Bipartisan Policy Center

Natural Carbon Solutions in U.S. Farms and Forests: Building a Policy Agenda for Congressional Action

THE BIPARTISAN POLICY CENTER'S FARM & FOREST CARBON SOLUTIONS INITIATIVE

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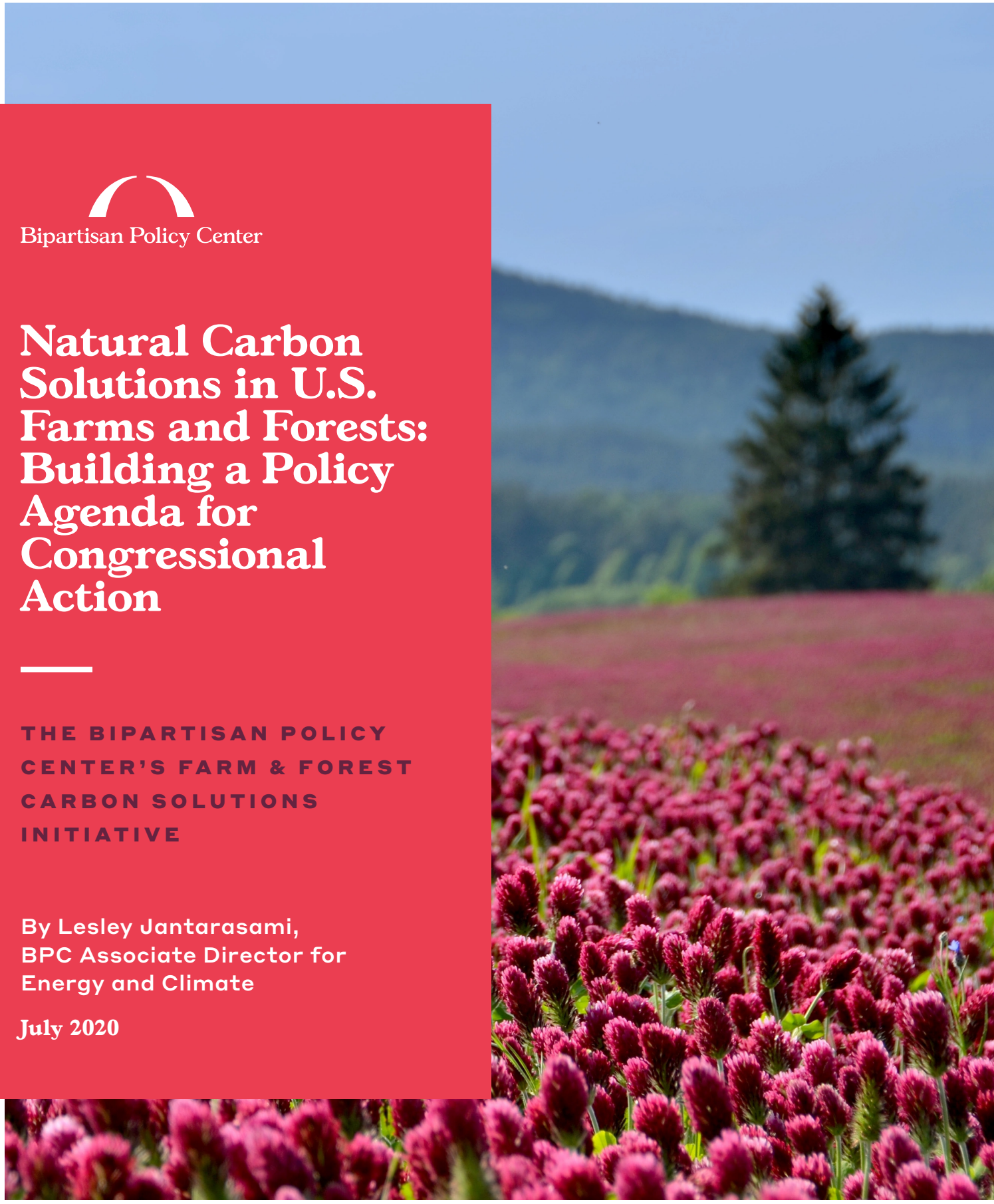
July 2020



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The international climate science and policy community has long recognized the importance of natural and working lands in addressing climate change: the first report of the Intergovernmental Panel on Climate Change, in 1990, included a chapter on agriculture and forestry.[1] More recently, attention has focused on designing policies for natural carbon (or climate) solutions (NCS), a term that encompasses actions aimed at increasing carbon storage and/or avoiding greenhouse gas emissions from forests, wetlands, grasslands, and agricultural lands. New policies and programs are needed to accelerate NCS and to create long-term revenue streams for land management practices that result in increased carbon storage, reduced emissions, and other environmental benefits.

This synthesis report from the Bipartisan Policy Center's Farm & Forest Carbon Solutions Initiative draws from a set of working papers prepared by experts in the NCS field to identify policy options for orienting federal programs to increase carbon storage in soils and trees. These options range from modifying existing farm and forest programs to establishing new programs that take advantage of innovations in American agriculture and forest management. In addition to highlighting near-term opportunities to advance policy changes through legislation, we identify promising concepts that warrant further development, in areas such as nutrient and manure management and methane capture and use, and outline policy priorities for the future.

1 See e.g., IPCC (1990). AR1: The IPCC Response Strategies. Chapter 4: Agriculture, Forestry, and Other Human Activities. https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_III_chapter_04.pdf

Section A: Policy, Science, & Economic Context

The Bipartisan Policy Center's Energy Project focuses on developing pragmatic, evidence-based energy and climate policies to achieve meaningful progress toward a low-carbon future. As part of our Farm and Forest Carbon Solutions Initiative, BPC engaged technical experts to review opportunities for effective climate-change mitigation in the agriculture and forestry industries and to develop related policy recommendations. BPC published the resulting working papers in 2019. They included contributions from:

- **Robert Bonnie, Duke University**, on overarching issues in designing climate policy for agriculture and forestry, including the need for public and private investment to generate changes to land practices at scale.
- **Eric Washburn, Windward Strategies**, on federal and state soil and forest carbon sequestration-related programs and policy proposals that could serve as models.
- **Alex Rudee and James Mulligan, World Resources Institute**, on the achievable scale of forest restoration and soil health building practices for different land types in the United States, including cost estimates and recommendations for federal funding levels.
- **Fred Iutzi and Timothy Crews, The Land Institute**, on the soil carbon sequestration benefits of planting perennial grain crops instead of annual crops, and the need for federal research investments to accelerate the development and deployment of perennial crops.
- **Debbie Reed, Ecosystem Services Market Consortium**, on designing a private ecosystem services market to incentivize improvements in soil carbon sequestration and retention, net greenhouse gas mitigation, water quality, and water-use efficiency through salable credits.

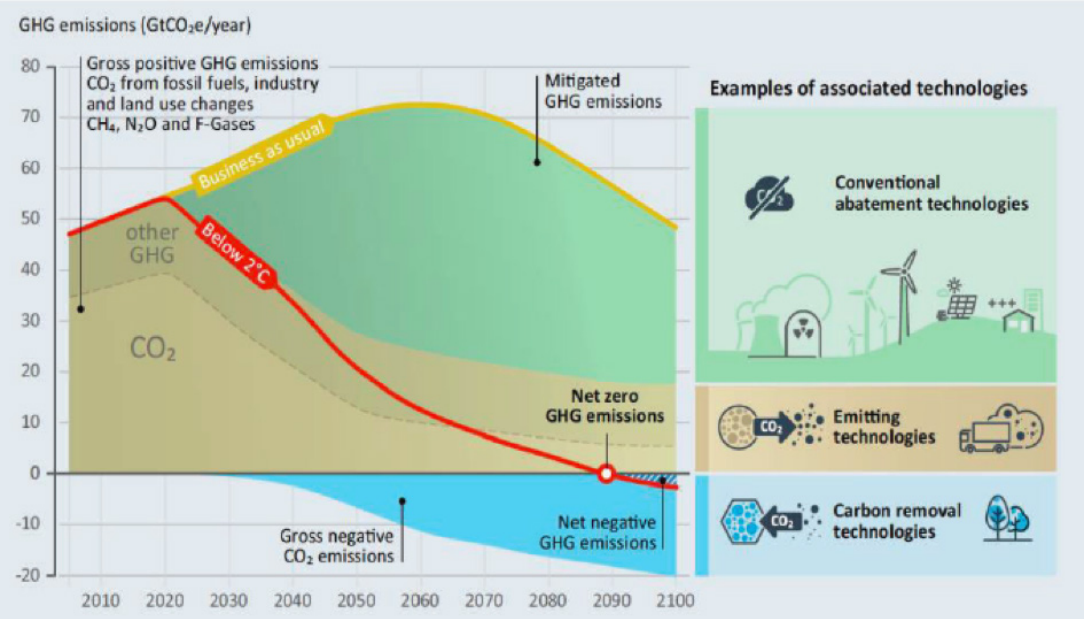
Section I of this synthesis report provides a high-level overview of the policy, science, and economic context for new efforts to promote soil and forest carbon sequestration, including information on previous efforts and recent congressional proposals. Section II outlines different policy options from the technical working papers. Section III concludes with a discussion of future policy opportunities.

A.1 LAND-BASED CARBON STORAGE IS KEY TO MEETING INTERNATIONAL CLIMATE GOALS

Terrestrial carbon sequestration and storage occurs when carbon from the atmosphere is taken up by soils and forests. This process holds considerable potential to mitigate climate change if the soils and trees function as *carbon sinks*, absorbing more carbon annually from the atmosphere than they release. Soils and forests become *carbon sources* if they release more carbon than they absorb. Policies to expand carbon sinks can complement traditional greenhouse gas (GHG) reduction strategies and are considered key to reversing near-term emissions growth and meeting long-term climate goals, especially where these goals require achieving net-zero emissions or carbon neutrality.

Many jurisdictions and companies, in the United States and globally, have committed to reducing their GHG emissions to a level consistent with meeting the Paris Agreement's goal of limiting global warming to "well below 2°C" by 2100, with some explicitly committing to a 1.5°C goal. For many, this commitment means achieving net-zero emissions by 2050 at the latest. Others, notably Microsoft Corporation, aspire to net-negative emissions.

Climate scientists have concluded that limiting global warming to well below 2°C will require active efforts to remove carbon dioxide from the atmosphere using a combination of natural and technological processes. A special report of the Intergovernmental Panel on Climate Change on strategies for limiting warming to 1.5°C finds that global carbon dioxide removal will be needed to compensate for residual GHG emissions from industries and sectors that are hard to decarbonize. The graphic below, from a recent study by the National Academies of Science, Engineering, and Medicine, illustrates how negative emissions technologies and techniques (the blue shaded area) balance out residual emissions (the brown shaded area) to achieve net-zero GHG emissions (the red circle).



Source: National Academies based on UNEP, 2017

The contribution from land-based sequestration, according to this and other analyses, has the potential to be significant. The World Resources Institute has estimated that soil carbon sequestration in the United States alone could total roughly 200 million metric tons of carbon dioxide per year, while U.S. forests could sequester as much as 360 million metric tons per year, for a total of 560 million metric tons of carbon dioxide (CO_2) per year. This total represents about 9 percent of the nation's annual GHG emissions.

Carbon Accounting Complexities

Policies and programs designed to achieve a target level of carbon dioxide removal through land-based sequestration must contend with data measurement, verification, and carbon accounting issues that have long been debated within the climate policy community. At the heart of the debate is the tension between two primary goals: (1) providing clear incentives and simple accounting approaches to encourage widespread landowner participation, and (2) establishing the measurement, monitoring, and verification protocols needed to ensure that claimed sequestration benefits have actually occurred.[2] Related to this second point are issues of *permanence* and *additionality*. Permanence requires policies that are designed to encourage long-term carbon storage, together with assurances that any stored or avoided carbon will not be re-emitted (or, if the carbon is re-emitted, that this will be accounted for in a national system of carbon accounting). Additionality means that policies are designed to achieve carbon sequestration or GHG reductions above and beyond what would be expected to occur absent the policy. Judging additionality can be somewhat subjective—thus policymakers should seek to reduce the potential for funding to go to business-as-usual activities.

State of Forest Carbon Accounting

Several state and voluntary climate programs follow established protocols for forest carbon offset credits. These protocols rely on a variety of accounting methods. Depending on the program, offset credits can be used for regulatory compliance or to meet corporate emissions reduction commitments.

To a large extent, challenges to forest carbon accounting and related disagreements about the efficacy of forest carbon offsets stem from two features of this natural resource. First, many forests are managed for multiple uses (e.g., commercial timber production, recreation, wildlife habitat, watershed management etc.). Second, forests are vulnerable to natural and human-caused disturbances, including harvest, wildfire, wind, insect damage, disease, and conversion to non-forest land uses. In some circumstances, forest disturbances can result in net carbon losses to the atmosphere, which can call into question the permanence of a forestry-based offset.

Most forest carbon accounting protocols address the permanence issue by including mechanisms to account for potential carbon losses—for example, by requiring a buffer pool, which holds a portion of carbon credits from a forest project in reserve to draw from in the event of an unexpected disturbance. Additional research and policies are needed to improve and simplify measurement and verification processes, which will reduce transaction costs and boost project participation.

State of Soil Carbon Accounting

Some certification organizations (e.g., the American Carbon Registry) have published standards and protocols for soil carbon offsets. But there is still some disagreement within the climate science and policy communities regarding the accuracy of current soil carbon accounting methodologies. To date, no state regulatory programs accept soil carbon offset credits. In addition, few transactions involving soil carbon offsets typically occur in voluntary carbon markets, in part because transaction costs are high and payments per acre have been too small to make such projects worthwhile.[3]

Organizations such as Indigo Ag, Nori, and the Ecosystem Services Market Consortium have emerged to address these challenges—often through new business models that aim to create a more robust private market for monetizing soil carbon sequestration. At the same time, growing numbers of corporations are pledging to achieve net zero carbon emissions by 2050. This is expected to spur growth in the voluntary carbon market. Efforts to improve soil carbon accounting systems and adjust for measurement uncertainties are underway for both private (voluntary) and government-led (regulatory) carbon markets.

Other key research areas include: (1) improving and simplifying measurement and verification processes; (2) quantifying the effectiveness of individual soil management practices for carbon removal, including estimating how long carbon will stay sequestered in soils; (3) understanding the potential for positive or negative feedback loops from interactions between multiple soil management practices; and (4) calibrating landscape-scale soil carbon models that can model the outcomes of various soil management practices across different regions, soil types, and farming systems.

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2 Wise, Lindsey, et al. "Optimizing sequestered carbon in forest offset programs: balancing accounting stringency and participation." Carbon Balance and Management 14.1 (2019): 1-11. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-019-0131-y

3 https://www.ecosystemmarketplace.com/articles/dirt-soil-carbon/

A.2 PRACTICES TO ENHANCE LAND-BASED CARBON SEQUESTRATION

Scientific assessments have found that certain land-based carbon sequestration approaches are ready for widespread deployment now. Reforestation, afforestation, forest management, and carbon uptake and storage by agricultural soils—including practices related to grazing lands and grasslands—are summarized below.

- **Reforestation:** This technique involves restoring forests on land that was once forested. Planting to replace trees that have been cleared can create carbon sinks that sequester CO_2 for decades.
- **Afforestation:** Afforestation differs from reforestation in that it involves cultivating forest on land that was previously unforested, typically for longer than a generation. As with reforestation, this practice can lead to long-term, year-on-year improvements in carbon sequestration.
- **Changes in Forest Management:** Certain management practices, such as forest thinning, may help forests adapt to a hotter, drier climate while also increasing their value in terms of long-term carbon storage, wildlife habitat, and potential timber production. Thinning forest understory can also deliver co-benefits by reducing the risk that high-intensity wildfires will ignite on the forest floor and spread into and through the tree crowns. Wood products are a sizeable portion of the current net carbon sink and are vital to providing economic incentives for landowners to maintain existing forests and plant new ones.
- **Cover Crops:** According to the Department of Agriculture's (USDA's) Sustainable Agricultural Research and Education program, planting cover crops can promote relatively large amounts of soil carbon sequestration. The roots and shoots of cover crops feed bacteria, fungi, earthworms, and other organisms, which increase soil carbon levels over time. Typical cover crops can be annual or perennial and include cereals, brassicas, legumes, and other broadleaf species. The use of cover crops is slowly becoming more common, and it is estimated that 20 million acres across the United States are planted in such crops today. Compared to about 267 million acres planted in row crops, however, cover crops remain a small part of the overall U.S. agriculture system. Planting cover crops on 20 million acres could remove approximately 60 million metric tons of CO_2 through soil carbon sequestration per year—enough to offset annual emissions from 12.8 million passenger vehicles.[4]
- **Conservation Tillage and Other Soil Health Practices:** Like cover crops, conservation tillage and no-till agriculture reduce soil disturbance, build

4 https://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops/Ecosystem-Services-from-Cover-Crops/Cover-Crops-and-Carbon-Sequestration

organic matter in soils, and, as a result, build soil carbon over time. These practices can improve soil productivity over time, though it may take three to five years before producers reap the rewards. While the amount of carbon sequestered per acre may be modest, the benefit to the climate across tens of millions of acres of cropland could be significant.

- **Restoration of Native Grasslands:** The natural recolonization of abandoned agricultural lands by native plant species can restore soil carbon stocks, but the process can take decades. For example, at a research site in Minnesota, roughly 50 years elapsed before the perennial plant species that dominate nearby native grassland ecosystems became dominant at the site. The deliberate, accelerated restoration of native grasslands using late-successional, diverse grasses can significantly increase soil carbon sequestration on abandoned and degraded agricultural lands.[5] Grassland buffers can also be used along streams or on unproductive sections of cropland to sequester carbon in the soil.
- **Rotational Grazing:** According to the Land Stewardship Project, "rotating livestock through a series of paddocks, a system called managed rotational grazing, helps keep the grassland healthy above and below the surface by spreading nutrients sustainably and allowing plant life to rest and recover." This system—also known as "regenerative adaptive multi-paddock conservation grazing"—can sequester large amounts of carbon in soils and revitalize degraded soils, even reversing desertification.[6] In fact, the Land Stewardship Project is working with farmers and ranchers in west-central Minnesota who are utilizing managed rotational grazing to revitalize wildlife habitat on refuges and other natural lands.
- **Combinations of Practices:** The most significant climate benefits are likely to come from combinations of practices. For example, the combination of planting cover crops with nutrient management, manure management, and increased crop diversity could maximize greenhouse gas reductions, including through carbon sequestration, nitrous oxide reductions, and possibly methane reductions. Promising systems for soil carbon sequestration may combine crop rotation, conservation tillage, nutrient management, and other practices. Long-term studies by the Rodale Institute and others suggest that such systems build (and do not simply conserve) significant quantities of organic carbon in the soil through a variety of mechanisms.[7]

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5 https://www.nature.com/articles/s41467-019-08636-w

6 https://www.sciencedirect.com/science/article/pii/S0308521X17310338

7 https://www.researchgate.net/publication/281511510_A_Review_of_Long-Term_Organic_Comparison_Trials_in_the_US

Recent Legislative Proposals that Address Soil and Forest Carbon

Since 2017, several bills have been proposed in Congress that address soil health, forest management, and general land conservation programs for the purposes of enhanced carbon sequestration. These proposals are summarized in the table below (note that many of the bills included in the table target multiple policy objectives, not just carbon sequestration).

116th Congress	Relating to forest management and carbon sequestration	Trillion Trees Act (H.R. 5859), Rep. Bruce Westerman (R-AR)
		The Climate Stewardship Act (S. 2452 and H.R. 4269), Sen. Cory Booker (D-NJ) and Rep. Debra Haaland (D-NM)
		The Northwest California Wilderness, Recreation, and Working Forests Act (S. 1110 and H.R. 2250), Sen. Kamala Harris (D-CA) and Rep. Jared Huffman (D-CA)
		The Residential Energy and Economic Savings (TREES) Act (H.R. 5615), Rep. Doris Matsui (D-CA)
		Reforestation Act of 2019 (S. 3106), Sen. Tom Udall (D-NM)
		21st Century Conservation Corps for Our Health and Our Jobs Act (S. 3684), Sen. Ron Wyden (D-OR)
		Climate Action Rebate Act (S. 2284 and H.R. 5041), Sen. Christopher Coons (D-DE), Sen. Dianne Feinstein (D-CA), Rep. Jimmy Panetta (D-CA), and Rep. Thomas Suozzi (D-NY)
		Tackling Residential Energy burdens Efficiently (TREE) Act (S. 4038), Sen. Cory Booker (D-NJ) and Sen. Shelley Capito (R-WV)
116th Congress	Relating to soil health and carbon sequestration	The Study on Improving Lands Act (H. R. 4133), Reps. Joe Neguse (D-CO) and John Curtis (R-UT)
		The Climate Stewardship Act (S. 2452 and H.R. 4269), Sen. Cory Booker (D-NJ) and Rep. Debra Haaland (D-NM)
		21st Century Conservation Corps for Our Health and Our Jobs Act (S. 3684), Sen. Ron Wyden (D-OR)
		Cultivating Organic Matter through the Promotion of Sustainable Techniques (COMPOST) Act (H.R. 6023), Reps. Julia Brownley (D-CA) and Chellie Pingree (D-ME)
		Agricultural Resilience Act (H.R. 5861), Rep. Chellie Pingree (D-ME)

116th Congress	Relating to soil health and carbon sequestration	Climate Action Rebate Act (S. 2284 and H.R. 5041), Sen. Christopher Coons (D-DE), Sen. Dianne Feinstein (D-CA), Rep. Jimmy Panetta (D-CA), and Rep. Thomas Suozzi (D-NY)
		Urban Agriculture Healthy Food and Entrepreneur Act (H.R. 5266), Reps. Tulsi Gabbard (D-HI), Gwen Moore (D-WI), and Bobby Rush (D-IL)
		Cover Crop Flexibility Act (S. 3479), Sens. John Thune (R-SD) and Debbie Stabenow (D-MI)
		Growing Climate Solutions Act (S. 3894), Sens. Braun (R-IN) and Stabenow (D-RI)
115th Congress	Relating to forest management and carbon sequestration	The Forest Incentives Program Act (S. 2350), Sen. Jeanne Shaheen (D-NH)
115th Congress	Relating to soil health and carbon sequestration	The Conservation for Very Erodible Row Cropland (COVER) Act (S. 2989), Sen. Michael Bennet (D-CO)
		Collaborative Water and Soil Enhancement Act (H.R. 4892), Rep. Marcia Fudge (D-OH)
		Agriculture Data Act (S.2487), Sen. Amy Klobuchar (D-MN)
		Agriculture Improvement Act (P.L. 115-334), Sen. Pat Roberts (R-KS) and Rep. Mike Conaway (R-TX)
		The Strengthening Our Investment in Land (SOIL) Stewardship Act (S. 2874 and H.R. 5188), Sen. Tina Smith (D-MN) and Rep. Tim Walz (D-MN)
		American Prairie Conservation Act (S. 1913 and H.R. 3939), Sen. John Thune (R-SD), Sen. Amy Klobuchar (D-NM), Sen. Mike Rounds (R-SD), Sen. Michael Bennet (D-CO), Rep. Kristi Noem (R-SD), and Rep. Timothy Walz (D-MN)
		Soil Health and Income Protection Program (SHIPP) Act (S. 499), Sen. David Young (R-IA)
		Urban Agriculture Act (S. 3005), Sen. Debbie Stabenow (D-MI)
		Water and Targeted Environmental Research (WATER) Act (H.R. 5426), Rep. David Young (R-IA)
		Water and Energy Sustainability through Technology Act (H.R. 3275), Rep. Jerry McNerney (D-CA)

A.3 COSTS AND BENEFITS OF PRACTICES TO ENHANCE CARBON SEQUESTRATION

Better information on the costs and benefits of carbon sequestration practices is still being developed as more projects are implemented across the country. Based on a synthesis of available data and literature, the World Resources Institute has estimated that:

- Agricultural and rangeland soil carbon practices cost in the range of $30–$100 per ton of CO_2 removed. A robust policy agenda designed to achieve the full sequestration potential of U.S. soils could require a total annual investment of roughly $500 million.
- Forest carbon practices cost in the range of $10–$100 per ton of CO_2 removed. A robust policy agenda designed to achieve the full sequestration potential of U.S. forests could require a total annual investment of roughly $1 billion to $4 billion.

Many measures to enhance carbon sequestration also align well with the goal of making U.S. farm and forestry operations more resilient to changing economic and climate conditions. Common co-benefits include cleaner water, greater drought resilience, improved wildlife habitat, open space conservation, and increased rural economic opportunities. The ability of landowners and land managers to reduce greenhouse gas emissions and promote carbon sequestration in soils, grasslands, and forests depends to a significant degree on their ability to stay profitable. Many conservation groups and others are working to help farmers, ranchers, and forest owners create new income streams around carbon storage, water quality improvements, wildlife habitat, and other ecosystem services.

Job creation in forestry and agriculture is one economic benefit of increased investment in enhanced carbon sequestration practices. According to the Economic Policy Institute, a total of 13.4 direct, indirect and induced (DII) jobs are created for every million dollars of final demand in the forestry industry.[8] (Direct jobs are jobs specifically related to an industry, indirect jobs support

8 https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/

the industry, and induced jobs result from the increased spending of those employed in direct and indirect jobs.) In agriculture, the estimate is 16.0 DII jobs and 14.4 DII jobs created per million dollars of final demand in crop agriculture and animal production, respectively. Further, support activities for agricultural production and forestry contribute 11.8 jobs for every $1 million in final demand. Agriculture, forestry, and wildland firefighting are traditionally rural enterprises that create jobs and generate positive local economic impacts, including for many tribes and indigenous communities.

Section B: Policy Options

The working papers commissioned by BPC's Farm & Forest Carbon Solutions Initiative identify four major categories of policy options for enhancing land-based carbon sequestration. The first two categories build on, or are modeled after, existing programs that are being implemented at the state and federal levels today. New funding would be needed to scale these programs to achieve significant benefits in natural carbon removal.

- Modifications to existing Farm Bill soil health and forest management programs
- Expansion of innovative state soil health and forest management programs

The last two categories of policy options involve new federal programs. In some cases, these options could be implemented with new funding under the existing authorities of USDA agencies. In other cases, new statutory authorities and funding would be required.

- New ideas to reward activities that sequester carbon in soils and forests, including changes in tax policy, expanded voluntary and incentive programs, and options such as creating a "carbon bank" to finance greenhouse gas reductions in the agriculture and forestry sectors.
- New R&D and data collection efforts to enable more widespread adoption of practices and to enhance scientific understanding of soil and forest carbon sequestration potential.

B.1 OPTIONS FOR MODIFYING EXISTING FEDERAL PROGRAMS

Many existing programs administered by the USDA's Natural Resources Conservation Service (NRCS), Farm Service Agency, and Forest Service support conservation and management practices that promote carbon sequestration in forests and agricultural and rangeland soils. The tables below summarize these programs and offer ideas for how they could be scaled up or modified to extend their reach and include carbon sequestration as an explicit area of focus.

In addition, Congress could consider three near-term policy changes that could apply across USDA conservation programs to support enhanced carbon sequestration:

- USDA could be directed to continually **update its standards for conservation practices** to reflect new understanding and improve practices for specific regions or production systems. This would help ensure that conservation practices remain current and reflect new opportunities for land regeneration and sustainability.
- Producers consistently cite the paperwork burden associated with subscribing to NRCS programs as a significant barrier to participation. Congress could consider directing USDA to convene a multi-stakeholder process, involving producers, representatives of producer organizations, NRCS field staff, and others, to **identify ways to reduce and simplify paperwork**.
- Congress could consider program changes to **allow project aggregation** by third-party intermediaries, such as land trusts and other nonprofit organizations, private companies, or local or state governments. Third parties must be eligible to receive the government subsidy (or tax credit or other incentive) for forest or soil carbon activities conducted on behalf of producers/landowners. Payments and other arrangements would then be negotiated between the intermediary and the producer/landowner.
    - Lack of knowledge and technical capacity among producers and landowners, absentee landownership, transaction costs for landowners, and the challenging economics of tree planting on small parcels can limit the effectiveness of a traditional subsidy that is paid directly to producers and landowners.
    - Aggregators can proactively solicit landowner participation—and facilitate that participation as needed by handling administrative aspects of program participation and even project implementation and reporting. This could help reduce transaction costs for producers/landowners in terms of completing the necessary paperwork to apply for cost sharing, which has been a significant barrier to entry in existing programs and has disproportionately limited enrollment from small producers/landowners.
    - Intermediaries can package together and directly implement tree planting projects across many producers/landowners, achieving economies of scale and making forest restoration more practicable on small parcels. Examples of economies of scale in this context include better access to private financing for larger projects, ability to spread greenhouse gas measurement and monitoring costs across many parcels, opportunities to optimize seedling supply and use of machinery, and ability to implement more advanced technologies, such as drone planters, or to organize volunteer planting crews.
    - Intermediaries can place responsibility for tree planting and maintenance activities in the hands of qualified project operators, addressing the barrier posed by lack of knowledge and technical capacity among some producers/landowners.

Natural Resources Conservation Service and Farm Service Agency Farm Bill Programs			
Name of Program	**Current Purpose**	**Opportunities for Modification to Support Enhanced Carbon Sequestration**	**Focus on Soils, Trees, or Both?**
Environmental Quality Incentives Program (EQIP)	Pays for practices or activities that benefit air quality, water quality, soil and water conservation, and wildlife habitat (subject to some restrictions).	• Increase program funding specifically for agriculture, forest management, and grazing practices that sequester carbon in soils and trees. • Authorize program to subsidize more of the upfront costs of project implementation for first-time participants. • Authorize program to allow project aggregation (described below).	
Conservation Stewardship Program (CSP)	Pay-for-performance program to maintain, improve, and expand activities that benefit natural resources (including soil, water, air, and wildlife habitat) or conserve energy.	• Increase program funding specifically for agriculture, forestry, and grazing practices that sequester carbon in soils and trees. • Authorize program to allow project aggregation (described below).	
Conservation Reserve Program (CRP)	Provides yearly rental payment to remove environmentally sensitive land from agricultural production and plant species that will improve ecosystem health and quality.	• Expand the acreage cap. • Open the program to allow tree planting on marginal pastureland. • Allow grazing within the CRP grasslands program while maintaining important grasslands. • Increase incentives to target flood prone lands, peatlands, or other areas where carbon gains could be substantial.	
Conservation Innovation Grants (CIGs)	Provides cost-sharing grants to support new conservation practices. New to the 2018 Farm Bill, CIG "on-farm trials" implement on-the-ground conservation activities and then evaluate their impact. Incentive payments help offset the risk to producers.	• Focus on-farm trials on evaluating agriculture, forestry, and grazing practices that sequester carbon in soils and trees. • Direct the program to prioritize CIG projects with carbon offset protocol developers.	
Conservation Technical Assistance Program	Provides technical assistance from NRCS, or from employees of other entities or agencies under the technical supervision of NRCS, to address opportunities, concerns, and problems related to the use of natural resources.	• Direct the program to assist producers in understanding: o The numerous agronomic and ecological benefits of healthy soils. o How to access NRCS and other programs that offer financial assistance for implementing soil and forest carbon-building practices.	
Regional Conservation Partnership Program	Promotes coordination between NRCS and eligible partners to engage in conservation activities using funding from EQIP, CSP, and ACEP (see below).	• Direct the program to prioritize project applications that list carbon sequestration and GHG reductions as a natural resource priority to be addressed.	

Natural Resources Conservation Service and Farm Service Agency Farm Bill Programs			
Name of Program	**Current Purpose**	**Opportunities for Modification to Support Enhanced Carbon Sequestration**	**Focus on Soils, Trees, or Both?**
Agricultural Conservation Easement Program (ACEP)	Provides financial assistance from the NRCS to eligible partners for the purpose of purchasing easements that protect agricultural land and limit non-agricultural uses of land.	• Direct the program to prioritize easements for eligible partners that demonstrate the potential to increase soil carbon and otherwise reduce GHGs in the land under consideration. • Focus the Wetland Reserve Enhancement Partnership on carbon sequestration benefits from wetlands restoration.	
Healthy Forests Reserve Program	Assists private landowners with 10-year restoration agreements and 30-year or permanent easements for specific conservation actions.	• Direct the program to increase the cost-share percentage landowners receive to further incentivize program enrollment. • Direct the program to prioritize easements and agreements for eligible partners that demonstrate the potential to increase carbon sequestration and restore forests in ways that reduce the threat of carbon loss from fire and other disturbances.	

USDA Forest Service Programs			
Name of Program	**Current Purpose**	**Opportunities for Modification to Support Enhanced Carbon Sequestration**	**Focus on Soils, Trees, or Both?**
Forest Legacy Program	Identifies and conserves forest areas that are threatened by conversion to non-forest uses. Protects private forests by purchasing conservation easements or land from forest owners, who participate voluntarily.	• Increase program funding in recognition of the climate-change mitigation benefits of preventing conversion of forests to non-forest uses.	
Forest Stewardship Program	Provides technical assistance to private landowners to manage their forests and woodlands, including developing forest management plans. Administered cooperatively between the U.S. Forest Service, state forestry agencies, cooperative extension, and conservation districts.	• Increase program funding to expand technical assistance to private forest owners interested in changing management practices to improve carbon sequestration on their lands.	
Community Forests Program	Provides grants to local governments, tribal governments, and qualified nonprofit entities to establish community forests on lands that are threatened with conversion to non-forest uses and that provide multiple community benefits.	• Increase program funding in recognition of the climate-change mitigation benefits of preventing conversion of forests to non-forest uses.	
Urban & Community Forestry Program	Supports the integration of urban forestry at all scales in the context of city, regional, and state master plans. Delivers urban natural resources science, technology, and information to local and state partners.	• Increase program funding in recognition of the climate-change mitigation benefits of urban and community forests.	

B.2 OPTIONS TO SUPPORT AND SCALE UP INNOVATIVE STATE PROGRAMS

Some states have designed and implemented successful programs that encourage practices such as planting cover crops to achieve a range of environmental goals, including carbon sequestration. Examples from Iowa and Maryland are summarized below. Congress could consider expanding USDA's existing Conservation Innovation Grants program or Congress could establish a new Innovative State Soil Carbon program to provide federal cost-share funding for states that design and implement promising soil carbon initiatives .

- In 2017, **Iowa** established a new program, called the "New Ground with Innovative Cover Crop Incentive," that gives farmers who plant cover crops a $5-per-acre discount on crop insurance over three years. The program is managed by the Iowa Department of Agriculture and Land Stewardship. USDA surveys show that more farmers would consider planting cover crops if they received such discounts, especially in the Midwest where crop insurance is tremendously popular (about 80% of Iowa cropland is insured through the Federal Crop Insurance Program). Technically, the program doesn't reduce the cost of insurance—instead, Iowa works with the USDA's Risk Management Agency, which administers the Federal Crop Insurance Program, to cover part of the insurance premium. The discount applies only to crop cover on "new" acres.
- **Maryland's** Healthy Soils Program aims to improve the health, yield, and profitability of soil; increase soil carbon sequestration; and promote more widespread use of healthy soil practices among farmers in the state. The program defines "healthy soil" in terms of the capacity to function as a biological system, increase organic matter, improve soil structure and water and nutrient-holding capability, and sequester carbon. State law requires the Maryland Department of Agriculture to provide incentives, such as research, education, technical assistance, and (subject to funding) financial assistance to farmers who implement practices that promote healthy soils. Using monies provided by the Chesapeake Bay Restoration Fund and the Chesapeake and Atlantic Coastal Bays Trust Fund, grants are made to farmers to plant cover crops that reduce erosion, suppress weeds and pests, and improve soil health. In the 2016/2017 fiscal year, 560,000 acres of farmland in Maryland—or about 50% of eligible land in the state—were planted in cover crops. The program is seen as helping Maryland meet its aggressive state climate goal (i.e., reducing greenhouse gas emissions 40% by 2030); its adoption reflected the potential for new cooperation between agricultural and environmental groups, which have often disagreed on these issues.

B.3 OPTIONS FOR NEW CARBON SEQUESTRATION PROGRAMS

In addition to modifying or scaling up existing USDA and state programs, Congress could consider establishing new programs to capture opportunities in the following areas:

- **Expanded Conservation Incentives.** A new direct payment program would be a natural extension of existing conservation incentives authorized under the Farm Bill and administered by USDA but would target an expanded set of landowners—including urban, residential, commercial, state and municipal—who have opportunities to implement tree restoration. Payments could be structured as either a cost-share or pay-for-performance (or a hybrid of the two). Under a cost-share approach, USDA would issue payments to landowners who restore trees on their land according to standardized rates and over a fixed contract period.
- **Developing and Supporting National Carbon Trading Platforms**
    - **USDA Carbon Bank—**To create initial demand for agricultural and forest-based carbon credits, Congress could direct the USDA to use the Commodity Credit Corporation (CCC) to buy, insure, and/or provide price guarantees for carbon credits from farmers, ranchers, and forest owners. These mechanisms can overcome past obstacles to participation in voluntary carbon markets because they help to de-risk carbon investments, and land managers are already familiar with the CCC.
    - **Facilitate inter-sectoral credit trading in private markets—**The Ecosystem Services Market Consortium is an example of a private market for trading ecosystem service assets (e.g., soil carbon, net greenhouse gas reductions, water quality, and water-use efficiency). To support the expansion of these types of private markets, Congress could codify policy positions within all federal agencies in two key areas:
        - Producers/landowners own the environmental assets or credits they generate, regardless of whether cost-share from public conservation programs helped them achieve the credited environmental outcomes.
        - Producers/landowners can "stack" credits. That is, that the same land can generate multiple ecosystem assets at the same time, such as carbon, water quality, and water-use credits, to achieve outcomes-based impacts at scale.
- **Reforestation of Disturbed or Abandoned Lands.** A new program could target efforts to reforest disturbed or abandoned non-agricultural land in areas that are ecologically appropriate for trees. An estimated 53 million acres of land of this type are available in the United States for reforestation and are not currently served by existing USDA programs. About half of this

opportunity is in lands that are categorized as "developed open space"—e.g., parks, roadsides, sparse suburban areas.

- **Forest Carbon Tax Credits.** A federal subsidy for forest restoration could be administered through a tax credit program. This would be akin to other major energy-related federal tax policies enacted to date—including the investment tax credit for solar, the production tax credit for wind, and the 45Q tax credit for carbon capture, utilization, and storage. Lawmakers would face choices in how to structure the program (e.g., credits for eligible carbon-enhancing actions, or credits for tons of carbon sequestered) and how to address the carbon accounting issues identified in Section I.A. (e.g., not paying for reforestation that would occur even absent incentives).

B.4 OPTIONS FOR NEW RESEARCH AND DATA COLLECTION EFFORTS

- **Perennial Grain Crop Research.** The soil carbon benefits associated with perennial grain crops can be substantial. Consequently, Congress should consider establishing dedicated research programs in this area, through USDA's National Institute of Food and Agriculture, the National Science Foundation, USDA's Agricultural Research Service, and the Department of Energy's Advanced Research Projects Agency–Energy (ARPA-E). Congress could also provide support for Hatch Act and Smith-Lever Act institutions in the states to establish dedicated research programs for perennial grain crops. Major research investments can be made through dedicated funding within the multi-agency Small Business Innovation Research program, the Foundation for Food & Agriculture Research, and a number of other relevant programs. Funding should also be provided to explore opportunities for maximizing the carbon benefits of perennial agroforestry crops, which could produce substantial food yields while delivering high levels of ecosystem services.
- **Soil Carbon Accounting, Monitoring, Reporting, and Verification.** Further R&D is needed to develop comprehensive, yet inexpensive and easily replicable methods and protocols for soil carbon accounting. Specific priorities include:
    - Distributed technologies to provide rapid and accurate in-field soil carbon testing.
    - More accurate and repeatable soil bulk density tests.
    - Satellite and drone remote sensing technologies that can interface with quantification models and databases.
    - General research to improve the state of monitoring, reporting, and verification of soil carbon and other ecosystem services assets. More field-

level data collection and analysis will improve the rigor of methodologies for quantifying and monetizing ecosystem services assets.

- **Improvements in data collection by USDA and other federal agencies.** More robust data is needed to project carbon gains from forest health and soil conservation practices. A consistent national plot network that can collect long-term data would be especially valuable. Specific priorities include:

  - Bolstering the Forest Service's Forest Inventory and Analysis and NRCS's Natural Resources Inventory (NRI). These programs provide critical baseline data on land-based carbon sequestration and emissions in the United States. Increased funding would allow for more frequent measurement at thousands of inventory plots across the country and accelerate the integration of new measurement technologies.
  - Adding a soil carbon data collection mandate to the NRI. The NRI is a national network of tens of thousands of farm plots that have extensive land management data records dating back several decades.
    - Enhancing national-level data collection and monitoring on soil carbon has also been recommended by the National Academies as a way to improve scientific understanding of the factors that affect soil carbon stocks and provide locally applicable baseline data for comparison studies.
    - Efforts to combine plot-based direct measurement with landscape-scale modeling are needed to better understand the efficacy, cost, constraints, and challenges of implementing various soil management practices in different regions, soil types, and farming systems.
  - Updating and improving the accessibility of databases such as USDA's SSURGO (Soil Survey Geographic) database. For example, SSURGO could include updated soils information at a more granular level, along with information about soil carbon content at different depths, by region and production system.

- **Research in agricultural economics.** A better understanding is needed of the economics of adopting various land practices and systems approaches to improve carbon sequestration and ecosystem services outcomes at the field, farm, and regional production scales.

Section C: Conclusion and Next Steps

Since BPC's working papers on farm and forest carbon solutions were published, the near-term policy landscape has shifted dramatically due to the COVID-19 pandemic and the ensuing economic fallout. Understandably, attention in Congress has turned to stabilizing the economy and protecting and rebuilding American jobs. Many of the NRCS and Farm Service Agency programs discussed in this paper offer bipartisan opportunities to channel federal investment in ways that support job creation in hard-hit rural communities while also providing soil and forest carbon sequestration benefits. The options for new carbon sequestration policies remain relevant, but programs that require additional authority or regulation will be less attractive as Congress aims for a rapid economic response. To that end, BPC has identified the following seven recommendations for supporting job creation in rural communities and building domestic expertise in natural carbon removal:

1. Expand **soil health** programs for farms and ranches.
2. Drive local job creation through **tree planting** programs on non-federal lands.
3. Address the **forest restoration and hazardous fuels** backlog on federal lands.
4. Further develop **rural broadband** infrastructure.
5. Promote diversified **wood products** markets and wood engineering innovation.
6. Augment federal **wildland firefighting** capabilities and preparedness.
7. Invest in **workforce development** through natural resources-based national service and job training programs.

For more detail on these proposals and other BPC energy and climate stimulus proposals, go to https://bipartisanpolicy.org/explainer/energy-stimulus-recovery/.

Meanwhile, opportunities to advance natural carbon solutions and promote economic recovery can be found in existing Farm Bill programs and in the next Farm Bill, USDA's Commodity Credit Corporation, Department of Interior (DOI) programs and policies, ongoing federal appropriations processes, and any future federal climate legislation. The policy focus over the past 20 years has been on carbon offsets (in the context of voluntary or compliance-based carbon markets), but there is growing interest in a broader set of strategies for

agriculture and forestry that reduce greenhouse gas emissions and also provide other environmental co-benefits.

Over the coming months, BPC will continue working to identify and build bipartisan consensus around a comprehensive set of policy options. As part of that process, we aim to fill key information gaps by:

- Analyzing the efficacy of existing USDA and DOI programs and authorities with respect to promoting natural carbon solutions;
- Identifying best practices for tailoring farm- and forest-based carbon policies to public, private, and tribal lands;
- Examining the need for changes to existing statutory authorities;
- Evaluating policy options—including for nutrient and manure management and for methane capture and use—that maximize economic and environmental benefits; and
- Assessing potential funding and implementation mechanisms such as public-private partnerships, voluntary carbon and/or ecosystem services markets, and federal grant programs or incentive payments to landowners.

Natural carbon removal by farm and forest lands is emerging as a critical element of comprehensive efforts to reduce atmospheric concentrations of greenhouse gases and mitigate the risks of climate change. At the same time, key industry sectors and regions are unlikely to support climate policies that introduce uncertainties or raise their cost of doing business. This creates a broad need to find common ground and to develop a shared agenda that can unite stakeholders from agriculture, forestry, environmental organizations, conservation groups, rural communities, and other interests. A diverse coalition in support of natural carbon solutions can be a powerful voice in the policy conversations that are occurring now around economic stimulus and recovery in the near term, and pragmatic climate solutions in the longer term. Finding new ways to encourage and reward practices that also deliver economic benefits to farmers and forest owners—and that position farmers, ranchers, and forest managers as valued contributors to climate solutions—will be instrumental in creating a bipartisan coalition for effective climate action.

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