



Restoring Carbon for Healthy Agricultural Lands

A US FEDERAL POLICY ROADMAP



Carbon180

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ABOUT CARBON180

Carbon180 is a climate NGO with a vision to remove legacy carbon emissions from the atmosphere and create a livable climate in which current and future generations can thrive.

Based in Washington, DC, we design and champion equitable, science-based policies that bring carbon removal solutions to gigaton scale.

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Section One:

Introduction & Overview

Introduction & Overview

Carbon dioxide removal (CDR) on agricultural lands can scale some of our most time-tested carbon storage practices right now, while helping farmers and ranchers withstand mounting environmental and economic disruption.

The scientific community recognizes that, alongside rapid emissions reductions, the world will need 5–10 gigatons (Gt) of CDR annually by 2050 to meet global carbon dioxide targets.¹ To set us on this path, the US should aim to remove 30 megatons (Mt) of carbon dioxide per year by the year 2030 — agricultural lands alone could exceed that several times over as practices scale toward midcentury. US croplands and grasslands are already a net carbon sink of 20–50 MtCO₂e per year. Moderate, sustained adoption of conservation practices across 175 million acres could more durably remove an additional 106 MtCO₂e annually over the next two to three decades. More aggressive adoption on 336 million acres could remove as much as 204 MtCO₂e.² Emerging pathways like biochar and enhanced rock weathering (ERW) could further scale removal with longer-lasting storage, though more research is needed to confirm feasibility.

Done well, agricultural carbon removal pays off beyond carbon benefits, with greater biodiversity, more diverse farm income, and improved yields. To scale responsibly, policy must center land stewards and their communities, as experts in what works on the ground. Policies should also take a holistic landscape approach in land management, so that CDR can enhance ecosystems, rather than come at their expense.³

This roadmap aims to bridge the gap between the ancient field of agriculture with its longstanding norms and the young, fast-evolving field of carbon removal. In recent decades, management of working lands for carbon, alongside production and conservation values, has become a climate change mitigation and resilience strategy. The underlying conservation agriculture practices are not new, but land stewards still face major barriers in adopting and sustaining them.

To realize the full potential of agricultural lands as carbon sinks — and to identify the most catalytic federal policies — Carbon180 went to the people making land management decisions every day. For nearly two years, we met with farmers, ranchers, technical service providers, and scientists in every major US agricultural region. We asked what practices

and programs have worked for them, and where carbon management could fit into their operations. Drawing on these perspectives, we identified **five areas** of opportunity for policy to help sustainably scale agricultural carbon sinks:



Infrastructure and Market Access



Land Access and Tenure



Technical Assistance and Local Capacity Building



Incentives and Risk Management



Monitoring, Research, and Development

Taken together, these five areas unlock a new, integrated model for agricultural carbon removal: one where ecosystem and community values are prioritized *with* carbon removal, and where production exists *alongside* conservation, climate change mitigation and resilience.

Recommendations in this roadmap prioritize the federal government's greatest levers for scaling established carbon removal pathways, while confirming the potential of emerging pathways. As US farmers and ranchers grapple with a perfect storm of high operational costs, economic uncertainty, and climate disruptions, this roadmap charts a path forward to build producer resilience, pairing innovative solutions and long-practiced intergenerational knowledge to offer policy solutions that meet this moment.

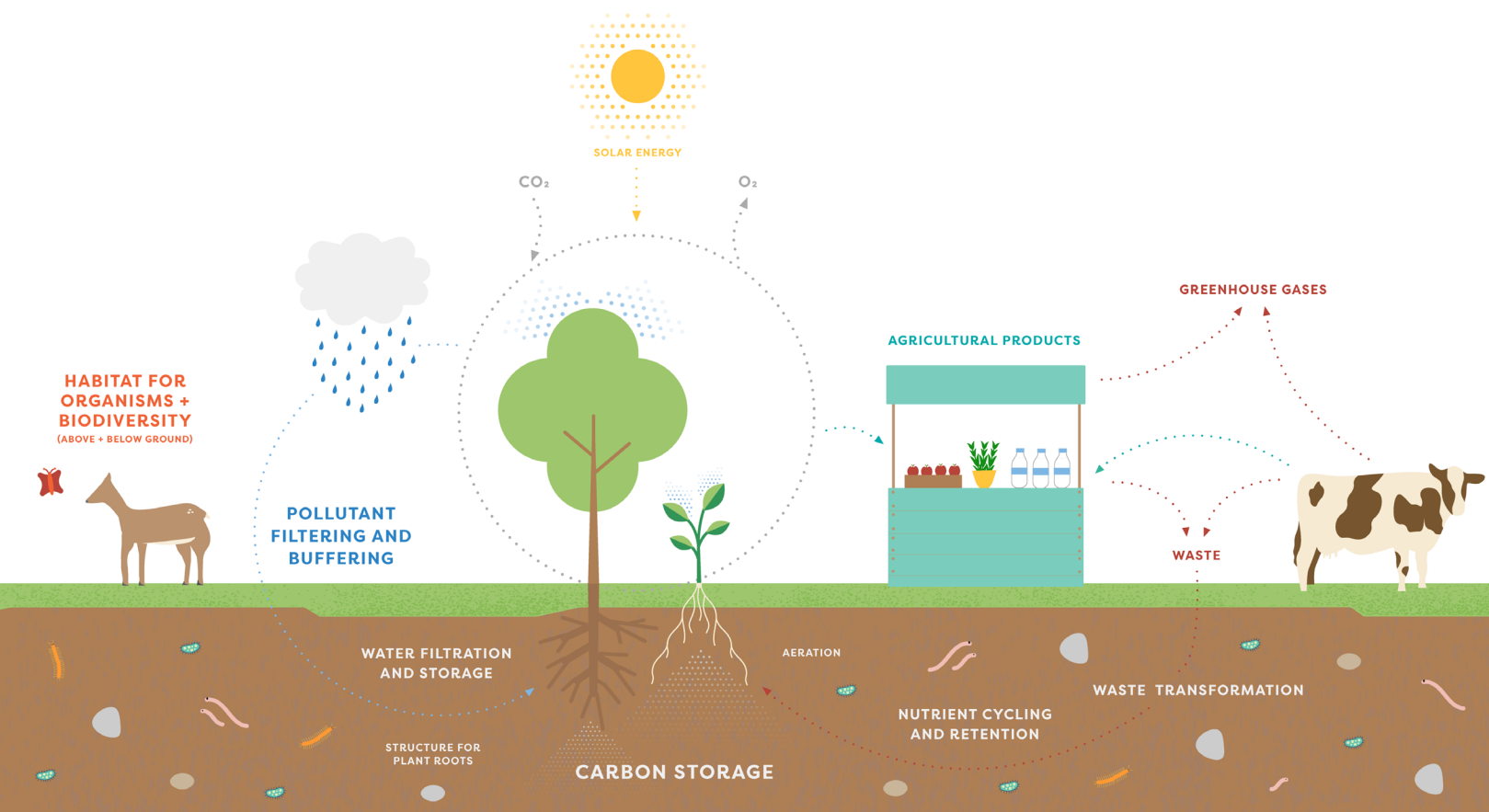
Soil health and soil carbon

Though soil health and soil carbon are not synonymous, they are closely intertwined. Soil organic carbon (SOC) helps give soil its structure, improving soil porosity to allow movement of water and air through the soil. This can improve water retention, nutrient availability, and root penetration to create stronger aggregates, decreasing likelihood of erosion. SOC also fuels microbial diversity and activity, supporting nutrient availability and crop production.⁴ Many key US agricultural regions have degraded soils without enough SOC to resist erosion, which costs farmers money and weakens the ecosystem services healthy soil provides.⁵

Where this roadmap refers to “soil health practices,” we mean those with demonstrated potential to build soil carbon. For practices that sequester carbon both in soils and aboveground biomass, we use “conservation practices” and “regenerative practices” interchangeably. “Agricultural carbon removal pathways” refers more broadly to carbon removal involving soil carbon, forest carbon, biochar, and enhanced rock weathering.

FIGURE 1

Healthy soil promotes multiple benefits



Section Two:

Policy Recommendations



Infrastructure and Market Access



Priority Recommendation: Establish a Conservation Pilot Procurement Program.

Getting regenerative crops to market requires infrastructure at every step of the value chain, which includes growing, cleaning, transport, aggregation, storage, processing, and marketing.

Where it's missing, farmers absorb the logistical and transaction costs. Farmers face special hurdles in cultivating culturally significant, perennial, and other specialty and diversified crops grown with conservation practices, often lacking the infrastructure needed to reach buyers at a profit. After decades of consolidation, small and midsize farms face wider infrastructure gaps than large ones.

Studies across a variety of crops show that implementing practices that sequester carbon and enrich soil health can increase yields and income and cut costs, alongside benefits like decreased soil erosion and compaction, earlier access to fields during wet years, and overall improved resilience to extreme weather.^{6,7,8} Yet, soil carbon builds slowly, so the payoff can take several years. And conservation-oriented markets are growing but they remain small in comparison to traditional agricultural markets. Market access and premiums can enable transition to regenerative practices by making the initial costs worth bearing.

As farmers increasingly look to shift land management practices to those that can weather new climate extremes, the federal government should support producers to build resilience by investing in the infrastructure and markets necessary to ensure food, farm and economic prosperity. The recommendations below aim to strengthen the agricultural value chain from sustainable seed supply to federal procurement.

Recommendation 1: Invest in a diverse supply of perennial seed and seedlings in key agricultural regions.

Interest in perennial systems like agroforestry has surged over the past five years, and is still likely artificially depressed due to low technical expertise and the longstanding norms of US annual production.⁹ Infrastructure is also drastically insufficient to meet native seed demand, with much of that for perennials, meaning scarce market availability

for producers looking to purchase seed.¹⁰

To address this gap, Congress should appropriate additional funding for the Natural Resources Conservation Service (NRCS) Plant Material Centers (PMCs) — a network of 25 ecologically distinct sites that support conservation practices through plant and vegetative technologies — to invest in a dedicated perennial seeds initiative. PMCs should collaborate with other USDA regional entities, including the Agricultural Research Service (ARS) Climate Hubs, to evaluate farmer needs and demand, and guide establishment of regional perennial seed supply. PMCs should then partner with the private sector to develop and supply perennial seed and seedling varieties that are regionally and culturally appropriate, and native where possible. Congress and USDA must more broadly invest in infrastructure needed to distribute seed widely to producers. In the interim, PMCs can continue to partner with USDA regional entities, as well as local, Tribal, and state entities, to distribute seed supply, including through NRCS conservation programs. Congress should also include the proposed provision regarding US Forest Service (USFS) grants to build nursery capacity for seed and seedling collection and storage in a final Farm Bill.¹¹

Annual crops cover more than 80% of the world's harvested area, requiring significant seed, labor, and other input resources to replant yearly.¹² Perennial crops, on the other hand, last two or more years,

establishing deep and complex root systems that store significantly more carbon than most annual crops, while delivering other benefits like enhanced water retention, greater biodiversity, and decreased

soil erosion.^{13,14,15} Strategic integration of perennials can yield operational benefits for producers, resulting in an overall decrease in inputs (seeds, fertilizer, labor) due to no need for annual replantings.¹⁶

Recommendation 2: Invest in market development for cropping systems with high carbon sequestration potential.

A. Establish an Agricultural Marketing Service (AMS) pilot program for market development of perennials. To grow perennials at commercial scale, producers need aggregation, processing, and market infrastructure, plus reliable market demand. Congress should authorize a competitive grant pilot within AMS for perennial market development, drawing on the experience of similar pilot programs such as the Bison Production and Marketing Grant Program.¹⁷ A variety of perennial

crops should be eligible, from grasses like Kernza to woody plants like chestnuts or elderberries, with a percentage set aside to source from Tribal and Indigenous communities. A pilot program would catalyze innovative approaches to building new markets, while crowding in additional private sector investment.

In 2022, USDA announced the new \$3.1 billion **Partnerships for Climate-Smart Commodities (PCSC) Program** to incentivize farmers, through market expansion, to implement practices that sequester carbon, reduce greenhouse gas emissions, and adopt practices that improve farm resilience to extreme weather. Projects involved private sector partnerships and an emphasis on innovation and monitoring, measurement, reporting, and verification (MMRV). The program was canceled in 2025 and reestablished as the **Advancing Markets for Producers (AMP)** program, which removed climate-related goals and emphasis on MMRV, though existing PCSC contracts could be redesigned to meet AMP eligibility requirements. With funding and program disruptions, results from both programs remain to be seen, though both clearly identify the need for innovative, data-driven markets that better support producers.

B. Better resource existing mid-scale market infrastructure to help diversified small and midsize farms prosper. Small and midsize farms often lack mid-scale aggregation, processing, and distribution infrastructure.^{18,19} By pooling supply, sharing processing capacity, and creating collective bargaining power with buyers, cooperatives and community hubs can mitigate risks associated with smaller individual farm volumes and lower yields in early years, enhancing the economics of carbon-storing systems.

USDA Program	Recommendation
National Institute of Food and Agriculture (NIFA) Rural Cooperative Development Grant Program	Pass the bipartisan, bicameral, Strengthening Rural Cooperatives and Communities Act (H.R. 1951, S.3075). ²⁰
Local Agriculture Market Program (LAMP)	Increase funding to ensure subsidiary programs have sufficient resources to meet their mandates. Reduce matching fund requirements for small or mid-sized operations.²¹
Resilient Food Systems Infrastructure Program (RFSI)	Permanently authorize RFSI, currently a one-time, COVID-era program. Pass the bipartisan American Food Supply Chain Resiliency Act (S.4842).²²

Recommendation 3: Use federal procurement to drive conservation practice adoption and local supply chain resiliency.

The US federal government purchases \$7.7 billion annually in food and agricultural products across agencies, with USDA accounting for \$5 billion in FY23.²³ A 5-10% reallocation toward products grown using conservation practices could send a strong market signal, both to producers and other purchasers, to strengthen incentives for farmers to adopt and sustain regenerative practices. USDA should:

A. Rebuild the Local Food Purchase Assistance (LFPA) program. USDA launched the LFPA program in 2022 through cooperative agreements with states and Tribal nations to bolster supply chains and buy food from local, small and midsize, and underserved producers. Though LFPA was rescinded in 2025, the bipartisan Local Farmers Feeding Our Communities Act (H.R. 4782) aims to authorize a new program modeled after LFPA, constructing resilient local supply chains while nourishing communities. If the program becomes law through the Farm Bill, appropriators should fully fund it in FY28.



B. Establish a Conservation Pilot Procurement Program. USDA should pilot a program that directs 5-10% of USDA's annual food spending toward products grown with practices that store carbon, reduce greenhouse gas emissions, and improve environmental resilience. The pilot should use a best value award methodology, the established federal approach that weighs non-price evaluation factors alongside price and past performance. USDA should set the conservation criteria through public comment and consultation with a range of producers.

Recommendation 4: Ensure policies governing private sector engagement center producers and prioritize practices that confer proven ecological benefits, including carbon sequestration.

A. Ensure equitable, science-based implementation of the SUSTAINS Act. The Sponsoring USDA Sustainability Targets in Agriculture to Incentivize Natural Solutions (SUSTAINS) Act was passed in late 2022, and allows USDA to accept private contributions to support federal conservation programs. In late 2025, USDA announced that the new Regenerative Pilot Program would use the SUSTAINS Act to secure additional investment from the private sector. Going forward, USDA should prioritize accepting private funding for practices that address several natural resource concerns at once, including carbon sequestration. USDA should continue investing in long-term MMRV (measurement, monitoring, reporting, and verification) for ecological benefits, aligning with priorities set by Congress and locally-led planning processes, and prioritizing producer ownership of carbon benefits.²⁴

B. Implement the Growing Climate Solutions Act to enhance producer protections, transparency, and scientific grounding for agriculture credits in the voluntary carbon market (VCM). The Growing Climate Solutions Act (GCSA) passed in 2022, but implementation has stalled.²⁵ The legislation establishes a Greenhouse Gas Technical Assistance Provider and Third-Party Verifier Program within USDA, positioning USDA as a trusted source regarding VCM protocols, qualified verifiers and technical assistance providers, and troubleshooting common producer barriers. USDA should play a role in evaluating VCM protocols for scientific rigor, establishing qualifications that technical assistance providers and verifiers must meet, and implementing stringent producer safeguards while also enhancing MMRV to facilitate scientifically accountable VCMs.²⁶

The voluntary carbon market (VCM) has opened a path to rewarding conservation practices through soil carbon crediting. However, strict eligibility requirements, uneven methodological rigor, and uncertain demand limit the ability of these markets to guarantee	payment for producers and transform agriculture at scale. Still, the VCM offers a meaningful niche source of payments for some producers, and advances soil-carbon MMRV. Two project developers, one working on cropland (Indigo Ag) and one on grazing lands (Grassroots Carbon),	have issued credits at the scale of millions of tons and reportedly paid producers tens of millions of dollars.²⁷ While public programs should serve as the dominant mechanism for incentivizing conservation practices, private sector options should remain a viable financing avenue.
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Land Access and Tenure



Priority Recommendation: Pilot a next-generation, sustainable land steward development program.

Working lands require consistent, long-term stewardship to durably store carbon.

When land changes hands, carbon storage can either persist, grow, or deplete depending on the management regime. Early adopters of conservation practices need stable tenure to sustain practices and keep carbon stored in the soil, and land transfers should preserve or enhance carbon storage when possible — especially as new, beginning, and young producers are generally more likely to implement regenerative practices.²⁸ Developmental pressures can risk losing agricultural lands to built environments and impervious surfaces that often convert carbon sinks to carbon sources. Affordable, secure, and equitable land tenure can unlock more continuous implementation of practices that sequester carbon, allowing accrual over time.

However, farmers seeking access to land — particularly new and beginning farmers — increasingly face farmland consolidation,^{29,30} mounting developmental pressure,³¹ and rising land values beyond inflation.³² For farmers looking to purchase land, affordability and identification of suitable land pose formidable challenges, with 59% of young farmers citing land affordability as the top challenge.³³ Barriers are even higher for Black, Indigenous, and other farmers of color.³⁴ Nearly 40% of farmland is rented, including over half of cropland and a quarter of pastureland.³⁵ Studies show^{36,37} that renters often do not adopt nor maintain capital or labor-intensive practices that sequester carbon when their future on that land is uncertain, a trend echoed in Carbon180's conversations with producers.

These challenges are coming to a head as the average farmer age is 58 years and 40% of farmland³⁸ is expected to change hands over the next 15 years, marking a time of both risk and opportunity. As farmland turns over to a new generation, federal support should facilitate affordable, secure, and equitable land access pathways to catalyze new adoption and sustain regenerative practices.

Recommendation 1: Preserve farmland from development while enabling long-term carbon storage across upcoming agricultural land transitions.

- A. Establish a federal grant program that supports regional, state, Tribal, and community-based land link programs to connect land-seeking stewards with conservation-oriented ownership and rental opportunities.** Land link programs match landowners selling farmland to those looking to lease or purchase. As a tool in facilitating land transition, land link programs³⁹ can also help carry over stewardship from farmer to farmer to maintain carbon stocks. While successful state and regional land link programs are eligible for some USDA opportunities such as the NIFA's Beginning Farmer and Rancher Development Program (BFRDP), USDA funding is generally short-term and highly competitive. Congress should increase funding for BFRDP and reserve a portion for community, Tribal, regional, and state-based land link and succession planning efforts across the country, with emphasis on preserving conservation stewardship, including land carbon stocks, across ownership changes. The existing carveout for socially disadvantaged producers should also be increased to address heirs' property and other issues that require more intensive resources. This initiative should synchronize with other land transition programs like the Conservation Reserve Program Transition Incentives Program (CRP-TIP).
- B. Formally authorize a new program within the Farm Service Agency (FSA) that provides competitive grants and cooperative agreements to tackle challenges of land, capital, and market access for new producers.** Keeping farmers on the land prevents sales that result in development or other land uses that deplete carbon sinks. The Increasing Land, Capital, and Market Access Program, originally funded through the American Rescue Plan Act, offered competitive grants for nonprofits, Tribal governments, and other organizations to support underserved farmers through land loss prevention, succession planning, access to capital, and market expansion. Congress should pass legislation such as the New Producer Economic Security Act (H.R. 2536/S.1237), to codify these important efforts. Key bill language includes plans to incorporate long-term adoption of conservation efforts into the application process, adding an opportunity to enhance carbon sequestration.

Recommendation 2: Expand sustainable land stewardship options outside of traditional land ownership.

A. Allow Farmland Commons projects to be eligible for federal conservation

program funding. Congress should update federal conservation program language in both ACEP-ALE and RCPP to allow Farmland Commons projects that focus on ownership and tenure to be eligible as a qualified real estate interest. Innovative and affordable land stewardship models are needed to support producers, particularly those who have been historically underserved, while enhancing and maintaining agricultural carbon sinks. In a Farmland Commons model,⁴⁰ land is donated or sold at a discount (by retiring farmers with no successor, or institutions with surplus land) to a nonprofit, then leased for 99-year terms (or the maximum allowable by state law) at affordable rates for farmers interested in implementing a certain threshold of conservation. This model could be replicated in urban, suburban, or rural areas, offering an innovative solution to affordably unlock carbon sequestration, natural resource conservation, farm legacy preservation, multi-generational stewardship, local food systems connectivity, and other benefits.



B. Pilot a next-generation, sustainable land steward development program to connect aspiring land stewards seeking hands-on experience with mentor farmers implementing regenerative practices.

New generations of land stewards need training and experience to profitably implement regenerative practices long-term. Learning under the mentorship of an experienced farmer can also alleviate immediate pressures faced by beginning land stewards to lease or purchase land.⁴¹ USDA should create a farmer-centric pilot development workforce program, providing grants to community organizations to recruit mentor farmers who are experienced in conservation practices, with an emphasis on soil health. Aspiring, new, and beginning farmers could then apply to the development program to match with a local mentor, earning a living wage while providing federally subsidized labor to mentor farmers. The program should set the core skills and competencies required, and upon program completion, farmers should receive a tangible benefit on their path to land acquisition, such as a preferential FSA loan rate.



Technical Assistance and Local Capacity Building



Priority Recommendation: Establish nationwide free soil health testing and interpretation.

Lack of credible, local, and affordable technical assistance (TA) is a long-standing barrier for farmers and ranchers.

Moving from conventional agricultural production to systems built for carbon removal and long-term resilience can seem risky and expensive at first, necessitating expert support. NRCS is the main public TA provider, but its TA funding is discretionary, requiring annual appropriations from Congress. While Farm Bill conservation programs like the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP) receive mandatory funding, the technical assistance required to deliver them is never assured. Recognizing this barrier, the 2022 Inflation Reduction Act included \$1 billion specific to technical assistance for climate-smart practices. Since then, however, more than 25% of NRCS staff left the agency in 2025 amid deep cuts, with the largest losses in soil conservation-related positions.⁴²

Even a fully staffed NRCS would require specialized TA for carbon-sequestering practices, as knowledge regarding these approaches is not yet mainstream. Rebuilding NRCS offers an opportunity to understand where previous support has fallen short for producers and reimagine what TA could look like. The federal government also has an opportunity to invest much more in locally-led efforts, building on the existing capacity of farmer and community networks, to unlock carbon and associated benefits for agricultural ecosystems and rural communities.

Recommendation 1: Bolster technical capacity of local NRCS offices to provide comprehensive and up-to-date soil health and carbon management support.

A. Rebuild NRCS staffing and technical assistance delivery. With its nationwide network of offices and staff, NRCS remains the backbone of conservation technical assistance delivery, with data showing that 67% of agricultural fields that received any technical assistance received it from NRCS.⁴³ Recent on-again, off-again federal

funding and support has been widely damaging. The number of conservation contracts awarded fell 20-40% through 2025, even as farmers applied for these dollars.⁴⁴ Congress must ensure restoration of former staff roles, including by appropriating robust Conservation Technical Assistance.

Additionally, NRCS has long prided itself on its unique role of providing free, one-on-one, personalized advice to producers. While rebuilding staffing, Congress should also ensure programs are streamlined to be less administratively burdensome so that NRCS can provide on-the-ground technical assistance. The bottom line: however much funding Congress provides for financial program assistance for farmers, farmers cannot adopt conservation successfully without NRCS technical assistance behind it. Funding must be durable so that farmers know NRCS is a reliable partner.

B. Amplify support for cooperative agreements, expanding specialized and culturally relevant training and technical assistance. Specialized and culturally relevant TA is especially lacking, resulting in a vicious cycle: as long as USDA, through NRCS, cannot offer specialized training, farmers will not try to enlist their help. And as long as farmers do not try to access NRCS assistance and programs, this apparent lack of demand will inform what NRCS interprets as farmer interest. Agroforestry is a clear example, with five NRCS-approved agroforestry practice standards and very few local staff with any agroforestry training.⁴⁵ Virtual training has offered a stopgap solution, but it is no substitute for hands-on learning. NRCS must expand and streamline the process for cooperative agreements with local organizations to provide TA to farmers and training to NRCS staff based on best practices. Bills such as the Farmer to Farmer Education Act (S. 1769/H.R. 8533) are a first step in a wider approach to large-scale expansion of technical assistance.

Agroforestry systems are a suite of perennial practices in which trees and/or shrubs are intentionally integrated on agricultural lands. USDA recognizes five agroforestry practices: alley cropping, silvopasture, forest farming, windbreaks, and riparian

buffers. When implemented and maintained over time, agroforestry can provide food production, durable carbon sequestration, enhanced biodiversity, erosion control, and even shade for farmworkers and animals.⁴⁶ Although

one of the pathways with the highest carbon sequestration potential, agroforestry often lacks the same level of federal support as more well-known conservation practices like cover crops. .

C. Better integrate farmer feedback and open opportunities for two-way

learning. USDA should not rely on farmers walking into an NRCS office to find out what help they need. More comprehensive survey work to better understand demand would be instructive at both state and county levels, at a regular three-year cadence. This could help reach the majority of producers who do not visit or no longer have access to a county NRCS office, offering direction to the agency about the true interests and needs of farmers.

USDA should also invest in better, farmer-centered training for NRCS technical support staff, including prioritizing workshops with producers to provide two-way education. NRCS staff can share program availability and eligibility while producers explain day-to-day decisions impacted by conservation management. This can improve relationships and build trust between NRCS and local land stewards. Giving NRCS staff the bandwidth to engage in continued, reciprocal education is essential to ensuring staff are more fluent in the terms that different communities use for specific management practices, and the benefits that draw them to implementation.⁴⁷



Recommendation 2: Establish nationwide free soil health testing and interpretation.

Farmers already see the value of testing their soils. A 2023 survey indicates that nearly two-thirds of farmers believe in testing soil once every three years, with only 3% saying they never test at all.⁴⁸ Soil health testing offers insights on variables like soil nutrient content and structure that often form the foundation of management decision-making for both production and conservation. For carbon removal, soil testing is how we quantify and monitor the carbon stored in soil, verifying soil's capacity as a carbon sink. While NRCS, cooperative extension, and some state programs offer subsidized or low-cost soil testing, soil health test and interpretation quality and availability varies widely based on farmer location and program.

USDA should implement a nationwide soil health testing initiative, enabling all farmers to be eligible for a free or low-cost annual “check-up” to maintain healthy soils and serve as the bedrock of sound, data-driven technical assistance. As a first step, soil testing cost-share should be a standard part of federal conservation program contracts. To build

capacity, USDA should bring together a consortium of land-grant universities, including historically Black colleges and universities and Tribal colleges and universities, to coordinate a nationwide soil health testing and interpretation initiative. The consortium should establish standards for a set of the most informative soil health indicators, testing methodologies, and interpretation systems. USDA can sign cooperative agreements with public and private sector labs to process soil samples, and farmers and ranchers should be able to opt-in to share soil health benchmarks and progress as part of aggregated, non-identifiable data to better tailor regional TA and implementation of conservation practices over time. When implemented at scale, soil testing can provide key data to help transform agriculture from a major emissions source into a major climate solution, while building farm resilience against extreme weather.

USDA's Regenerative Pilot Program (RPP), announced in late 2025, is an outcomes-based conservation pilot that uses existing EQIP and CSP funding to address whole-farm resource concerns. RPP recognizes the importance of soil health testing,

requiring both a whole-farm conservation plan and soil health tests in the first and fifth years. The initial list of eligible practices includes familiar ones like cover crops and grazing management, while excluding other carbon sequestering practices like agroforestry. NRCS began

implementing RPP in early 2026, and USDA notes that the program has to date completed 67,000 whole farm conservation plans covering more than 49 million acres. Universal soil health testing would help outcomes-based conservation grow beyond this pilot.

Recommendation 3: Support local capacity building and community innovation in sustainable agriculture.

Knowing which practices best suit conservation and production goals takes local expertise that state, local, and Tribal partners are often best equipped to offer. Although federal USDA programs aim to deliver NRCS technical and financial assistance that is regionally tailored, a dramatic reduction in NRCS staff paired with oversubscribed conservation financial assistance and a dearth of knowledge on many regenerative practices has inhibited practice adoption and persistence. A low-barrier way for the federal government to unlock a greater scale of conservation practices is simply by funding locally-led efforts.

The Partnerships for Agricultural Climate Action (PACA) Act (H.R. 6341) offers a strong start, aiming to catalyze locally-led efforts to increase carbon sequestration, reduce greenhouse gas emissions, and strengthen extreme weather resilience on agricultural

lands.^{49,50} Based on a successful and bipartisan Washington state program, the bill establishes a subprogram within USDA's successful Conservation Innovation Grants (CIG) to fund local partner, state, and Tribal initiatives. This program would build on local strengths and knowledge to spur a mosaic of innovative, bottom-up approaches to agricultural climate mitigation and resilience.⁵¹ Collective knowledge sharing can inform where and how to scale approaches most effectively.



Incentives and Risk Management



Priority Recommendation: Adjust and extend conservation program contracts.

Federal conservation program incentives are popular, with farmer and rancher demand consistently exceeding available funds.^{52,53}

These programs offer much-needed financial and technical support to ease early implementation hurdles, rewarding a long list of practices that vary in their carbon and non-carbon environmental benefits. EQIP provides cost-share reimbursements to farmers, and tends to reward practice adoption over long-term maintenance. CSP pays farmers to maintain existing conservation activities that provide environmental benefits, and to implement new practices, with contracts that can be renewed to meet additional conservation goals. Despite recent funding increases, these programs remain a small share of federal support, eclipsed by farm safety net programs that primarily incentivize yield rather than environmental outcomes.⁵⁴

Used well, conservation programs are one of USDA's strongest risk management tools in building agricultural resilience. Better-targeted investments that support long-term carbon management could deliver more ecosystem benefits while advancing comprehensive farm productivity.⁵⁵ Agriculture also sits within a wider landscape, and safeguards should ensure that farms thrive alongside grasslands, wetlands, and other critical ecosystems.

Recommendation 1: Retool existing conservation programs to better support adoption of carbon storing practices.

A. Embed carbon sequestration and climate resilience in federal conservation program purposes, expanding practice eligibility and payment support.

Federal conservation programs should evolve to meet the environmental challenges and natural resource concerns that farmers face today, or otherwise risk subsidizing ineffective or harmful practices that leave operations vulnerable to a changing world. USDA should embed carbon sequestration and climate resilience in conservation program purposes and priorities, practice eligibility, and payment support to create more adaptive programs that maximize taxpayer dollars by meeting

farmers' evolving needs to extreme weather and economic disruptions. The table below includes recommendations,⁵⁶ organized by conservation program, to drive regenerative practice adoption and optimize program funding:

Recommendation	EQIP	CSP	ACEP	RCPP
Program Purpose				
Add carbon sequestration and climate resilience to conservation program statutory purpose	●	●	●	●
Include carbon sequestration and climate resilience under eligible priority resource concerns and/or ranking criteria	●	●	●	●
Practice eligibility				
Restore localized NRCS practice scenarios and payment rates for conservation practices ⁵⁷	●	●		
Develop a standardized definition of agroforestry that incorporates Traditional Ecological Knowledge (TEK), and common use terms by land stewards ⁵⁸	●	●		
Ensure the 50% EQIP funding that goes towards livestock includes at least 2/3 dedicated to grazing management	●			
Offer a national funding pool for perennial practices	●			
Make perennial production systems eligible for supplemental payments		●		
Make agroforestry practices like alley cropping, forest farming and silvopasture eligible for the new Regenerative Pilot Program	●	●		

Recommendation	EQIP	CSP	ACEP	RCPP
Practice eligibility (cont'd)				
Require conservation plans for agricultural land easements, including for land that is not highly erodible			●	
Payment levels				
Increase cost-share rates for carbon sequestering practices and offer a 50% advanced payment	●	●		
Pay a premium for suites of practice enhancements, or “bundles” that sequester carbon		●		

B. Establish a new Agroforestry Initiative within CRP. The Conservation Reserve Program (CRP) already recognizes the value of agroforestry by sharing the cost of establishing practices like windbreaks, riparian buffers, and shelterbelts under 10-15 year contracts. But CRP strictly regulates harvesting and grazing on agroforested land, disincentivizing reenrollment once contracts expire so producers can harvest tree and shrub crops for income. By excluding productive agroforestry, CRP misses the opportunity to maintain conservation outcomes while supporting producers to build resilience and diversify operations, which is especially relevant in rural communities looking to rebuild their economies. Building on the success of the CRP Grasslands Initiative, Congress should create a new Agroforestry Initiative that supports establishing agroforestry practices and eventually, harvesting and grazing agroforested acres as long as conservation outcomes are maintained.

Recommendation 2: Adapt existing conservation programs to better enable durable soil carbon storage.

A. Increase funding for CSP to better meet demand. Created in 2002, CSP was designed to reward producers for maintaining conservation efforts and taking them to the next level. In the 2018 Farm Bill, Congress changed the program from an acre-

based program to a dollar-based program, which reduced the total funding flowing to farmers.⁵⁹ Even after a historic infusion of Inflation Reduction Act funding — some of which was permanently included in the program baseline — demand still far exceeds available funding, resulting in between one-fourth and one-third of applicants receiving contracts over the last several years.^{60,61} Congress should authorize \$4 billion annually for CSP to better satisfy farmer demand and provide the support needed to sustain implementation of conservation practices.



B. Adjust and extend conservation program contracts to reflect soil carbon accrual timelines, providing one-time “persistence payments” to encourage practice longevity.

Soil organic matter (and in turn, soil organic carbon) typically takes five or more years to see significant improvement following initial practice implementation.^{62,63,64,65} Implementing perennial systems in particular takes multiple years and often ongoing technical and financial assistance to properly establish and maintain. Current conservation program contract lengths fall short of the time needed for meaningful carbon sequestration: though working lands program contracts can range up to 10 years under EQIP conservation incentive contracts and CSP contract renewals, average contracts last one to three years under EQIP and five years under CSP.

Congress should direct NRCS to offer longer options for contracts that involve soil health as a primary resource concern to fully secure the soil health and carbon benefits of conservation activities. For EQIP, NRCS should direct non-structural soil health activities to the conservation incentive contract (CIC) option that spans five to 10 years, versus the one to three years offered under general EQIP. For CSP, NRCS should reinstate non-competitive automatic renewals to allow back-to-back five-year contracts for eligible producers. For producers who maintain conservation practices for three or more years beyond contract conclusion, a one-time “persistence payment” can encourage practice longevity, locking in soil carbon and other environmental benefits that require time to flourish. USDA should also collect data on the maintenance and longevity of practices associated with different federal programs to ensure that outcomes meet program goals, especially once those goals have been updated to reflect carbon sequestration and climate resiliency.

Recommendation 3: Build on-farm resilience through a data-driven crop insurance program.

A. Incorporate more and better scientific data in crop insurance ratings. The unpredictable risks of growing food are the basis for our \$15 billion/year federally-subsidized crop insurance program. However, the federal crop insurance program currently falls short in protecting food production and our nation's soils by paying out on losses incurred, not on risk reduced. Today's data and science make it possible to manage risk before the losses happen. For example, USDA's Pandemic Cover Crop Program (PCCP) required farmers to certify their cover crop data with FSA, which was matched with Risk Management Agency (RMA) insurance forms. This was a small and easily-administered first step toward improved USDA data collection and integration that should be reinstated.

Federal crop insurance rates should reflect a broader set of data than is currently included, drawing on not only USDA sources but also those collected by other federal agencies including NASA, ag-tech providers, and land-grant universities. Modernization could include soil type data or soil water holding capacity. Better data would also let farmers establish expected profitability without waiting 4-10 years to collect actual yields before being able to purchase full coverage.

B. Create innovative risk mitigation programs to better tackle emerging insurance needs. Within RMA, improved data integration and analysis create opportunities for innovation to help farmers transition to more resilient crops and systems. The current program is siloed by individual commodity, generally covering an annual, single-crop cycle, with a few exceptions, including the Whole Farm Revenue Protection (WFRP) policy and the Pasture, Rangeland, Forage policy (PRF). Newer, more resilient systems will require creative pilots that lead to broad coverage for new kinds of landscapes.

For example, no coverage exists for agroforestry systems like silvopasture, alley cropping, or windbreaks that intentionally combine trees or shrubs with crops or livestock. Existing prohibitions around interplanting different crops in the same field at the same time, as well as the large differences in schemes for insuring crops and livestock pose high barriers.

Without crop insurance coverage, farmers must bear the risks of innovation alone. Specific gaps include multi-year coverage for perennial crops, like agroforestry and perennial grains, and coverage for multi-crop systems, such as three-crop rotations like corn-hybrid rye-soybeans, which do not fit into double-crop rules. A conventional approach to insuring these crops, which requires years of individual yield history over large areas, is simply not practicable for the crops and systems of the future. Advances in agricultural data collection can innovate to meet these demands.

- C. Discount crop insurance premiums for conservation adoption.** Crop insurance is meant to be market-based, not an income transfer like other farm subsidies. In other lines of insurance, policyholders who reduce their risk are rewarded through discounts and incentives. Crop insurance works the other way: a farm that depletes its soil and suffers a large loss can collect taxpayer-paid indemnities, while a farm that invests in soil health to mitigate loss has to bear the investment cost without a corresponding premium reduction. Growing evidence demonstrates the risk mitigation efficacy of conservation practices: combining low tillage and cover crops on cropland reduces yield losses, while rotational grazing improves grasslands health and diversified crop rotations and perennial systems increase resilience.^{66,67} RMA should offer premium discounts for conservation adoption, which both farmers and taxpayers recognize as the way to reward risk-reducing behavior.

Recommendation 4: Strengthen federal incentive integrity to ensure that agricultural production does not come at the expense of other existing carbon sinks.

- A. Expand sodsaver grassland protections nationwide.** Agricultural land, even regeneratively managed, must be considered as part of a broader landscape of land uses for carbon sequestration. To address this tension, Congress included a sodsaver provision as part of the 2014 Farm Bill, reducing crop insurance premium subsidies on land tilled from native prairie. However, current law extends only to six states. The existing sodsaver provision can reduce grassland conversion up to 7% of total grassland area, a reduction largely determined by crop prices.⁶⁸ Congress should

expand sodsaver grassland protections nationwide, preventing crop insurance from incentivizing conversion of native prairie, as championed in the bipartisan American Prairie Conservation Act.⁶⁹

B. Modernize conservation compliance to meet soil health challenges. The 1985 Farm Bill included two provisions collectively known as conservation compliance that producers must adhere to in order to receive federal support like commodity or conservation program payments: highly erodible lands conservation (HELC) to address the plowing of native sod, and wetlands conservation to tackle draining of wetlands.⁷⁰ Enforced properly, both protect carbon. In the 1980s and 1990s, erosion fell significantly more on fields subject to HELC than on fields that were not.⁷¹ Enforcement has since weakened to almost nothing in some states, and erosion is still a major problem. In the Midwest, soil erosion occurs at 10-1000x faster than it forms.^{72,73}

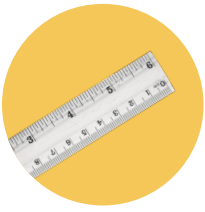
As part of a fair and effective agricultural enterprise that not only catalyzes productivity but also enables responsible stewardship, conservation compliance needs modernization. While producers can freely choose whatever practices or systems work best for them, the ability to receive federal taxpayer support must come with basic conservation responsibilities. Congress should broaden conservation compliance to extend to all land used for production and require a basic soil conservation plan for all cropland receiving federal subsidies, rather than only highly erodible land or wetlands. USDA must also improve enforcement to uphold core eligibility conditions for federal money, ensuring appropriate staffing and consistent implementation across states. NRCS should offer producers additional technical assistance to come into compliance.

US farmland is concentrated in the Midwest and Great Plains,

once home to vast grasslands. Rich soil, stemming from the deep roots of perennial grasses and shrubs and flat open landscapes, has supplied ideal conditions for agriculture, resulting in

significant conversion. Now less than half of America's grasslands remain, often as marginal land, and loss continues at an alarming rate.⁷⁴ However, grasslands also serve as critical carbon sinks, storing one-third of total global terrestrial carbon stocks, alongside

great sources of wildlife habitat, biodiversity, erosion prevention, and other ecosystem services.⁷⁵ Converting native grassland almost always results in a significant loss in carbon storage, and should be avoided whenever possible.



Monitoring, Research, and Development



Priority Recommendation: Pass and implement the multi-pronged Advancing Research on Agricultural Soil Health Act.

As part of a dynamic system, living carbon can be difficult to pin down.

While existing federal soil data and models offer soil carbon projections, they still lack high certainty and ground-truthed data that span diverse land types and geographies, and capture natural fluxes. Carbon also rarely builds alone. Producers need more holistic monitoring capabilities to assess the full spectrum of environmental and operational outcomes conferred by a practice or system to make the most effective land management decisions. Practices maintained by Indigenous communities for millennia, like agroforestry and biochar, have attracted recognition for their climate change resilience and mitigation potential. More attention is needed to understand how to scale highly effective, yet underutilized practices like perennialization, as well as researching emerging agricultural practices that can benefit operations while sequestering carbon. In an era of global economic and environmental disruption, US agricultural research needs a renewed focus on strengthening farm and food security while mitigating climate risk to reposition US farmers on the cutting edge.⁷⁶

Recommendation 1: Improve landscape-level soil carbon MMRV to offer land stewards better tools that link holistic ecosystem outcomes with land management.



A. Pass and implement the multi-pronged Advancing Research on Agricultural Soil Health Act (ARASHA for short; H.R. 4865/S.2582), as well as Coordination for the Soil Carbon Research and Monitoring Act (H.R. 641), that in tandem, address:

- i. A standardized soil carbon MMRV methodology:** Without federal coordination and guidance, soil carbon measurements are often not interoperable, making it difficult to aggregate data and draw insights to inform producers' land management decisions. ARASHA directs USDA to develop a standardized methodology in consultation with producers and experts.

ii. Establishment of a soil carbon inventory and analysis network: Carbon storage potential varies drastically across regions, soil type, and land use history. Through ARASHA, USDA would stand up a novel network that broadly maps soil carbon across US geographic diversity, analyzing the impacts of land management practices on soil carbon over time.

iii. Producer-focused on-farm demos, technical assistance for voluntary reporting, and predictive models: Though the responsibility of soil carbon research and MMRV falls on USDA, producers are the primary intended beneficiaries. ARASHA includes provisions allowing producers to participate in voluntary soil carbon MMRV, supplemented with technical assistance, as well as ensuring systems and tools to manage soil carbon are eligible for on-farm trials. Additionally, the bill directs USDA to develop a modeling tool that allows land managers to estimate soil carbon changes as a result of conservation practices.

iv. Soil carbon research coordination: Significant research is needed to scale soil carbon storage, but current efforts across the federal government are siloed. The Coordination for Soil Carbon Research and Monitoring Act creates an interagency committee on soil carbon research to identify ongoing soil carbon R&D efforts, identify gaps, propose new projects, and engage with stakeholders, including producers.

B. Permanently authorize and fund the Long-Term Agroecosystem Research (LTAR) Network and the Climate Hubs. The LTAR network consists of 19 research sites that coordinate research, collect and manage long-term data, and develop management practices to improve agricultural productivity and natural resource stewardship. Similarly, the 10 regional Climate Hubs — a partnership between USDA's ARS, NRCS and USFS — develop and deliver science-based information and tools to land stewards to reduce agricultural risk and improve environmental and operational resilience. Together they produce much of the existing soil health research to farmers, ranchers, and foresters across the US, and host rich knowledge that would prove impossible to replace. Congress should formally authorize and fund the LTAR Network and Hubs to ensure continuous service to producers, particularly as environmental stressors increase.

Recommendation 2: Invest in innovative farmer-focused research on perennial systems.

A. Establish a new SARE Resilience Initiative to equip farmers to adapt and

manage environmental shocks and stressors. At a time when funding for agricultural research has stagnated, every dollar counts.⁷⁷ Farmer-focused research keeps insights moving out of the lab and pointed at the questions farmers actually face, in the conditions they actually farm in. USDA's Sustainable Agriculture Research and Education (SARE) program is a key research program that centers farmers and ranchers as core investigators or consultants in the research process. SARE is well positioned to support a new Resilience Initiative that directly equips farmers with the research needed to adapt to operational and environmental stressors and shocks.⁷⁸ Congress should provide at least \$50 million in annual mandatory funding for SARE, alongside additional discretionary funding to support existing SARE research and this new initiative. New research under the Resilience Initiative should include farmer-directed projects on perennial systems and the carbon storage potential of different practices.

B. Expand research commitments to perennial systems. Strategic integration of perennials can save farmers time, money, and labor otherwise spent on annual replantings, but crucial perennial varieties like grains and forage require additional research to develop and scale. USDA should prioritize innovative research on perennial crops, particularly on perennial grains, across the Research, Education, and Economics (REE) mission area, as well as through partners like the Foundation for Food and Agriculture Research (FFAR).

Agroforestry, a more complex perennial system, needs specialized, regionally relevant research and technical expertise. The National Agroforestry Center (NAC) is located in Lincoln, NE, but lacks the funding and staff to work at national scale. USDA should urgently fill the currently vacant NRCS National Agroforester role. Congress should authorize at least three new regional centers to improve local uptake of these practices, offering important demonstration and education sites for neighboring farmers. Beyond the 2022 National Agroforestry Survey (NAS), no institutionalized monitoring exists to inventory agroforestry systems and ascertain

patterns of adoption. The NAS should be readministered every 5 years to track agroforestry trends over time, a collaborative effort between NAC, NRCS, ARS, and the National Agricultural Statistics Service (NASS). Lastly, ARS should expand research grants that provide direct funding for ready-to-use, regionally adapted, and publicly available seed varieties. They should continue to undertake research, development, and demonstration on soil carbon, crop cultivars with enhanced carbon uptake and retention, and regional best practices, in partnership with the USFS and Climate Hubs.

Recommendation 3: Improve understanding of underexplored and emerging CDR pathways.

- A. Pass and implement the Biochar Research Network Act.** Research is still needed to evaluate biochar's efficacy across different types of operations, and confirm life-cycle sustainability from feedstock to application. The bipartisan Biochar Research Network Act (H.R.4764, S.2450) would direct ARS to establish a coordinated network of research sites across the country to test biochar's potential on agricultural and forest lands. By passing this bill, Congress could advance an innovative practice that tackles both production and climate goals.

Biochar is an agricultural innovation that takes plant material, like crop residue or unmerchantable wood, and transforms it into a charcoal-like substance that is applied to agricultural soils to be stored for centuries, longer	than usually possible in land-based systems. Originally created and used thousands of years ago in the Amazon Basin of South America, biochar has garnered significant attention in the US, comprising a majority	of carbon removal credits delivered in the voluntary market. ⁷⁹ Deployment at scale requires better understanding of biochar suitability across diverse landscapes, and how key infrastructure can be built.
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- B. Allocate some of the Department of Defense's budget for PFAS remediation to research the potential of biochar as a dual PFAS and carbon storage solution.** Early research suggests biochar can effectively immobilize PFAS in soils, keeping contamination out of crops, livestock, and drinking water. Soil immobilization spares more expensive and destructive remediation processes, and biochar also has the benefit of improving, rather than damaging, soil health. The EPA has identified over 9,000 PFAS-contaminated sites in the US,⁸⁰ and as many as 700 military installations and airports may have contaminated drinking water.⁸¹

The Department of Defense (DoD) should turn some of its PFAS remediation budget towards exploring lower cost options through biochar.⁸² Research should also evaluate how biochar feedstock, production conditions, and application methods influence PFAS immobilization and agricultural performance across different soil types and cropping systems. Findings could then be applied as appropriate to agricultural fields, integrating biochar at scale as a dual PFAS and CDR solution while meeting multiple producer goals.

- C. Conduct a feasibility assessment on establishing an enhanced rock weathering (ERW) mineralization hub.** Targeted, carefully designed research is needed to clarify ERW uncertainties under real-world conditions. Because ERW spans several stages (sourcing rock, spreading it on fields, and weathering products moving through waterways), studying it at the watershed scale may best capture its benefits and risks. The National Science Foundation’s (NSF) National Ecological Observatory Network (NEON) collects and monitors long-term ecosystem data across the US, including freshwater systems, and could offer helpful leadership on ERW study. Access to on-farm sites and conditions will also be critical to a complete assessment. Congress should authorize NSF’s NEON to partner with USDA to conduct a feasibility study on establishing an ERW mineralization hub that enables collective research, development, and demonstration trials, as well as MMRV, including environmental and human health evaluations. The hub should prioritize deployment-led learning by pairing rigorous, site-specific measurement with transparent reporting of methods and data, helping accelerate improvements in ERW quantification across diverse contexts. The study should assess site locations, feedstock supply, and community partnerships and co-development, while outlining how such a hub could address common barriers to ERW research and implementation.

ERW⁸³ is a CDR pathway that accelerates the natural process of rock weathering by crushing certain rock types and spreading them on land (particularly crop fields) where they react with carbon dioxide,

removing carbon from the atmosphere. The resulting bicarbonate washes into waterways for relatively durable storage in the ocean, combining elements of tech, land, and marine CDR for a truly

hybrid pathway. Many barriers and uncertainties remain, however, especially concerning on-farm impacts, supply of low-contaminant feedstocks, and human and environmental health monitoring.⁸⁴

Section Three:

Conclusion

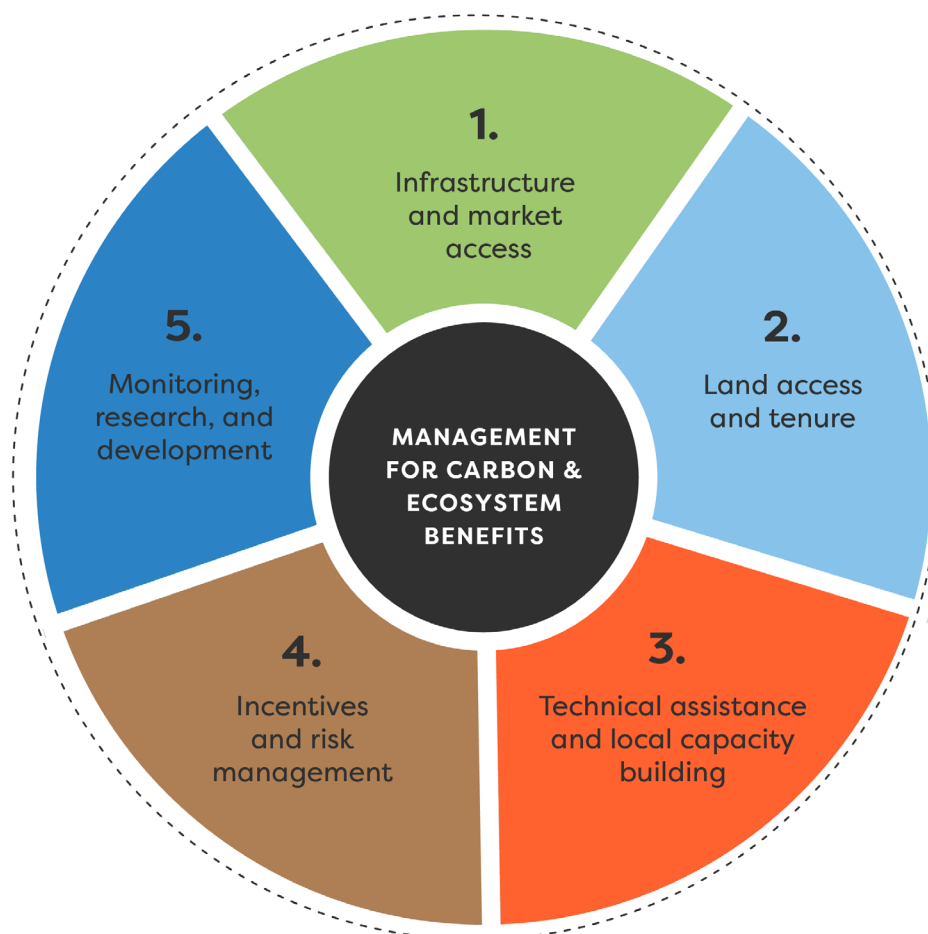
Conclusion

Status quo policy is no longer acceptable in an era where change and disruption have become the new normal.

Removing 30 million metric tons of CO₂ per year by 2030 and equipping producers with what they need to thrive requires a fresh vision for both agriculture and CDR that aligns profitability, resilience, environmental stewardship, and production goals. Improving infrastructure and market access ensures that farmers are compensated for the ecosystem services they provide, while enhancing land access and tenure gets more farmers on the land for longer, opening up conservation opportunities.

FIGURE 2

A systems approach to restoring soil health and carbon on US agricultural lands



Conclusion

Expanding technical assistance and local capacity building takes a dual approach to give farmers the knowledge they need to build on-farm resilience, whether through NRCS or their neighbor. Incentive and risk mitigation programs help ease farmer transitions to regenerative practices, and research and development underpins every other condition, grounding our understanding of soil carbon in the latest science and opening new and old practices to a wider range of producers. Even as US farm and food policy sits at a crossroads, the US can continue strong agricultural leadership with a comprehensive approach that addresses these five enabling conditions, providing for farmers while ensuring operational and environmental sustainability.

Contact us at land@carbon180.org to learn more and join this work.

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56. Several of these recommendations have been put forward by the Agriculture Resilience Act (H.R. 3077/S.1507) as well as the National Sustainable Agriculture Coalition.
57. The consolidation of NRCS payment schedules, while pursued as a means of simplification, has in some cases created new barriers to locally-relevant practices. Scenarios for agroforestry, for example, were condensed nationally so that currently the only silvopasture scenarios are for planting pine plantations, which is not relevant for much of the country.

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