRAM

May 2019



The diagram above identifies the effects expected to occur when this practice is applied according to NRCS practice standards and specifications. These effects are subjective and somewhat dependent on variables such as climate, terrain, soil, etc. All appropriate local, State, Tribal, and Federal permits and approvals are the responsibility of the landowners and are presumed to have been obtained. All income changes are partially dependent upon market fluctuations which are independent of the conservation practices. Users are cautioned that these effects are estimates that may or may not apply to a specific site.

Appendix B: Conservation Practices Commonly Used to Address Resource Concerns

Note: For additional information see the National Handbook of Conservation Practices (450-NHCP-620, Amend. 18, September 2019) and for individual conservation practices, see <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/>

Resource Concern	Conservation Activities to Address Concern
Soil	
Soil – Sheet and rill erosion; wind erosion	Alley Cropping (311); Conservation Cover (327); Contour Buffer Strips (332); Contour Farming (330); Contour Orchard and Other Perennial Crops (331); Cover Crop (340); Critical Area Planting (342); Mulching (484); Multi-Story Cropping (379); Forage and Biomass Planting (512); Prescribed Grazing (528); Range Planting (550); Residue and Tillage Management (329, 345); Row Arrangement (557); Stripcropping (585); Terrace (600); Vegetative Barriers (601)
Soil – Ephemeral gully erosion; Classic gully erosion	Alley Cropping (311); Cover Crop (340); Critical Area Planting (342); Grassed Waterway (412); Lined Waterway or Outlet (468); Precision Land Forming (462); Prescribed Grazing (528); Stripcropping (585); Terrace (600); Tree and Shrub Establishment (612); Underground Outlet (620); Vegetative Barriers (601)
Soil – Bank erosion from streams shorelines or water conveyance channels	Access Control (472); Critical Area Planting (342); Prescribed Grazing (528); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390); Stream Habitat Improvement and Management (395); Streambank and Shoreline Protection (580); Watering Facility (614)
Soil – Organic Matter Depletion	Alley Cropping (311); Conservation Cover (327); Conservation Crop Rotation (328); Cover Crop (340); Multi-Story Cropping (379); Prescribed Grazing (528); Residue and Tillage Management (329, 345); Tree and Shrub Establishment (612)
Soil – Compaction	Access Control (472); Conservation Cover (327); Controlled Traffic Farming (334); Deep Tillage (324); Forage Harvest Management (511); Grazing Land Mechanical Treatment (548); Prescribed Grazing (528); Residue and Tillage Management (329, 345)
Soil – Concentration of salts or other chemicals	Agrichemical Handling Facility (309); Conservation Cover (327); Conservation Crop Rotation (328); Integrated Pest Management (595); Irrigation Water Management (449); Nutrient Management (590); Prescribed Grazing (528); Salinity and Sodic Soil Management (610); Subsurface Drain (606)
Soil – Subsidence	Drainage Water Management (554); Pumping Plant (533)
Soil – Soil organism habitat loss or degradation	Alley Cropping (311); Conservation Cover (327); Conservation Crop Rotation (328); Cover Crop (340); Forage and Biomass Planting (512); Multi-Story Cropping (379); Prescribed Grazing (528); Residue and Tillage Management (329, 345); Riparian Forest Buffer (391); Tree and Shrub Establishment (612)
Soil – Aggregate instability	Alley Cropping (311); Conservation Cover (327); Conservation Crop Rotation (328); Cover Crop (340); Forage and Biomass Planting (512); Grassed Waterway (412); Multi-Story Cropping (379); Prescribed Grazing (528); Residue and Tillage Management (329, 345); Riparian Forest Buffer (391); Tree and Shrub Establishment (612)
Water	
Water – Ponding and flooding; Seasonal high-water table; Seeps; and Drifted snow	Dike (356); Diversion (362); Drainage Water Management (554); Grassed Waterway (412); Hillside Ditch (423); Precision Land Forming (462); Pumping Plant (533); Stormwater Runoff Control (570); Structure For Water Control (587); Subsurface Drain (606); Underground Outlet (620); Vertical Drain (630); Water and Sediment Control Basin (638); Wetland Creation, Enhancement, and Restoration (658, 659, 657).
Water – Surface water depletion; Ground water depletion	Dam, Diversion (348); Forage and Biomass Planting (512); Riparian Forest Buffer (391); Structure For Water Control (587); Tree and Shrub Establishment (612)
Water – Inefficient use of irrigation water	Irrigation Field Ditch (388); Irrigation Land Leveling (464); Irrigation Reservoir (436); Irrigation System (441, 443, 447); Irrigation Water Management (449)
Water - Pesticides transported to surface or ground water	Agrichemical Handling Facility (309); Filter Strip (393); Irrigation System, Microirrigation (441); Irrigation System, Tailwater Recovery (447); Irrigation Water Management (449); Integrated Pest Management (595); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390)
Water - Nutrients transported to surface or ground water	Access Control (472); Agrichemical Handling Facility (309); Conservation Cover (327); Filter Strip (393); Heavy Use Area Protection (562); Irrigation Water Management (449); Nutrient Management (590); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390)
Water - Sediment transported to surface water	Access Control (472); Alley Cropping (311); Anionic Polyacrylamide (PAM) Erosion Control (450); Conservation Cover (327); Cover Crop (340); Critical Area Planting (342); Filter Strip (393); Irrigation Water Management (449); Residue and Tillage Management (329, 345); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390); Sediment Basin (350); Stream Crossing (578); Streambank and Shoreline Protection (580); Stripcropping (585); Terrace (600); Tree and Shrub Establishment (612); Vegetated Treatment Area (635); Vegetative Barriers (601); Water and Sediment Control Basin (638)
Water - Pathogens and chemicals; Salts; Petroleum, heavy metals, and other pollutants; transported to surface or ground water	Access Control (472); Agrichemical Handling Facility (309); Anionic PAM Erosion Control (450); Conservation Cover (327); Constructed Wetland (656); Filter Strip (393); Heavy Use Area Protection (562); Irrigation System, Tailwater Recovery (447); Irrigation Water Management (449); Nutrient Management (590); On-farm Secondary Containment Facility (319); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390)
Water – Elevated water temperature	Access Control (472); Stream Habitat Improvement and Management (395); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390)
Air	

Water – Elevated water temperature	Alley Cropping (311); Combustion System Improvement (372); Conservation Cover (327); Cover Crop (340); Dust Control from Animal Activity on Open Lot Surfaces (375); Dust Control on Unpaved Roads and Surfaces (373); Field Operations Emissions Reduction (376); Firebreak (394); Woody Residue Treatment (384); Forest Stand Improvement (666); Fuel Break (383); Hedgerow Planting (422); Herbaceous Wind Barriers (603); Prescribed Grazing (528); Residue and Tillage Management (329, 345); Stripcropping (585); Surface Roughening (609); Windbreak/Shelterbelt Establishment and Renovation (380, 650)
Air - Emissions of Ozone Precursors	Combustion System Improvement (372); Farmstead Energy Improvement (374); Field Operations Emissions Reduction (376); Residue and Tillage Management (329, 345)
Air - Emissions of Greenhouse Gases (GHGs)	Combustion System Improvement (372); Conservation Cover (327); Cover Crop (340); Farmstead Energy Improvement (374); Feed Management (592); Nutrient Management (590); Residue and Tillage Management (329, 345); Riparian Forest Buffer (391); Tree and Shrub Establishment (612)
Air – Objectionable odors	Amendments for Treatment of Agricultural Waste (591); Composting Facility (317); Hedgerow Planting (422); Nutrient Management (590); Roofs and Covers (367); Waste Separation Facility (632); Waste Treatment (629); Windbreak/Shelterbelt Establishment and Renovation (380, 650)
Plants	
Plants – Plant productivity and health; Plant structure and composition	Access Control (472); Alley Cropping (311); Brush Management (314); Conservation Crop Rotation (328); Early Successional Habitat Development/Management (647); Field Border (386); Firebreak (394); Forage Harvest Management (511); Forest Stand Improvement (666); Fuel Break (383); Irrigation Water Management (449); Multi-Story Cropping (379); Nutrient Management (590); Forage and Biomass Planting (512); Integrated Pest Management (595); Prescribed Burning (338); Prescribed Grazing (528); Range Planting (550); Riparian Forest Buffer (391); Salinity and Sodic Soil Management (610); Silvopasture Establishment (381); Tree/Shrub Establishment (612); Tree/Shrub Pruning (660); Tree/Shrub Site Prep (490); Upland Wildlife Habitat Management (645); Wetland Creation, Enhancement, and Restoration (658, 659, 657); Wetland Wildlife Habitat Management (644)
Plants – Plant pest pressure	Access Control (472); Brush Management (314); Critical Area Planting (342); Forest Stand Improvement (666); Herbaceous Weed Treatment (315); Prescribed Burning (338); Prescribed Grazing (528); Restoration and Management of Rare and Declining Habitats (643); Upland Wildlife Habitat Management (645); Wetland Enhancement (659); Wetland Restoration (657); Wetland Wildlife Habitat Management (644)
Plants – Wildfire hazard from biomass accumulation	Brush Management (314); Forest Stand Improvement (666); Firebreak (394); Fuel Break (383); Herbaceous Weed Treatment (315); Prescribed Grazing (528); Woody Residue Treatment (384)
Animals	
Animals - Terrestrial habitat for wildlife and invertebrates; Aquatic habitat for fish and other organisms	Access Control (472); Aquatic Organism Passage (396); Brush Management (314); Conservation Cover (327); Early Successional Habitat Development/Management (647); Field Border (386); Forage Harvest Management (511); Forest Stand Improvement (666); Hedgerow Planting (422); Forage and Biomass Planting (512); Integrated Pest Management (595); Prescribed Burning (338); Prescribed Grazing (528); Range Planting (550); Restoration and Management of Rare and Declining Habitats (643); Riparian Forest Buffer (391); Riparian Herbaceous Cover (390); Shallow Water Development and Management (646); Structures for Wildlife (649); Stream Habitat Improvement and Management (395); Tree/Shrub Establishment (612); Upland Wildlife Habitat Management (645); Watering Facility (614); Wetland Creation, Enhancement and Restoration (658, 659, 657); Wetland Wildlife Habitat Management (644); Wildlife Habitat Planting (420); Windbreak/Shelterbelt Establishment (380)
Animals - Feed and forage imbalance; Inadequate livestock shelter; Inadequate livestock water quantity, quality and distribution	Brush Management (314); Feed Management (592); Fence (382); Forage Harvest Management (511); Heavy Use Area Protection (561); Nutrient Management (590); Forage and Biomass Planting (512); Integrated Pest Management (595); Livestock Shelter Structure (576); Pipeline (516); Pond (378); Prescribed Burning (338); Prescribed Grazing (528); Pumping Plant (533); Range Planting (550); Silvopasture Establishment (381); Spring Development (574); Trails and Walkways (575); Watering Facility (614); Windbreak/Shelterbelt Establishment (380)
Energy	
Energy – Energy efficiency of farming/ranching practices and field operations	Conservation Crop Rotation (328); Cover Crop (340); Field Operations Emissions Reduction (376); Irrigation Water Management (449); Nutrient Management (590); Pumping Plant (533); Residue and Tillage Management (329, 345)
Energy – Energy efficiency of equipment and facilities	Building Envelope Improvement (672); Combustion System Improvement (372); Farmstead Energy Improvement (374); Lighting System Improvement (670); Pumping Plant (533); Tree/Shrub Establishment (612); Windbreak/Shelterbelt Establishment and Renovation (380, 650)