Technical Assistance for Conservation: Landscape Report and Synthesis

by JG Research and Evaluation for Meridian Institute

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MERIDIAN INSTITUTE

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Foreword

Meridian Institute is pleased to present this landscape report on the US technical assistance system for conservation.

Technical assistance for conservation plays an essential role in achieving the many environmental, climate, and productivity goals within agriculture and on private forest lands. Understanding the technical assistance "system" is not an easy task. It encompasses a diverse range of providers, from government agencies and universities to non-profit organizations and private consultants. Importantly, it also includes producers who provide peer-to-peer support. These entities and individuals offer technical support on a wide variety of topics and through a diversity of formats and delivery mechanisms, making the technical assistance system necessarily heterogeneous and wide-ranging but challenging to grasp in its entirety.

This report was commissioned to inform research and convening being conducted as part of the Technical Assistance Accelerator for Conservation project funded by the National Fish and Wildlife Foundation. The report synthesizes existing research across the US technical assistance for conservation and identifies key trends and challenges. However, it is important to acknowledge that the technical assistance system is constantly evolving. This report attempts to take an inclusive view of the system but cannot capture every nuance. We hope that it will be a valuable tool for practitioners, educators, policymakers, and all interest holders invested in stewarding working lands conservation.

We are grateful to Dr. Kristal Jones and her team at JG Research and Evaluation for their dedication and expertise in compiling this report. Their work sheds light on this critical component of the agricultural sector and its role in supporting farmers, ranchers, and forest landowners.

This report is the beginning of a conversation about how to thoughtfully envision the future of technical assistance for conservation and the people and pathways that can enable producers and landowners to respond to a dynamic operating environment and meet their own goals and requirements. We encourage you to reach out to us at taaccelerator@merid.org with ideas or questions.

Sincerely,

Heather Lair, Partner, Meridian Institute

Cover photo: Texas silvopasture, USDA NRCS

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Executive Summary

The demand for readily available, high quality technical assistance (TA) to help United States (US) working land managers (producers) adopt and expand conservation practices is steadily increasing. Private working lands – farms, pastures, grazing lands, and forests – play a critical role in conservation and climate change mitigation, especially considering they account for more than one-third (38% as of 2022) of the US's total land area (NASS 2024). Even though producers are offered TA at the local, state, and national levels from a variety of both public and private providers, key opportunities for TA to be expanded and enhanced remain to best meet the specific needs of producers across the agriculture and forestry sectors, now and into the future. Inspired by evidence that demand for TA for conservation is increasing at a pace that the current TA workforce lacks the capacity to fully meet (Keith Campbell Foundation 2023), this report reviews the existing literature around opportunities for barriers to TA. Our intent is to inform efforts to enhance the quality and quantity of TA offered to producers for conservation.

This report:

- defines technical assistance for conservation and the array of actors involved in providing TA to producers and forest landowners;
- explores the current capacity of the educational and training pipeline to ensure an adequate and skilled supply of TA providers; and
- identifies effective forms of technical assistance and the current challenges being faced across agriculture and forestry, as well as gaps that are specific to diverse production systems, geographies, scale of production, and producer groups.

As we build upon existing insights regarding TA for conservation, we also highlight gaps that hinder a comprehensive understanding of what we consider the "TA system" – networks of actors who facilitate conservation action on working lands by engaging and partnering with producers. While we believe this report provides an essential foundation for envisioning a more robust future TA system, more work is needed to develop a complete picture of what TA for conservation looks like across the entire United States. That said, we provide key findings to help further discussion around this important topic.

Technical assistance for conservation

In this report, we define technical assistance for conservation as substantive expertise, information, and tools given to farmers, ranchers, and forestland owners by a diverse range of public, private, and individual actors through a wide range of methods and systems. The National Resources Conservation Service (NRCS) of the US Department of Agriculture (USDA) is considered the most central actor in the provision of TA for conservation – due to its historical role as a TA provider and the fact that the main source of public funding for conservation comes from the conservation title (Title II) of the US Farm Bill, of which NRCS is the main implementer of conservation program funding. However, since the creation of the Soil Conservation Service in 1935 (now NRCS), an array of other TA providers has emerged in both the public and private sectors that complement and expand the types of services offered by NRCS. Within this report, we provide a typology of these TA providers, which characterizes the whole TA system as composed of three sub-categories of TA systems: formal, semi-formal, and informal.[1]

The formal TA system comprises federal and state agencies, conservation districts, cooperative extension, private and non-profit organizations, and individuals certified or otherwise vetted to receive public funds to provide TA to producers. The semi-formal TA system is made up of non-profit and private-sector organizations that often have touchpoints with the formal TA system but also function outside of federal requirements for specific experience or credentials related to conservation practice implementation with Farm Bill funds. Finally, the informal TA system describes producer-led organizations and peer networks that support information exchange, shared learning, and place-specific innovation. To date, the vast majority of publicly available literature and reporting has focused on the formal TA system, although new emphasis has been placed on investing and expanding semi-formal and informal TA systems to complement the formal TA system as well as better meet the needs of historically underserved producers.

USDA NRCS

1 The use of terms such as "formal," "semi-formal," and "informal" is intended to describe different structures and approaches within the TA system, without implying any value judgments. As such, "informal" should not be interpreted as indicating a lower level of quality or importance compared to "formal" or "semi-formal" categories.

The educational and training pipeline

Across the US, a broad range of programs exist that can prepare the next generation of TA providers for careers in conservation, agriculture, and forestry. Within the higher education system, there are 1,160 2-year and 4-year programs available to students wishing to study natural resources and 750 programs related to agriculture (DataUSA 2024). Most of these programs are housed at public colleges and universities, where students are learning skills in focus areas such as animal science, agronomy, forestry, agricultural engineering, and rangeland management.

However, while the sheer number of programs that could lead to a career in TA for conservation is impressive, less is known about the quality of these programs and how receiving an education in these areas translates to a job in conservation. Future research that links education to job outcomes is thus necessary – especially considering the apparent gap in TA workforce capacity, with NRCS alone reporting a current record of 3,000 unfilled positions (Fatka 2023).

Furthermore, relatively few programs in agriculture, forestry, and natural resources are housed at Historically Black Colleges and Universities (HBCUs) and Tribal colleges and universities, inherently limiting the recruitment of Black, Indigenous, and people of color (BIPOC) students into conservation-related positions. That said, while a degree is often needed to obtain formal certifications related to providing TA (e.g., education or extensive experience is needed to become a Technical Service Provider (TSP) or Certified Crop Advisor (CCA)), higher education is not the only method of obtaining skills relevant to providing TA for conservation. First-hand, familial, and even childhood experience is also valuable, especially when paired with professional training opportunities offered through Cooperative Extension, NGOs, and the private sector. Kindergarten through grade 12 programs that offer youth a foundation in agriculture and forestry are particularly robust in the US – with over 900,000 members of Future Farmers of America (FFA), 19,000 members of Minorities in Agriculture, Natural Resources, and Related Sciences (MANNRS), and nearly 6-million children reached through 4-H programs housed at over 100 universities, among many other youth-based programs.

> Across the US, a broad range of programs exist that can prepare the next generation of TA providers for a career in conservation, agriculture, and forestry.

What's working and what needs improvement

Across the TA system, commonalities can be found both in terms of the opportunities that may be leveraged and the challenges faced. Regardless of production system, TA is most effective when it is reflexive and adaptive to the unique needs of producers, locally provided, and based on trust. Looking into specific production systems (field crops, specialty crops, grazing land, confined animals, agroforestry, and forestry), the dominant providers of TA change depending on the production system, meaning that there is no "one size fits all" approach for what constitutes "good TA." For instance, while producers growing row crops generally get their TA from private crop advisors who are a highly trusted source of information among farmers, producers in systems such as grazing lands rely on other sources of TA. Ranchers receive the bulk of their TA through semi-formal TA systems, likely due to the limited number of NRCS grazing specialists and private-sector consultants. Yet regardless of the production system, innovation is occurring that can be further leveraged to enhance the TA that is available to producers through the providers that they already work with. Technology, new funding opportunities such as the Partnerships for Climate-Smart Commodities (PCSC) program, and renewed attention being placed on place-based and peer-to-peer learning opportunities are all helping provide producers with more tools to improve conservation in their operations.

STEPHEN AUSMUS, USDA

Of course, the TA system is not without its challenges. Current challenges in the TA system include uneven distribution of opportunities across the educational pipeline, limited recruitment, and uneven retention of both formal and semi-formal TA providers, especially in rural communities. Additionally, there is an overall lack of equity in capacity to support historically underserved communities in accessing funds and expertise to support conservation practices on working lands. This may be at least partly because historically underserved communities, namely communities of color, often have a lingering distrust of USDA and its agencies after facing decades of discriminatory practices. Moreover, there is evidence that BIPOC producers are often providing and receiving TA through the informal TA system (Smith & Mormile 2021), which is generally limited in its ability to receive federal funding. That said, even within the formal TA system, private consultants and crop advisors may also be limited in their ability to access federal dollars for TA, thus reducing the ability of private actors to complement NRCS and other federal agencies that are currently unable to meet demand for TA. This underscores how a lack of collaboration across formal, semi-formal, and informal TA providers hinders the ability of producers to receive both funds and TA to meet their conservation goals.


LANCE CHEUNG, USDA

These challenges, along with gaps specific to each production system, point to a need for more integration and collaboration across TA providers and systems and across sources of funds for conservation practice implementation. Several new federal initiatives seek to address gaps in the TA system, but a clear roadmap does not yet exist for how to leverage investments in increased capacity and resources for conservation practices on working lands.

Key conclusions

This report highlights key areas for improvement and investment within the technical assistance (TA) system to better support producers and ensure the sustainability and effectiveness of conservation practices on working lands.

The report emphasizes the following:

1. Thousands of qualified professionals are working across the TA system and their expertise could be more fully leveraged to support producers and conservation outcomes. At the same time, there are concerns about whether the workforce pipeline is up to the challenge given a steady increase in demand from producers.
2. Equitable access to TA services can be supported by investing in TA providers and systems that are embedded in local communities and production systems.
3. New and innovative federal conservation programs should be leveraged into pathways that can support long-term professional TA positions.
4. Targeted investments in TA systems should focus on gaps in capacity that are specific to each production system.
5. The education and training pipeline is strong but should be expanded and enhanced to provide opportunities for appropriate training, including in ways that support providers within the informal TA system.
6. Supporting and enabling collaboration across TA systems provides an important opportunity to maximize the impact of financial assistance (FA), TA, and the evidence base for conservation practices.

As the federal government and other actors make new investments to bolster TA capacity, further research should identify specific ongoing gaps and future challenges in sustaining a more robust and varied TA system that meets the needs of more producers than are currently supported. The need to support and expand adoption of conservation practices on working lands is especially critical as the pressures of climate change – extreme weather, pest and disease outbreaks, supply chain disruptions – increase and require more adaptive management by producers. At the same time, conservation practices on working lands can contribute to climate change mitigation. Through greater holistic investment in TA systems, we can ensure the continued development of innovative solutions, enhanced collaboration among stakeholders, a reinforced workforce that can ensure producer success in their conservation goals, and the adaptability necessary to address the dynamic and diverse requirements of working lands across the United States.

Acronyms

ACC	American Climate Corps
ACES	Agriculture Conservation Experienced Services
AFA	Alternative funding arrangement
AI	Artificial intelligence
AMS	Agricultural Marketing Service
ARS	Agricultural Research Service
ASA	American Society of Agronomy
CCA	Certified crop advisors
CD	Conservation district
CEAP	Conservation Effects Assessment Program
CEU	Continuing education units
CPA	Conservation planning activities
CIG	Conservation Innovation Grants
CPCC	Certified Professional Crop Consultant
CPH	Certified Professional Horticulturalist
CPPE	Conservation Practices Physical Effects
CPS	Conservation Practice Standard
CPSS	Certified Professional Soil Scientist
CRMC	Certified Range Management Consultant
CRP	Conservation Reserve Program
CTA	Conservation technical assistance
DIA	Design and implementation assistance
ECOP	Extension Committee on Organization and Policy
EPA	Environmental Protection Agency

EQIP	Environmental Quality Improvement Program
FA	Financial assistance
FSA	Farm Services Agency
GCSA	Growing Climate Solutions Act
GHG	Greenhouse gas
GLCI	Grazing Lands Conservation Initiative
GPS	Global positioning system
HBCU	Historically Black Colleges and Universities
IRA	Inflation Reduction Act
NAC	National Agroforestry Center
NACD	National Association Conservation District
NAICC	National Association of Independent Crop Consultants
NGO	Non-governmental organization
NRCS	Natural Resources Conservation Service
PCSC	Partnerships for Climate-Smart Commodities
PFAS	Per- and polyfluoroalkyl substances
RAP	Rangeland Analysis Platform
RCPP	Regional Conservation Partnership Programs
ROI	Return on investment
SCRI	Specialty Crops Research Initiative
SCS	Soil Conservation Service
TA	Technical assistance
TSP	Technical Service Provider
US	United States of America
USDA	United States Department of Agriculture
USFS	United States Forest Service
WLCC	Working Lands Climate Corps

Background

TED KORNECKI, USDA

Private working lands in the United States (US) – farms, pastures, grazing lands, and forests managed by private individuals – account for about one-third (38% as of 2022) of the nation's land area and play a central role in conservation and climate change mitigation in the country (NASS 2024). From maintaining wildlife habitat to sequestering carbon and decreasing per-unit emissions intensity of food, fiber, and industrial products, conservation practices on working lands can maintain and enhance the natural resource base while supporting rural community livelihoods (Kennedy et al. 2024; World Wildlife Fund 2023; Otto et al. 2018). Many impactful conservation practices require investment of time, labor, money, and expertise by producers and the agricultural professionals who work with them. In many cases, producers seek technical assistance (TA) – information and expertise from a wide range of sources – to plan, design, implement, and monitor conservation practices. However, due to a wide range of factors, the current TA system in the US does not have adequate capacity to meet producer needs and interests. At the same time, many actors across the agriculture and forestry sectors are interested in expanding and enhancing TA capacity to catalyze conservation action on working lands.

This report, a foundational work for the Technical Assistance Accelerator for Conservation Project being undertaken by Meridian Institute in collaboration with key interest holders in the US TA system, reviews the existing evidence base and current discussions around opportunities and gaps in TA to support the implementation and expansion of conservation practices on working lands in the US. One motivation for this work is the well-documented and ongoing mismatch between TA needs for producers interested in accessing federal funds via the Natural Resources Conservation Service (NRCS) of the US Department of Agriculture (USDA), and the funding and human capacity available to provide that TA (Eckelkamp 2023; FACA 2023; R Smith and Normile 2021; Keith Campbell Foundation 2023). This need is likely being exacerbated by the inflow of funds to NRCS over the next several years from the Inflation Reduction Act (IRA). IRA funds begin to decrease in 2026, but capacity needs will remain assuming historically consistent pre-IRA levels of federal funding for conservation programs.

This report's focus on NRCS reflects the reality that the US federal government, through the conservation title (Title II) of the Farm Bill, is the primary funder of conservation practices on working lands in the US. The consensus across policy and advocacy organizations, producers, and the private sector is clear: producers need more TA of all types to maximize the benefits to producers and conservation practices on working lands. This includes bolstering NRCS staff capacity and the capacity of other public and private partnerships on which NRCS relies to distribute federal funds. However, producers do not always implement conservation practices with federal funds, and a wide range of individuals and organizations provide TA to producers. Cross-cutting needs in the TA systems include expanding the number and types of TA providers and supporting the educational pipeline and the resulting workforce to secure the next generations of TA providers. Thus, the findings of this report are applicable to both the TA capacity supported by the federal government in addition to private-sector and NGO investment in conservation practices.


LANCE CHEUNG, USDA NRCS

Scope of this report

This report focuses on the TA necessary to implement conservation practices on private working lands in the United States. In the following sections, we define and describe what this report means by TA and conservation practices, using generally agreed upon definitions. At the same time, we acknowledge areas of disagreement and critiques among producers, practitioners, researchers, and policy makers over concepts and terminology. Language and definitions of sustainability and conservation, as well as assessments of the evidence base for the conservation impacts of practices, vary widely in terms of consensus within and across interest holders.

Furthermore, as with any review and synthesis of a large, complex topic and system, there are drivers and contextual details that impact TA capacity and efficacy that are beyond the scope of the work presented here. For example, we are focused on TA that directly supports the implementation of conservation practices on the ground, including expertise to plan, design, implement, and monitor conservation practices in specific production systems. We recognize the need for TA on many other, related topics – navigating programs and associated paperwork, business planning and return on investment, marketing and value-added opportunities, and many more – but do not include them in this review. As noted above, this report starts from the pragmatic reflection that most conservation on working lands in the US is funded by the federal government and its state and local partners, and we thus take as a starting point the definitions and structures used by these public programs. Although we identify certain gaps in the literature that are well-documented, this report is not a systematic review nor assessment of evidence of conservation impact. With that in mind, we do not qualify or quantify the strength, directionality, or consistency of the evidence base, but we do provide extensive reference to other efforts and note where there is general agreement or lack thereof.

After establishing clear definitions of conservation and TA, this report focuses on the review and reflection on broader topics with a refined lens. For example, we explore equity in access to TA that is appropriate and useful to the diversity of producers that make up the agricultural and forestry systems in the US and its territories. We note several issues that can negatively impact equitable access to and use of TA, including historical marginalization and trust, linguistic and cultural barriers, and specific structural limitations like various forms of property ownership that do not align with the private family farm model assumed by dominant TA systems. However, we do not explore deeply broad history and trends of inequitable access to financial assistance (FA) and other resources within agriculture and forestry, nor the even broader history of racism and discrimination within many public and financial systems in the US (for more detail on these linkages, see SWCS 2024). For similar reasons, we do not provide examples of specific non-profit and/or place-based organizations, individuals, and networks working to provide TA to producers and build capacity within agricultural

communities. This is in large part to avoid elevating only a few among myriad examples of innovative and effective TA. Although examples and approaches are important, the capacity and expertise of these organizations, many of which operate on local-to-regional scales, is not as easy to generalize in the same way that we are able to generalize nationwide public agencies that provide TA, which is more extensive and standardized.

Finally, we note that this report focuses on conservation practice implementation on private working lands, though we recognize that in certain production systems, especially grazing livestock, public working lands are an important part of the overall system. However, these lands are subject to different regulations and requirements than private lands and implementing conservation practices requires distinct resources and expertise. Similarly, we acknowledge many critiques of the overall FA and funding ecosystem for conservation practices on private working lands and whether there is in fact enough and the right type of FA to achieve conservation goals, including but not limited to climate change mitigation. In this report, we take the amount of FA available as a starting point and assess whether there is adequate TA capacity to make full and best use of this existing FA.

We hope that this report serves as a starting point for further dialogue and action to strengthen TA systems in the United States, with the ultimate goal of enhancing conservation initiatives and outcomes across working lands. This report attempts to paint a broad and honest picture of the current state of TA across the US, but continued work is necessary that dives into the nuances of TA access, quality, and equitability.

What is Technical Assistance?

In this report, we define TA for conservation as substantive expertise, information, and tools given to farmers, ranchers, and forestland owners by a diverse range of public, private, and individual actors through a wide range of methods and systems.

PRESTON KERES, USDA NRCS

Defining technical assistance for conservation

The term "TA system" refers to the network of actors who help translate conservation knowledge into conservation action on working lands. This includes (but is not limited to) federal agencies such as NRCS and its partners, but also non-profit organizations, private businesses, individual consultants, community-based organizations, and other producers. TA modes of delivery – the ways that TA is provided to producers and landowners – include formal direct TA (e.g., personalized conservation plans developed by conservation professionals) as well as semi-formal capacity building by NGOs and

alternative forms of knowledge exchange such as peer-to-peer learning, educational experiences, etc. Although we recognize the need for and the value of TA on many topics related to farm, ranch and forest management, in this report we focus on TA that directly supports the implementation of conservation practices on the ground.

Specific types of TA providers are characterized by the relative formality (or not) of their credentials and the organizational setting within which they work. In practice, what counts as TA is often defined by who is paying for that assistance. Public funds from the federal government and state and local agencies are allowed only to individuals who hold certain qualifications and have been approved by the funder. These formal TA providers include NRCS and Conservation District[2] (CD) staff, third-party organizations contracted by NRCS, and certified Technical Service Providers (TSPs). In some production systems, formal TA is also provided extensively by private crop advisors, who are often connected to input suppliers and connect TA services to sales.

Formal Technical Assistance — The formal TA system comprises federal and state agencies, Tribes, conservation districts, cooperative extension, private and non-profit organizations, and individuals certified or otherwise vetted to receive public funds to provide TA to producers to implement practices in Farm Bill conservation programs.

Semi-formal Technical Assistance — The semi-formal TA system is made up of non-profit and private-sector organizations that often have touchpoints with the formal TA system but also function outside of federal requirements for specific experience or credentials related to conservation practice implementation with Farm Bill funds.

Informal Technical Assistance — The informal TA system describes producer-led organizations and peer networks that support information exchange, shared learning, and place-specific innovation. Informal TA comes from peer-to-peer or place-based networks and thus is highly specific.

2 We use the term 'Conservation District' as a broad term that includes many different names used in specific states and localities, including soil and water conservation district, resource conservation district, and others (NACD 2016a).

TA provided by conservation or non-profit organizations as well as by private funds supporting carbon offset credit projects and corporate carbon inset[3] investments often take a broader view of who can be considered a TA provider, but still generally require some form of training or certification. Finally, from the point of view of producers, TA can also come from informal peer-to-peer networks and relationships. This form of engagement is unpaid and framed more around learning, mutual support, and mentorship.

Brief history of technical assistance from NRCS

The long history of NRCS (and its precursor the Soil Conservation Service (SCS)) and the support that has been provided to producers to implement conservation practices has been well-documented (NRCS 2024a; Flach 2003). In brief, the federal government established the SCS in 1935 to focus on soil and water resources on working farms, grazing, and forest lands in the US. The long-term drought conditions in much of the country known as the Dust Bowl catalyzed investment in the SCS. Within two years, the first Soil Conservation District was established to create a structured partnership between federal staff and resources and local offices that could provide more

Example definitions of TA

"[Conservation technical assistance] provides our nation's farmers, ranchers and forestland owners with the knowledge and tools they need to conserve, maintain and restore the natural resources on their lands and improve the health of their operations for the future." (USDA NRCS, n.d.)

"A range of public and private technical experts to connect the dots between policy, financial assistance, program compliance, practice verification and much more." (Chesapeake Bay Commission, 2017: 3)

"The art and science of acquiring and placing technically trained personnel in the sciences of agriculture, soils, forestry, ecology, sociology, economics, hydrology, engineering and similar sciences on the ground with farmers, ranchers, and forest stewards to help them understand the capabilities and needs of the natural resources under their care." (Keith Campbell Foundation for the Environment, 2023: 1)

3 Carbon insets are credits for greenhouse gas (GHG) emissions reductions or sequestration generated through projects within a company's supply chain.

"boots on the ground." The SCS supported producers by placing federal staff in state and local offices, providing in-field consultation and support, and translating information and evidence on best practices from federal and university researchers to rural communities (NRCS 2024a).

Beginning in the 1980s, with the addition of the Conservation Title (Title II) to the Farm Bill, SCS staff began to provide expanded TA for planning, designing, and implementing practices. The 1994 Farm Bill changed the SCS's name to the Natural Resources Conservation Service to reflect the broader set of conservation practices and priorities (in addition to soil health) included in Title II programs. From the 1990s through to today, the role of NRCS field staff has evolved as funding for conservation programs and interest from the nation's producers in conservation programs has increased. Consequently, NRCS staff spend more of their time today focused on administration of the financial agreements that are core to Title II funds and less time in the field (although the addition of program assistant staff has helped to address this challenge). Increased interest from producers and flat or even slightly decreased staffing within NRCS has also led the agency to create innovative partnerships with the private and non-profit sectors to ensure that producers have access to the TA services that are needed to accompany increased funding (NRCS 2024a).

Funds for NRCS TA come from two main sources. The first is through appropriations under the Soil Conservation and Domestic Allotment Act, Public Law 74-46, which provides NRCS with its soil conservation purpose and authority for, among other things, Conservation Technical Assistance (CTA), data collection (soil and snow surveys, water forecasting), and plant materials. The second is the Food Security Act of 1985, Public Law 99-198, otherwise known as the Farm Bill, as it has been periodically amended. Within the Farm Bill, Title II receives funds to support the implementation of conservation practices under a suite of conservation programs by providing cost-share to producers for both the TA needed to implement and financial assistance (FA) for the cost of materials or supplies. Some analysis and critique of the bifurcation of funding (i.e., TA and FA) and the lack of separate salaries and expenses funding for staff, argues that funding to grow NRCS staff capacity has not increased at the same pace as the conservation programs. However, other assessments of funding options point to the flexibility built into FA and the challenges of maintaining salary and expense lines each year in federal budgets.

NRCS staff, CD staff, or other approved providers (including some TSPs) must provide the first stage of conservation TA, the planning phase (Conservation Planning Activities (CPA)), which is required before a producer can seek cost-share support (FA) for conservation practice implementation (Design and Implementation Assistance (DIA)) under the Farm Bill conservation programs. Without adequate funds to support NRCS and partner TA capacity for the planning phase as well as for approving the design and implementation, interested producers are unable to access Title II funds to enable conservation practice adoption (Keith Campbell Foundation 2023; R Smith and Normile 2021; Drecker-Waxman, Greco, and Findley 2023).

What Are Conservation Practices?

We define conservation practices on working lands as techniques, tools, and technologies that improve one or more dimensions of the landscape or ecosystem within which producers farm, ranch, and manage forests.

Defining conservation practices on working lands

Historically, public conservation efforts have focused on maintaining and enhancing soil health and water quality, with a focus on minimizing erosion mostly in crop fields and in the Great Plains (NRCS 2024a). Although these conservation and stewardship goals were reflected in the creation of NRCS, the balance of USDA funding throughout the mid-20th century focused more on supporting prices and reducing risk for producers rather than primarily on conservation (Helms 2006). The 1985 Farm Bill created Title II for conservation, including the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program (CRP), the latter of which provides cost-share for producers to retire or otherwise shift use on highly erodible land from cultivation or grazing to continuous land cover that supports ecosystem function (NSAC 2019). Equally important, the 1985 Farm Bill for the first time linked conservation activities on highly erodible lands and wetlands to access to USDA commodity funds and crop insurance (Helms 2006).

As the evidence base has grown for how practices on working lands can maintain and enhance natural resources, definitions of 'what counts' as conservation practices have expanded as well. In the NRCS context, conservation practices are approved to receive funds when they have a conservation practice standard (CPS). Close to 200 national CPSs are approved or interim, though their specifications and eligibility varies

Example definitions of conservation practices

"Conservation practice physical effects (CPPE) document [focus] on how the application of that practice will affect the resources (soil, water, air, plants, animals, energy, and human)." (USDA NRCS, 2024c)

"Conservation practices, frequently called best management practices, or BMPs, are tools that farmers can use to reduce soil and fertilizer runoff, properly manage animal waste, and protect water and air quality on their farms." (Chesapeake Bay Foundation, 2022: 6)

LANCE CHEUNG, USDA

by state and sometimes even sub-state region (NRCS 2024b). Many CPSs are for practices that are well-established to have a conservation benefit on-farm and in the broader landscape. Recent additions/upgrades to full CPS status highlight emerging conservation practices with an adequate evidence base. Over the past five years, these include soil carbon amendments, wildlife habitat planning, and wastewater treatment. As of 2023, the list of interim CPSs also provides insight into emerging but not yet well-established practices. Of the 22 interim CPSs listed by NRCS, half (11) are related to irrigation water management, and the rest are mostly related to specialty crops (3) or livestock (4).[4]

Over the past several years, NRCS has undertaken a congressionally-mandated effort to review each CPS to ensure that the evidence base that describes and guides the conservation impacts is reflected in the standards (Fiddler 2020). In addition, the Conservation Effects Assessment Program (CEAP) of the USDA was initiated through the 2002 Farm Bill with the goal of quantifying the environmental impacts of CPS to ensure that the intended outcomes are achieved (Mausbach and Dedrick 2004). A 2017 Government Accountability Office report found that the CEAP studies provide data

4 Interim CPSs are listed in the Partnerships for Climate-Smart Commodities Program Data Dictionary for grantees: https://www.usda.gov/sites/default/files/documents/partnerships-climate-smart-commodities-data-dictionary.pdf.

on potential environmental impacts but did not include enough applied criteria like budget requirements, regulatory challenges, and economic efficiency (GAO 2017). A recently introduced Senate bill proposes to address some of these concerns by making the CPS review and revision process fully transparent and open to public comment (Ernst et al. 2023). Outside critiques of CPS highlight the fact that the impacts of some conservation practices can vary widely over geography and time, and that the most widely adopted practices might not achieve at least some of the benefits expected by the public (Bell et al. 2023). For example, a recent Environmental Working Group report (Schechinger 2024), highlights the uncertainty around the climate-smart impacts of some CPS by pointing to the evidence summary provided by NRCS on the physical effects of conservation practices (the CPPE matrix).[5] The CPPE takes a systems approach to categorizing impacts of conservation practices across many physical dimensions of the ecosystem and demonstrates the potential trade-offs and magnitude of those trade-offs across different conservation impacts.

While conserving natural resources on working lands has many approaches, descriptions of conservation practices often start by listing those most adopted by US producers, which reinforces a focus on erosion control, soil management, water quality, and ground cover. A recent metanalysis of 35 years of conservation practice adoption in the US divided conservation practices into three large buckets: livestock management, nutrient management, and soil management (Lu et al. 2022). The top five most common practices in the adoption literature reviewed in that study were conservation tillage, buffers/borders, soil testing and sampling, grassed waterways, and cover crops (Lu et al. 2022). However, another recent study found that an outsized amount of federal Title II funding has gone to livestock-related large infrastructure projects (Happ 2024). Data from NRCS reflects both observations. Both evidence syntheses are accurate and capture distinct dimensions of the scope and prevalence of conservation practices. In FY 2023, by area, livestock management and infrastructure practices are by far the most common; just four livestock-related practices cover over 60% of the area covered by the top ten funded practices. However, when looking at the number of


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5 The Conservation Practice Physical Effects matrix for 2024 can be found here: https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-physical-effects

contracts, only two of the top ten are specific to livestock and these account for only 20% of the contracts.[6]

Over the past two decades, an expansion of terms and definitions around conservation practices in agriculture and forestry has evolved. Regenerative, sustainable, climate-smart, agroecological – each term sets the boundaries slightly differently in terms of what counts as a conservation practice (Wittwer et al. 2021; Codur and Watson 2018; Newton et al. 2020). More recently, policy makers and private actors are exploring what counts as climate-smart agriculture, and whether the boundaries should be set to include only practices that have a clear and meaningful mitigation impact (by sequestering carbon in soils or biomass, or by reducing GHG emissions from soil management, animal management, and land conversion) or if climate adaptation should be the focus, thereby including practices that increase resilience of the overall operation and landscape even if they do not contribute to measurable changes in GHG emissions (Hellin et al. 2023; Totin et al. 2018). The definition offered by the PCSC program focuses on mitigation: "For the purposes of this funding opportunity, a climate-smart commodity is defined as an agricultural commodity that is produced using farming, ranching or forestry practices that reduce greenhouse gas emissions or sequester carbon." (USDA n.d.). Other public sector programs, like the USDA's Conservation Innovation Grants (CIG) program, focus on supporting new and innovative practices that support conservation in a more traditional sense, through improvements to soil health, water quality, and biodiversity (USDA 2019).

Why implement conservation practices on working lands?

For individuals and organizations focused on both production and conservation, the longstanding consensus has been on the importance of management practices to support long-term ecosystem health and economic viability for farms, ranches, private forests, and rural communities (Carlisle et al. 2019a; Kennedy et al. 2024; Miller and Hobbs 2002). Observations of the linkage between soil health and rural livelihoods emerged in the US during the Dust Bowl of the 1930s and drove the creation of the federal Soil Conservation Service (SCS) (initially called the Soil Erosion Service and established in the Department of the Interior, before being transferred to the USDA and being renamed the SCS) and its successor, NRCS (NRCS 2024a; Carlisle et al. 2019b). Almost one century later, definitions of conservation practices reflect variation in what is considered important to be conserved. Priorities continue to include highly erodible soils and wetlands, avoidance of new regulatory requirements (Naugle et al. 2019), and long-term ROI for producers (Boyd, Epanchin-Niell, and Siikamäki 2015),

6 Data available on the RCA data viewer: https://publicdashboards.dl.usda.gov/t/FPAC_PUB/views/RCATopPracticesbyLandUseandState/TopPracticesDashboard?%5C%3Aembed=y%26%5C%3AisGuestRedirectFromVizportal%3Dy&%3Aembed=yes

but now increasingly include climate change mitigation (Kennedy et al. 2024)


LANCE CHEUNG, USDA

Producer motivations for conservation practice adoption is the focus of a large body of scholarly literature (Prokopy et al. 2019; Oliver and Gazal 2021). Though producers are highly diverse and dynamic, with many nuances in terms of the relative balance of motivations (Epanchin-Niell et al. 2022), a few key and consistent findings emerge. First, producers are stewards of their land and are interested in conservation practices that support their own ecological goals, which are tied to but bigger than simply productivity. (Olsovsky, Strong, and Berthold 2021; Prokopy et al. 2019). Second, agriculture and forestry, especially for family-owned and small-scale operations, are low-margin sectors and any practice that can increase economic or production efficiency will be compelling to producers looking to manage their bottom line (Bergtold et al. 2019; Prokopy et al. 2019; Lu et al. 2022). This is one reason that conservation practices that could generate carbon credits are of interest in the agriculture and small-scale forestry sectors. However, recent studies show that many producers would prefer to be paid through public programs rather than private markets (N. M. Thompson et al. 2022; Gramig and Widmar 2018). Third, producers are experiencing an increasingly unpredictable climate, and regardless of to what they attribute that variability, they are interested in practices that can buffer against associated risks such as drought, floods, extreme temperatures, wildfire, pest outbreaks, and other climate-related pressures.

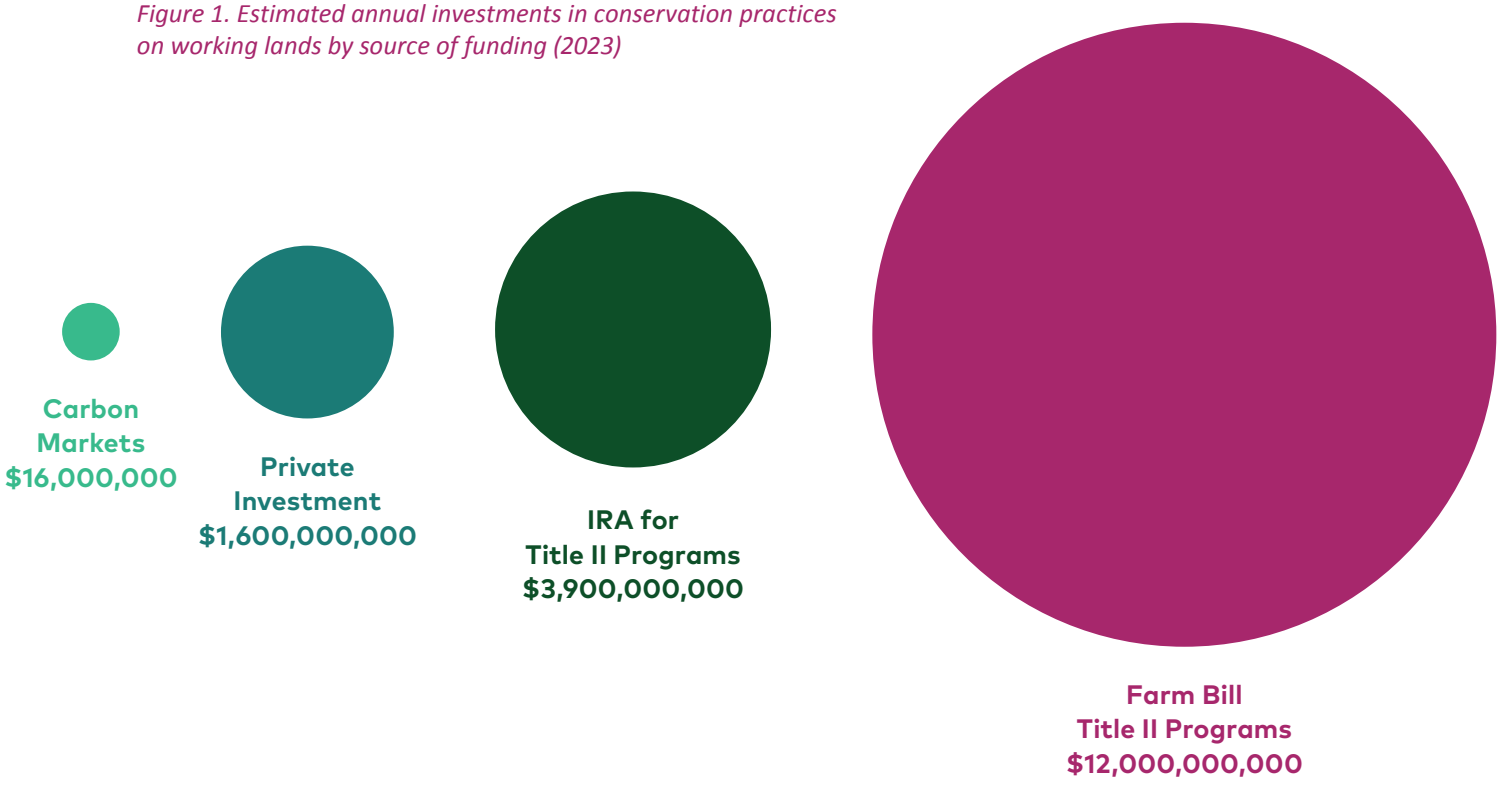
Beyond producer priorities, the motivations of policy makers and consumers to support conservation practices on working lands through the investment of public and private funds generally align with the high-level goal of ensuring that producers, rural communities, and the environment can adapt and thrive into the future. However, consumers vary in their willingness to pay for the implementation of conservation practices, whether through price premiums on products (Ellison, Lusk, and Briggeman 2010; Li et al. 2016; Canavari and Coderoni 2020; Lin and Nayga 2022; Lohmann et al. 2022) or through investment of taxpayer dollars (Dorfman et al. 2009; Adams and Salois 2010). For example, one possible outcome of the new USDA Partnerships for Climate-Smart Commodities (PCSC) initiative is to explore the potential challenges and opportunities associated with defining a climate-smart commodity and thus creating a market opportunity for both producers and consumers to operationalize the value of conservation practices that contribute to climate change mitigation (Thurman 2022).

Who pays for conservation practices on working lands?

Although the focus of this report is on TA, producers need financial resources to help offset the costs of implementing conservation practices. These costs include time from TA providers to plan, design, and support implementation of practices; materials and labor to make modifications on the landscape; and possible changes to operations to align with the requirements of the FA source. Recent estimates of the not-yet-passed 2024 Farm Bill suggest that roughly $60 billion, about $12 billion per year, will be included for Title II programs (Stubbs 2023). An additional $19.5 billion from the IRA is committed from 2023-2028 for Title II programs (NRCS 2023b), although these numbers may change depending on the outcome of the current Farm Bill negotiation process. NRCS has been using complementary funds to hire, with the goal of adding 3,000 field-based staff by 2025 (Cosby 2024). Figure 1 compares annual funding for conservation practices on working lands across key funding sources.

Over the past 30 years, the number of ecosystem services markets in the US has increased almost 40-fold, from about 60 in 1995 to 2,400 in 2015 (Bennett et al. 2016). An increasing minority of these markets are voluntary carbon markets, though most of these (58% of total credits from 2013-2021) are for forestry and only a very small number (3% of total credits for the same period) are from agricultural practices (USDA 2023a). Increased interest from corporate buyers of agricultural and forestry products

Figure 1. Estimated annual investments in conservation practices on working lands by source of funding (2023)



to use carbon insets to address Scope 3 emissions reductions requirements[7] is another emerging market opportunity for producers, with more variable approaches to when and how payments are made for implementation of practices (Buckley Biggs et al. 2021; Tipper, Coad, and Burnett 2009; Hertwich and Wood 2018). Despite growing interest in carbon markets within the agriculture sector, recent estimates suggest that the revenue generated from agricultural project carbon offset credits is roughly $16 million per year (USDA 2023a).[8] Interest in private investment in conservation and working lands management is also growing, with estimates from 2015 that about $1.4 billion annually in the US was invested by private capital and equity (Whelpton and Ferri 2016). As noted above, the structure of Farm Bill conservation programs that provide FA for conservation practices is a cost-share model, in which the federal government provides funds for most of the estimated cost of practice implementation, and producers provide financial or in-kind contributions for the remainder. Critiques of the cost-share model point out that the coverage by federal sources is not adequate to ensure participation for many producers (even though historically underrepresented producers receive a higher proportion of coverage), and that the short-term and long-term costs for maintenance and ROI is not adequately included in the FA calculations (Smith and Normile 2021; Drecker-Waxman, Greco, and Findley 2023). FA provided by private markets is more variable.

In contrast, when private investment and FA for conservation practices is part of a program that does not plan to pass along any profit from the agricultural or forestry product and/or carbon credit to the producer, the full cost of implementation is generally covered (this is the case for many carbon insetting and Scope 3 programs). For most carbon inset and offset projects in which producers will see some return on their investment in carbon credits, however, the cost of implementation is assumed by the producer. FA can also support producers through data collection and verification support, TA for implementation, and access to the carbon credit market (Perez et al. 2023; USDA 2023a). The cost of practice implementation in these cases is often reimbursed using public FA through federal conservation programs, making public FA and TA important sources of support for the private sector to meet their Scope 3 goals. As more private sector actors invest in their own climate-smart and conservation-oriented supply chains (including through public-private efforts like the Partnerships for Climate-Smart Commodities (PCSC) program), financial resources to support conservation implementation are increasing, and so too are pressures on the TA system to provide expanded capacity to support this implementation.

7 Scope 3 emissions are all indirect emissions that occur in the supply chain of an individual company or organization but are not directly in the reporting organization's control. In contrast, Scope 1 emissions are those that are related to the activities of a reporting organization, and Scope 2 emissions are those related to electricity use directly by a reporting organization (GHG Protocol, n.d.).

8 This report (USDA 2023a) estimates that 10 million carbon credits from agricultural projects were issued over a ten-year period, and most were in compliance markets. This means an average of one million credits per year at an estimated average rate of $16 per credit.

Who Provides Technical Assistance for Conservation Practices on Working Lands?

TA for the implementation of conservation practices is provided by a wide range of organizations and individuals through formal (public or private sector actors that are formally certified by the federal government and/or a professional organization), semi-formal (private and NGO sector actors) and informal (placed-based organizations and peer-to-peer networks) systems.

DAVID GEALY, USDA

Formal technical assistance

This section synthesizes what is known about the scope (in numbers and expertise) of current formal TA providers and systems across the US. In addition to TA provided through NRCS and its third-party relationships, many other sources of publicly funded TA to support conservation practice implementation are available. For example, a recent comprehensive guide to federal TA listed 148 distinct TA programs relevant to IRA funds, with 47 focused on direct TA (The White House 2023b). A similar list maintained by the USDA Climate Hubs found 42 technical support programs for climate change adaptation and mitigation activities alone (USDA Climate

Hubs 2024c). Table 1 provides estimates of the human capacity across the formal TA system, separated into the public and private sectors.

Public sector

TA public sector includes federal, state, and local agency staff, individuals and organizations with contracts or other formal agreements or certifications that provide a direct connection to federal FA, CD staff, and employees of land-grant universities and cooperative extension.

Table 1. Estimates of formal TA system capacity by sector and source

	SOURCE OF TA	ESTIMATE OF INDIVIDUAL CAPACITY
PUBLIC SECTOR	NRCS staff	9,360 staff in field offices[a] 108 are grazing specialists[b]
	Conservation district staff	7,000 employees[c]
	Alternative funding arrangements (incl. RCPP)	60 organizations[d]
	Individual TSPs on registry	1,063 in US and territories[e] 4 in the Pacific, 6 in Puerto Rico
	USFS Cooperative Forestry staff	50 staff[f]
	USFS National Agroforestry Center staff	10 staff[g]
	State and local agency staff	50,000[h] including: 7,000 conservation district staff[c] 8,100 foresters[i]
	Cooperative extension staff	35,000, with about 12,000 serving as community-based advisors and agents[j]
PRIVATE SECTOR	Certified crop advisors	8,621 CCAs in US[k]
	Independent crop consultants	175 NAICC crop consultants, 58 are CPCC[l]
	Certified professional soil scientists	526 CPSS, 7 are TSPs[m]
	Certified professional horticulturalists	53 in US (including 1 in Puerto Rico)[n]
	Private foresters	1,300 private foresters[i]
	Independent grazing specialists	18 Certified Range Management Consultants[o]
	Manure management	33 EPA AgStar partner organizations[p]

Data sources: [a] Consistent estimates are that 90-95% of the 10,400 NRCS staff are in field offices [b] NRCS Grazing Lands Personnel Directory [c] National Conservation District Employees Association [d] RCPP Awards [e] NRCS TSP Registry [f] USFS Cooperative Forestry Staff [g] NAC Staff [h] NACD on CTA [i] Bureau of Labor Statistics [j] Extension.org (a 2023 survey conducted by the Extension Committee on Organization and Policy suggests that about one-third of all Extension employees are community-based advisors and agents) [k] Find a CCA [l] NAICC Member Directory [m] Find a Professional Soil Scientist [n] Certified Professional Horticulturalist Directory [o] Find a Range Expert [p] AgStar partners

» NRCS STAFF

TA capacity to support NRCS conservation programs has varied over the past two decades. As of 2023, there were 10,400 NRCS employees, the vast majority of which are in over 2,500 field offices around the country (Crosby 2024; Stubbs and Monke 2020). Figure 2 shows the number of NRCS employees at intervals from 2004 to 2023, as well as the planned hiring through 2025. The number of unfilled NRCS staff positions varied over the same period, rising as high as 2,500 in 2020 (partially due to the Covid-19 pandemic) (Stubbs and Monke 2020). Importantly, if we take the projections of needing to have 14,000 NRCS employees by 2025, then the current number of unfilled positions is closer to 3,000, an all-time high (Fatka 2023). In addition, there have been several hiring freezes across the federal government over the past decade, making it even more difficult to quickly address unfilled positions and staff turnover.

14,000

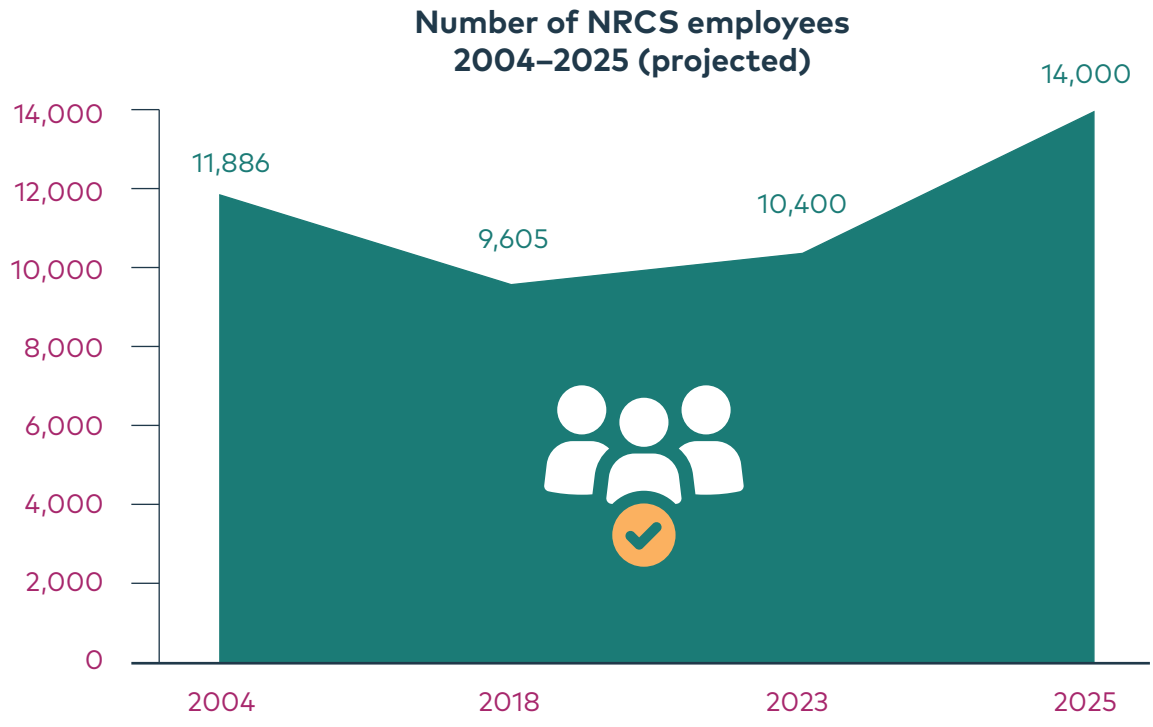
NRCS employees will be needed by 2025

3,000

of these positions are currently unfilled

SOURCE: FATKA 2023

Figure 2. Number of NRCS employees, 2004-2025 (Sources: Stubbs and Monke 2020; Crosby 2024)



The core strength of the current TA system that supports access to federal conservation practice dollars is the longevity that many NRCS employees have in the field and the relationships they build and maintain with producers (Flach 2003; Rachel Smith and Normile 2021). The innovation of the TSP program sought to build on this strength by creating opportunities for complementary activities, with NRCS staff still statutorily required to provide initial CTA for planning, and TSPs being able to then support implementation on the ground. On the funding side, the increase in NRCS staff numbers and cooperative agreements like alternative funding arrangements (AFAs) has been the direct result of additional resources from the Inflation Reduction Act of 2022 that total $19.5 billion for the NRCS over five years. For example, in 2023 an additional $500 million was added to Regional Conservation Partnership Program (RCPP) funds, including up to $50 million prioritized for AFAs with Tribal partners (USDA 2023b).

» CONSERVATION DISTRICTS (CDS)

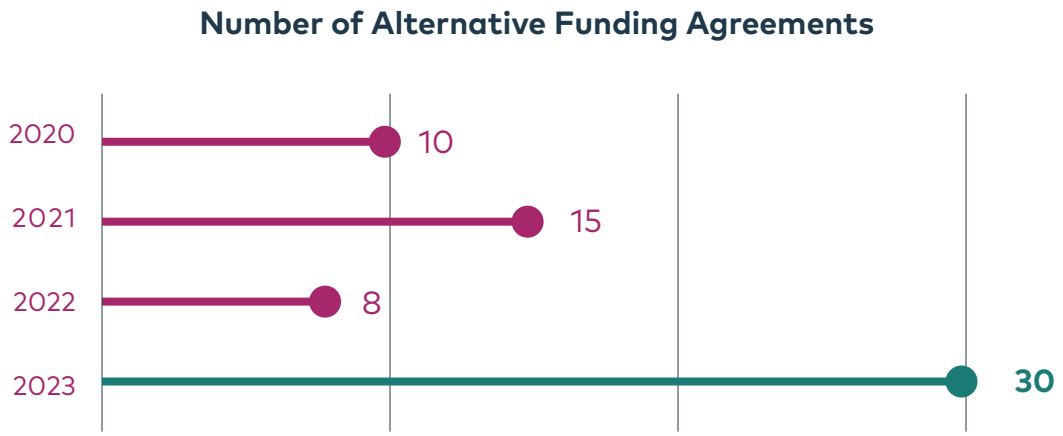
The US government established Soil and Water Conservation Districts, also called Resource Conservation Districts as well as other names as dependent on location, shortly after founding the SCS (now NRCS), to provide an on-the-ground linkage between land manager and federal field staff, and to build long-term relationships on the ground with producers and communities. CD staff are often co-located with NRCS staff in the same offices. Today, an estimated 7,000 staff are located across 3,000 CD offices across the US and its territories (NCDEA 2022). CDs are funded through a combination of federal CTA funding (through a cooperative agreement) and state and local contributions (through local mills, taxes, and state budgets (NACD 2017)), and capacity therefore varies widely by geography (NACD 2016b). CD staff support conservation planning and provide TA for implementation to landowners, and they also work with local and state NRCS offices to set priorities for conservation activities (Rosenberg and Wallander 2022).

STEPHEN AUSMUS, USDA

» CONTRACTED RELATIONSHIPS, COOPERATIVE AGREEMENTS, AND OTHER FUNDING APPROACHES

As Title II funds increased, the federal government sought to expand the ways that producers can access TA to help meet planning needs and thus adopt or expand conservation practices FA. NRCS has added programs to further expand the pool of approved third-party TA providers, including through the Agriculture Conservation Experienced Services (ACES) program of the 2008 Farm Bill that supports retired agricultural professionals in being approved to provide reimbursable TA (Keith Campbell Foundation 2023). As of 2023, there were 500 TA providers contracted through ACES positions (NEW Solutions 2024). Over 60 AFAs have also been funded since 2020 (Figure 3), specifically for RCPP, as designated in the 2018 Farm Bill (R Smith and Normile 2021). In early April 2024, the USDA announced a new $1 billion in funding for the RCPP program split between the classic approach that uses NRCS contracting and cost-share processes and AFAs (NRCS 2024d). NRCS also has cooperative agreements with specific organizations to provide targeted TA (for example, the National Grazing Lands Coalition for western rangelands (NRCS 2022a)).

Figure 3. Number of AFAs by year, 2020-2023 (Source: RCPP 2023)

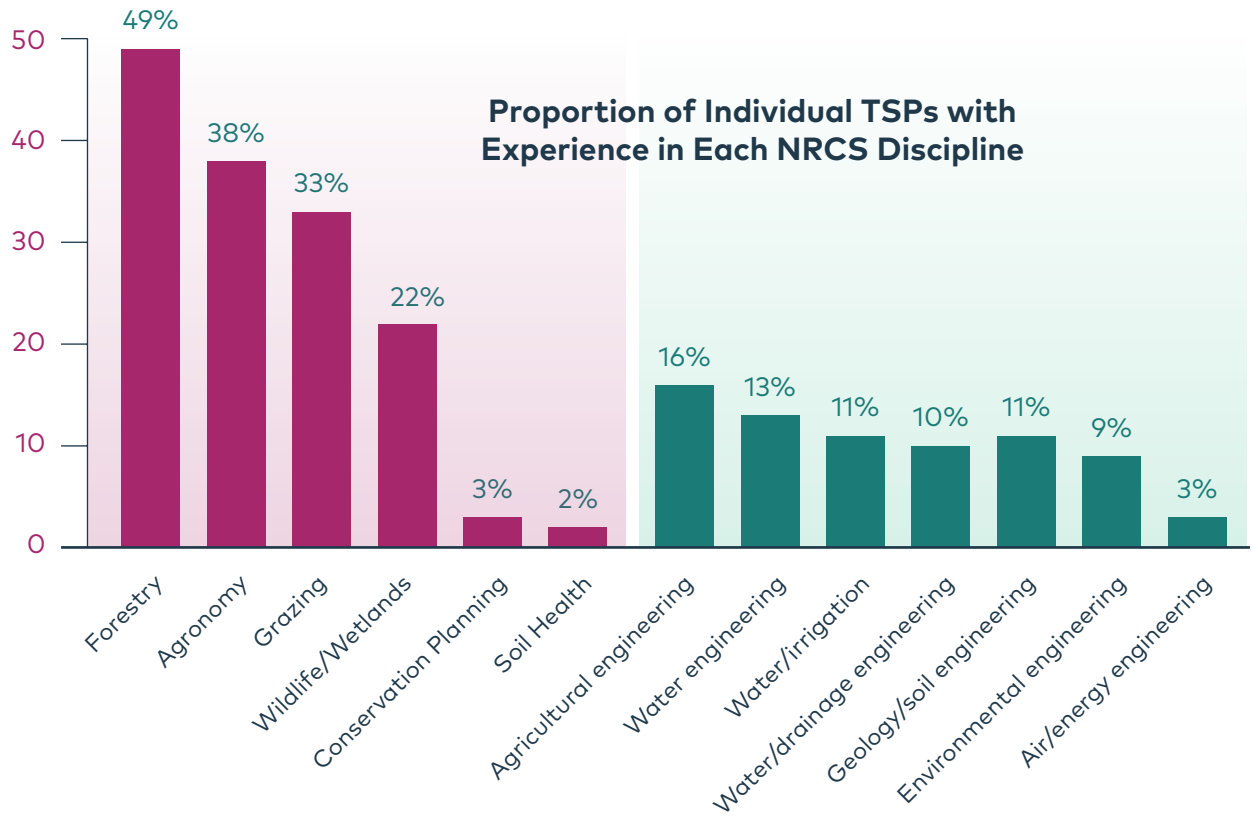


» TECHNICAL SERVICE PROVIDERS (TSPS)

Notably, in the 2002 Farm Bill, the government created the TSP role, which allows approved third-party individuals to provide reimbursable (with Title II dollars) TA to producers. CTA must still be provided by NRCS employees (Keith Campbell Foundation 2023; Flach 2003; Drecker-Waxman, Greco, and Findley 2023). More recently, the TSP program provides about 10% of the total TA capacity for accessing federal FA for conservation practices on working lands. As of March 2024, 1,063 TSP providers were registered on the NRCS Registry (NRCS 2024c). However, not all certified TSPs choose

to list themselves on the NRCS registry, especially those who work in the private sector and do not engage producers outside of their contracted role as a certified crop advisor or similar position. Figure 4 shows that among those TSPs on the NRCS registry, almost half have expertise in forestry (including agroforestry), and about one-third have expertise in agronomy and in grazing (note that TSPs can have expertise in more than one domain so proportions do not add to 100%). Substantial gaps exist on the TSP registry for expertise in soil health, conservation planning, and all types of engineering. In addition, only 23 TSPs on the registry list organic production experience.

Figure 4. Proportion of TSPs on NRCS registry with expertise across NRCS disciplines



» FOREST SERVICE

The US Forest Service (USFS) Cooperative Forestry Unit provides cost-share FA and TA to private forest owners primarily through the Forest Stewardship Program (USFS 2017). In total, Cooperative Forestry has about 50 staff, with 10 of those focused on private landowner support. In addition, the Joint Forestry Team is an active partnership between NRCS, USFS Cooperative Forestry, state agencies, and CDs to align support for forest landowners. One example of collaborative efforts includes integrating and aligning requirements of NRCS conservation plans and USFS forest stewardship plans so that landowners can use one plan to access complementary funds across their forest. The Cooperative Forestry unit also has cooperative agreements and other

partnerships like those held by NRCS. For example, in 2023, Cooperative Forestry established a partnership with the Conservation Finance Network to provide TA on private forest lands (Conservation Finance Network 2023).

The USFS National Agroforestry Center (NAC) provides TA and research support to producers and organizations nationwide working on agroforestry. As of early 2024, two NAC staff are focused on TA out of 10 total permanent positions (NAC 2024b).

» OTHER USDA PROGRAMS

In addition to the core federal agencies and partners focused on delivering Title II conservation program FA and TA, several other USDA agencies provide some TA to specific types of producers. The Farm Service Agency (FSA) administers CRP as well as several emergency programs for farmers and ranchers (FPAC 2022). FSA provides TA for these programs alongside NRCS through cooperative agreements with universities or NGOs. Over 20 cooperative agreements were in place as of early 2024 (FSA 2020).

The Agricultural Marketing Service (AMS) of the USDA, which administers the National Organic Program, provides limited TA directly but does maintain the Organic Integrity database, which lists 55 organic certifiers as currently active in the US (AMS 2024a).

The American Rescue Plan Technical Assistance Investment Program (ARPTAI) is funded by the National Institute for Food and Agriculture (NIFA), with the goal of increased participation in USDA programs by underserved producers. Since 2020, 34 cooperative agreements have been made with NGOs and universities (NIFA 2024).

USDA NRCS

Currently, 10 USDA Climate Hubs across the US (including one focused in the Caribbean) are hosted by the Agricultural Research Service (ARS) of the USDA and the USFS and focused on information synthesis and knowledge translation on topics related to climate hazards, risks, and resilience (USDA Climate Hubs 2024a). Climate Hub staff do not provide direct TA to landowners but do play a key role in information exchange between universities, agency researchers, and TA providers across the formal and semi-formal TA systems. About 120 individuals are in the Climate Hub network (USDA 2024c).

» LAND-GRANT UNIVERSITIES

Outside of federal agency TA, the land-grant university system, including the 1862 universities originally established to support agricultural and forestry needs in each state and the 1890 historically Black land-grant universities as well as the network of Tribal colleges and universities across the country, is a key source of place-based research, outreach, and training for conservation practice implementation (Crazy Bull 2015). Current estimates are that 35,000 cooperative extension professionals are in state and local offices across the country, though the number of those providing TA to producers and communities is likely much smaller. Despite decreasing public funding for Extension positions within the last half century, the number of full-time positions for Extension professionals at educational institutions is rising (ECOP, 2023). Nevertheless, structural inequalities exist in funding levels for land-grant universities that serve predominantly Black and Latino communities as well as Tribal colleges, which are disproportionately small compared to those of 1862 land-grant universities (Partridge 2023; Smith 2023). This lack of funding limits relevant research and outreach capacity in and for communities already underserved by the dominant agricultural system, and it also limits the education and training opportunities for students at these institutions, which in turn impacts the diversity of the agricultural and TA workforce in the long term.


PRESTON KERES, NRCS

Private sector

In the private sector, a broad range of TA providers support producers' conservation priorities. This includes innovative practices that NRCS has not yet approved as well as practices that meet NRCS standards but are supported with funds and through programs other than traditional Farm Bill FA, and access to ecosystem services markets that pay based on outcomes rather than practice implementation. These individuals and organizations operate as part of the formal system through certifications that the federal govern-ment also recognizes, although currently private sector TA providers must still become certified as TSPs to be eligible for reimbursement.

» CERTIFIED CROP ADVISORS

As of early 2024, there are 8,621 certified crop advisors (CCAs) in the US, and none in the minor outlying islands (ASA 2024). To become a CCA, a four-year degree or higher with two years of experience, an associate 's degree with three years of experience, or four years of experience with no advanced degree is required. With a CCA certification, an individual can apply for TSP status through NRCS, though they must take the required USDA training and have their credentials approved by an NRCS office. Despite the recognition by the NRCS of the CCA credential, only 4% of current CCAs are certified TSPs. The low participation rate of CCAs in the TSP program is due in large part to the fact that the majority of CCAs (80%) work in the private sector as independent advisors or as employees of agricultural input companies (Eckelkamp 2023). Because of these affiliations with the private input market, and the requirements that TSPs not have competing interests, most CCAs choose not to pursue TSP status.

The American Society of Agronomy (ASA) implements the CCA program, and the majority of CCAs focus on areas of expertise that are relevant to cropping systems. Figure 5 shows the relevant dominance of areas of expertise as self-reported by CCAs. Crop management and nutrient management are the most common areas of expertise, followed by integrated pest management (IPM) and soil management. Importantly, however, only 20-40% of CCAs report expertise in each of these areas (individuals can report more than one area), highlighting the relative diversity in skill sets across these consultants.

Figure 5. Proportion of CCAs with self-reported areas of expertise

» INDIVIDUAL CONSULTANTS

In addition to CCAs, who are primarily employed by the private agri-input sector, many other types of individual consultants provide formal TA to producers. The National Alliance of Independent Crop Consultants (NAICC), for example, provides training and certifications for crop consultants. NRCS accepts the NAICC Certified Professional Crop Consultant (CPCC) designation as a qualifying credential to become a TSP. In early 2024, 175 US-based crop consultants were listed in the NAICC database, and 58 of these are CPCCs (NAICC 2024). The Soil Science Society of America also offers a Certified Professional Soil Scientist (CPSS) credential, which NRCS accepts as a TSP qualifying credential. The CPSS requires at a minimum bachelor's degree and 5 years of experience or an advanced degree and fewer years. In early 2024, there were 526 CPSS in the directory, and 7 of these are TSPs (SSSA 2024). The American Society for Horticulture Science also has a Certified Professional Horticulturist (CPH) credential, which requires a bachelor's degree and years of experience. There are currently 53 CPHs in the US, and they are present in 21 states and Puerto Rico (ASHS 2024).

More independent consultants are working in forestry and grazing than in crops. The US Bureau of Labor Statistics estimates that in 2022 there were about 1,100 private foresters in the country (out of about 9,400 foresters total) (BLS 2022). The American Society of Foresters similarly lists about 1,000 Certified Foresters, including individuals who work in the public or the private sector (ASF 2024). For grazing animals, individual consultants can focus on grazing or on rangelands. For example, currently 18 Certified Range Management Consultants (CRMC) are listed on the Society for Range Management (SRM) website (SRM 2024). To achieve CRMC status, an individual must have a Bachelor of Science and at least 10 years of experience, or an equivalent advanced degree and experience.

SCOTT BAUER, USDA

Semi-formal technical assistance

Semi-formal TA providers are individuals and organizations that operate with only an indirect connection to the formal TA system and the federal FA that supports conservation practice implementation. Many organizations provide TA through both semi-formal and formal channels. For example, an NGO might provide semi-formal TA using philanthropic funds while also at times providing formal TA through cooperative agreements with the NRCS.

Semi-formal TA includes both the NGO and private sector actors providing TA to support conservation practice implementation not directly connected to federal funding. This part of the system is described as semi-formal because there are few systemic requirements for these organizations in terms of who can provide TA and on what topics. Much of the TA provided in the semi-formal system is supported by funds from federal grants, rather than cost-share, as well as by private philanthropy, or investments from market actors and the private sector. While there are too many NGOs working in conservation on working lands in the US to summarize, some key resources are available for finding active lists. For example, Ambrook, an agricultural software company, maintains a list of agricultural funding for TA (Ambrook 2024). One of the key features of the semi-formal TA system is that funds often originate from either the federal government, as grants, or the private sector, and NGOs then regrant those funds to TA providers and landowners. Thus, the TA requirements are less strict, but estimating how many individuals provide that TA is challenging.

In the private sector, semi-formal TA is provided by individuals working with landowners in carbon markets and other ecosystem services markets. Estimates of how many TA providers are available to producers through carbon markets (voluntary and compliance) are difficult to ascertain as there is currently no clearinghouse of information about market actors and the capacity they offer. However, a recent announcement by the USDA related to implementing the Growing Climate Solutions Act (GCSA) highlights the creation of a resource hub and list of qualified TA providers for voluntary carbon offset markets (USDA 2024; see later section on new federal investments). Semi-formal TA can also be provided by individuals with some certification but without sufficient credentials to meet specific USDA requirements. For example, the Technical Assistance Provider (TAP) certification developed in the state of California and offered through public universities allows individuals to provide TA for some RCPP projects, as well as state programs and other funding sources (Chico State University 2024).

Another important set of actors in the semi-formal TA space that are commodity-specific are research and promotion boards, often called "checkoff programs." These boards – there are currently 22 – are overseen by AMS and focus on developing and strengthening markets for key agricultural commodities by investing funds provided

by each producer of the commodity in research and marketing promotional activities (AMS 2024b). Most checkoff organizations do not provide direct TA on topics related to production or conservation to their members. However, some, like the Cattlemen's Beef Board, the National Pork Board, and US Dairy, provide funding to project partners to provide TA on topics related to animal health and sustainability (CBB 2024; NPB 2024; US Dairy 2024). Others, like the Cotton Board, maintain resource libraries for producers and TA providers to access up-to-date research, climatic, and marketing information (Cotton Board 2024).

Informal technical assistance

Informal TA tends to be provided by producers to one another, through place-based organizations and peer-to-peer networks. Place-based or community-based producer organizations are generally small nonprofit organizations or are fiscally sponsored by other nonprofit organizations and focus on resource and production concerns that are highly localized. They are common in rangelands (Allen 2006; McNew, Dahlgren, and Beck 2023; Gold 2022) and private forests (Ballard, Fernandez-Gimenez, and Sturtevant 2008). Peer-to-peer networks historically involved 'talking over the fence line,' with neighbors learning from neighbors in a process of information diffusion. Affinity networks focused on production methods (Crawford et al. 2015), seeds (Helicke 2015) or market outlets (Hinrichs, Gillespie, and Feenstra 2004) might not share specific neighborhoods but often evolve within communities and regions. In the digital era, many opportunities exist for peer networks to form and thrive across geographies (Quintana and Morales 2015; Phillips, McEntee, and Klerkx 2021).

As budgets for formal TA in the public sphere have plateaued over the past decades, informal TA through producer-led networks has become increasingly important (Nelson et al. 2014). The strengths of these informal TA systems are a deep embeddedness in a specific production and social context, trust based on multidimensional relationships, and the ability to show and talk about new practices and their impacts (Henderson 1998). Informal TA can also support new and emerging production practices that are not yet considered mainstream, sometimes with grant funding from federal or other public sources (for example, many CIG grants draw on informal TA). For example, social networks and peer-led information sharing supported interest in and the spread of organic production practices before they were institutionalized in the formal TA system (Ingram 2007). Research has also shown that informal TA systems are often most effective when they have touchpoints with the formal or semi-formal TA system to receive new information and support initial conservation innovation (Nelson et al. 2014; Niewolny and Lillard 2010).


STEPHEN AUSMUS, USDA

Education and Training Pipeline

Education and training to build capacity in TA providers can come from the formal education system, in the form of two- and four-year degree programs, and can also include agricultural education for youth, the interested public, TA providers looking to expand their expertise, and for producers themselves.

Degree programs in core agriculture and forestry disciplines

The education and training pipeline for core disciplines related to providing TA focuses mostly on natural resources, including forestry, environmental science, natural resource conservation, fisheries, and wildlife; and agriculture, including agronomy, soil science, plant science, animal sciences, and rangeland management. These are disciplines and degrees that are required to qualify as a TSP (using the combination of education and experience option for most practices). General estimates of the number of two-year and four-year degree programs show far more four-year degree programs than two-year degree programs in natural resources (almost four times as many), and slightly more two-year degree programs than four-year degree programs in agriculture.

Figure 6 shows these numbers and Figure 7 shows a more detailed breakdown of certain degree programs (see also Brevik et al. 2020). The more detailed data sources shown in Figure 8 include one crops/soil/agronomy program in Guam and one in American Samoa, as well as one range management program in Puerto Rico.

Figure 6. Number of two-year and four-year degree programs in agriculture and natural resources in the US, 2021 (Data from IPEDS as summarized by DataUSA (2024))

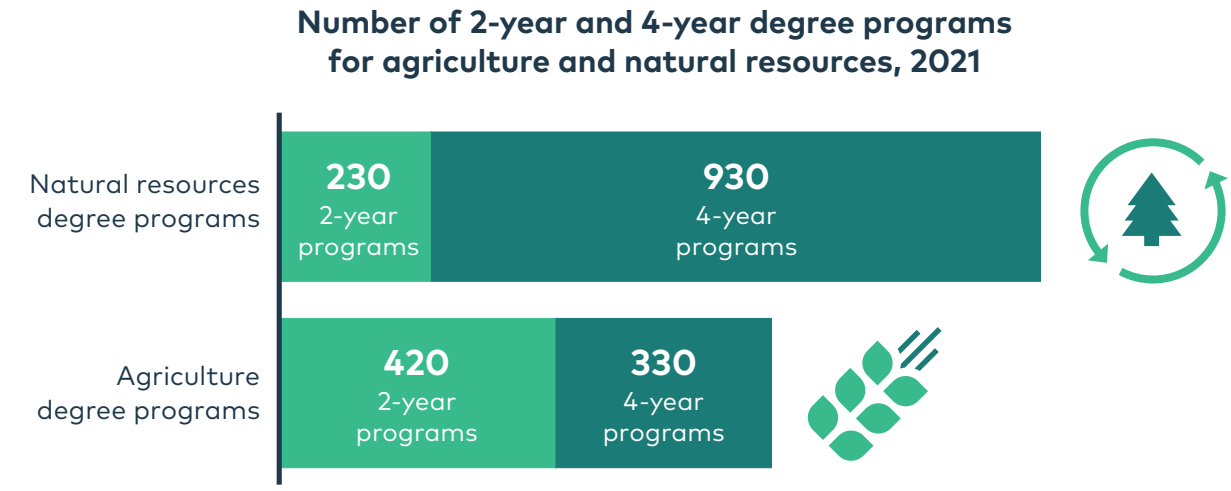
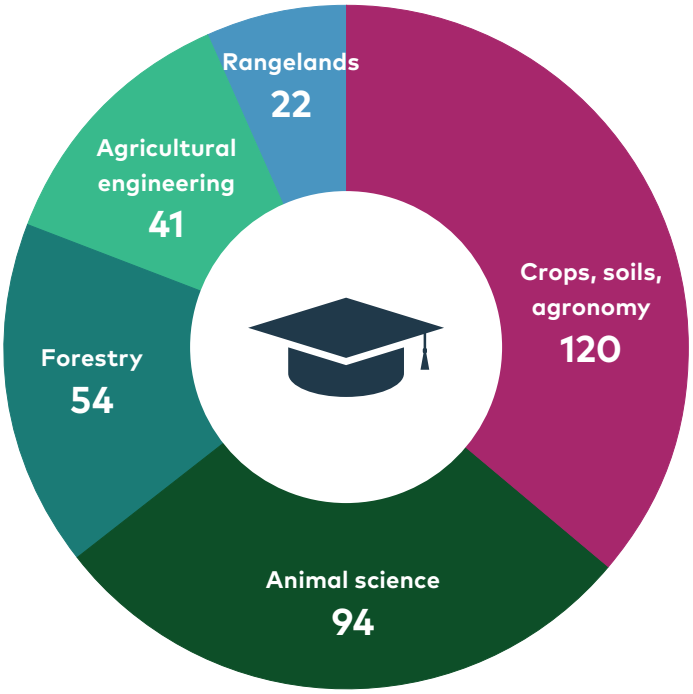


Figure 7. Number of four-year degree programs in agricultural and forestry disciplines, 2021 (Sources: Agronomy Society of America 2024; Forestry USA 2022; US News and World Reports 2024 [for animal science]; Society for Range Management 2023; IPEDS as summarized by DataUSA (2024))[9]

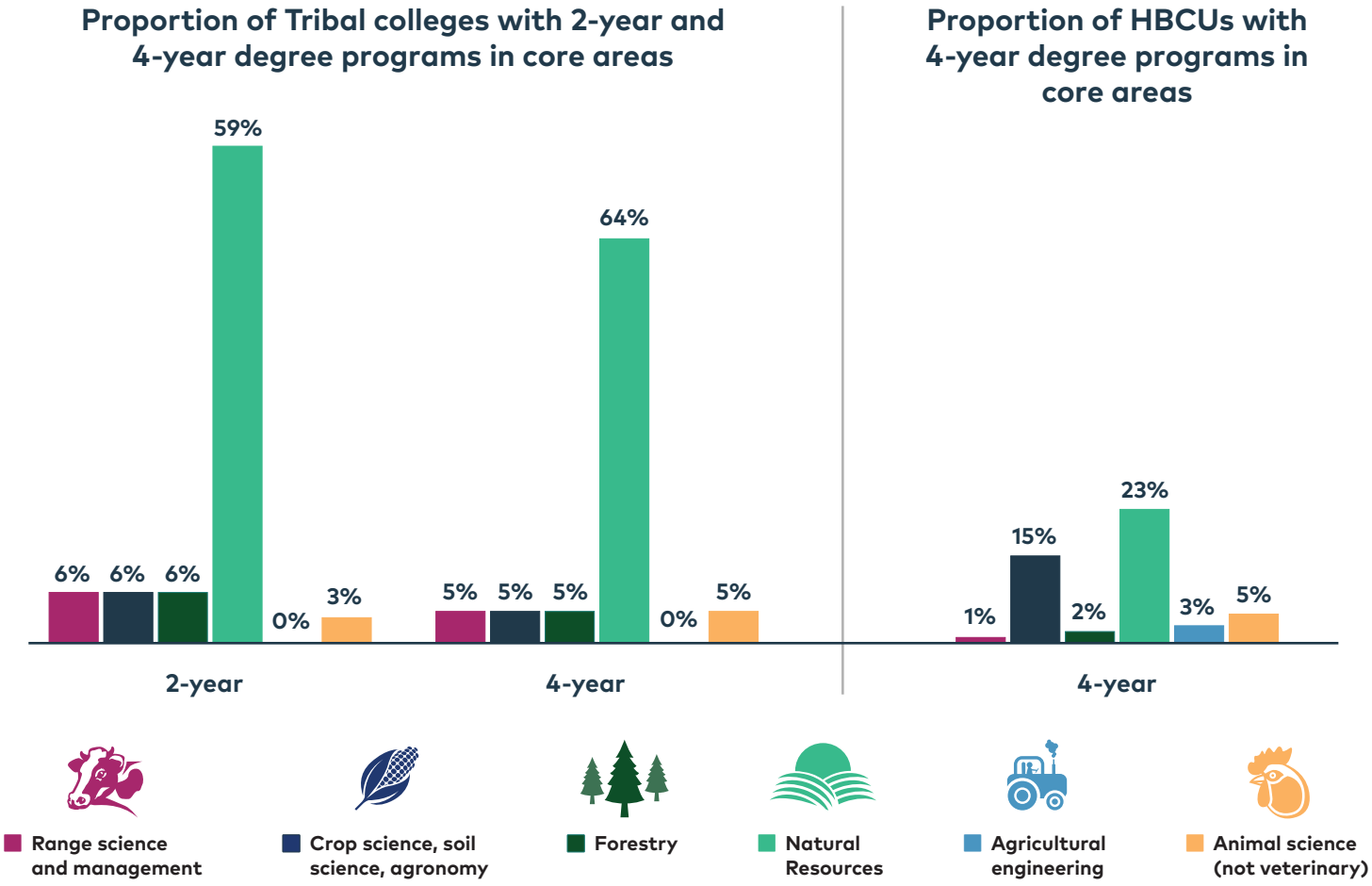
Number of 4-year degree programs in agriculture and forestry, 2021



Most of the programs included in Figure 6 and Figure 7 are located at public colleges and universities, and relatively few are located at historically black colleges and universities (HBCUs) or Tribal colleges. Figure 8 shows the proportion of Tribal colleges and HBCUs that have two-year (Tribal colleges only) and four-year degree programs in core agricultural and forestry disciplines. In total, 34 Tribal colleges offer two-year degrees, and the majority (59%) offer at least one program in natural resources. All other agriculture and forestry disciplines are offered by only one or two colleges. Twenty-two Tribal colleges offer four-year degrees, and the same patterns exist for two-year degree programs; 64% offer at least one program in natural resources, and only one college offers a program in other agriculture and forestry disciplines. Twelve HBCUs offer two-year degrees, and only one of these offers an agricultural program (in crop science, soil science, or agronomy). Of the 91 HBCUs that offer four-year degrees, almost one-quarter (23%) offer at least one program in natural resources, 15% offer at least one program in crop science, soil science, or agronomy, and few offer other types of programs.

9 Figure 7 includes degrees that directly provide TA capacity for implementing conservation practices. We do not include degrees like agricultural economics or agri-business, which support adoption of conservation practices but not practice implementation.

Figure 8. Proportion of Tribal colleges and HBCUs that offer programs in core agricultural and forestry disciplines (data from NCES 2024)



Other education and training programs

In addition to formal, post-high school training programs, many other opportunities are available within the educational pipeline to build capacity for conservation practice TA. For youth, the 4-H program remains an important source of early education in agriculture. Over 3,500 4-H professionals and 500,000 volunteers engage 6 million children annually nationwide (National 4-H Council 2024). The National FFA Organization (often called Future Farmers of America or FFA), another source of youth and young adult agricultural education, currently has just over 900,000 members in grades 5-12 and college (FFA 2024). Other organizations, like Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS), focus on expanding professional opportunities and representation for minorities in agriculture and natural resources fields. MANRRS currently has 19,000 members across the US at the high school and college levels (MANRRS 2023). For young adults who are entering into agricultural fields, the Farm Bureau offers networking and capacity

building for Young Farmer and Ranchers (aged 18-35) (Farm Bureau, 2024b) as well as for college students through the Collegiate Farm Bureau chapters at many land-grant colleges and universities (Farm Bureau, 2024a). The National Association of Agricultural Educators has over 9,000 members who focus on agricultural education in secondary, post-secondary, and adult learning environments (NAAE 2024). Although these numbers are significant, maintaining and expanding the pipeline for future TA providers requires ensuring adequate numbers of students and educators. The National Council for Agricultural Education has as a focus of its current strategic priorities on the training and retention of agricultural educators that reflect the diverse backgrounds of teachers, students, and production systems to ensure that agricultural education is relevant for a wide range of learners (NCAE 2024).

In addition to youth and the interested public, agricultural training can provide new learning opportunities for current TA providers, producers, and other professionals. Cooperative extension, NGOs, and the private sector offer many training programs to producers. There are far too many of these programs to list or easily quantify, and the opportunities are not centralized anywhere that make them easy for producers to find. That said, they remain an important form of place-based and often peer-based learning that often be more accessible (both financially and geographically) than enrolling in formal programs offered by colleges and universities or by private-sector organizations.

Many colleges and universities offer certificate programs for professionals to add a new skill set or specific expertise to their existing knowledge. These options range from training programs that last a few months to programs that require nine to twelve months to complete. Certificates are not always sufficient in and of themselves to qualify an individual to provide formal TA, but they can complement existing expertise or allow someone new to the field to explore areas for future learning. Figure 9 shows the number of certificate programs by discipline. Most certificates offered focus on natural resources, and very few focus on range science or agricultural engineering.

BUILDING CAPACITY FOR TA FOR CONSERVATION

3,500
4-H professionals

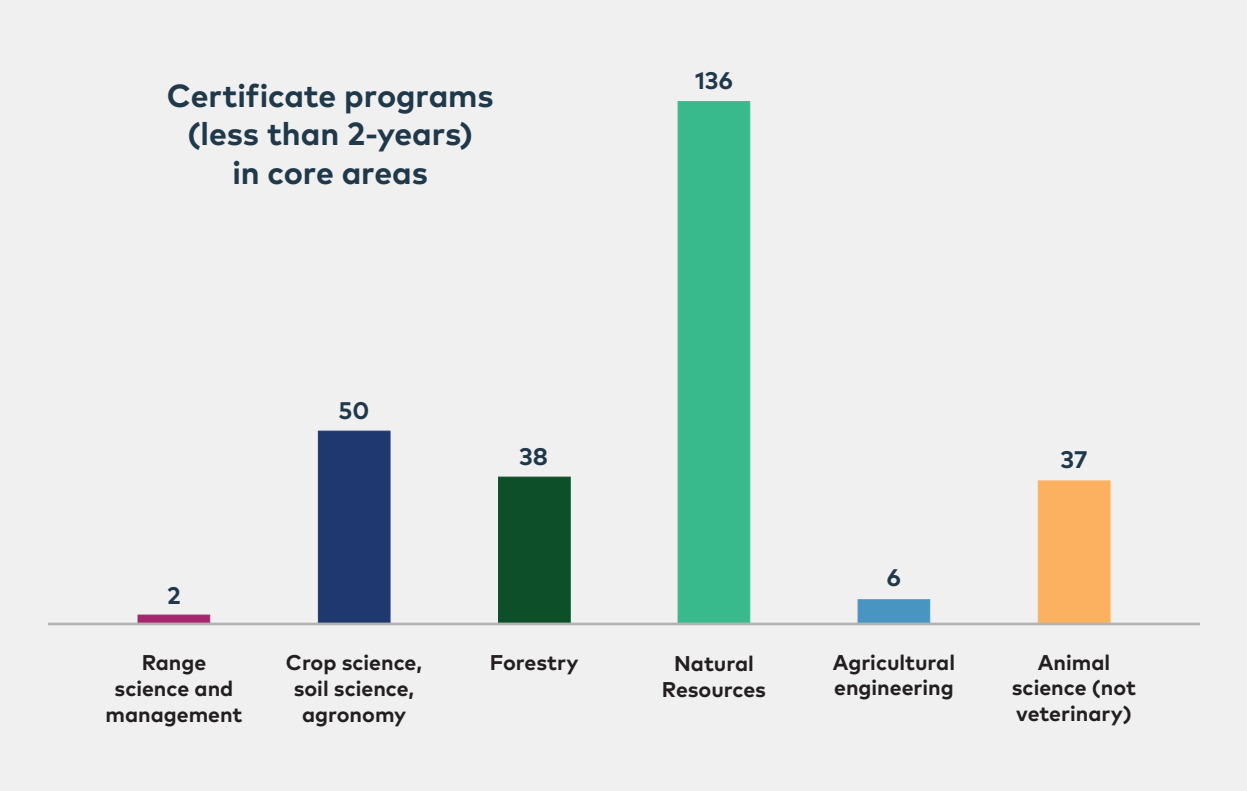
900,000
members of National FFA Organization

9,000
members of National Assoc. of Agriculture Educators

500,000
4-H volunteers

19,000
members of Minorities in Agriculture, Natural Resources and Related Sciences

Figure 9. Number of certificate programs in agricultural and forestry disciplines (data from NCES 2024)



For professionals looking to enhance or expand their areas of expertise, an increasing number of these programs provide opportunities for continuing education units (CEUs). CEUs are also required to maintain CCA and other certifications. Programs that offer certificates and/or CEUs are generally offered by institutions of higher education and include in-person education. Beyond programs at formal institutions, the training pipeline should ideally include supported real-world learning and experience as well. This could include peer-to-peer learning and networking for individual conservation professionals, as well as more structured mentorship opportunities (SWCS 2021). For organizations that invest time in post-degree training of staff, one of the challenges of such a long runway to professional status is balancing time and resources for training with concern about staff retention (Chesapeake Bay Commission 2017). This is true as well for core NRCS staff. To connect the educational pipeline to permanent positions, NRCS has adapted long-standing student recruitment and retention programs under the new umbrella of the Pathways Internship Program (NRCS 2022b). This program seeks to engage students with high school through graduate degrees in short-term internships that can quickly (within 120 days in some cases) be converted into permanent NRCS staff positions.

Effective Forms of Technical Assistance

The success or efficacy of TA is generally measured by the extent to which it leads to durable practice implementation on the ground (Chesapeake Bay Commission 2017; Epanchin-Niell et al. 2022), as well as by the capacity building and changes in knowledge, attitudes, and behaviors among producers (Morris and Arbuckle 2021; SWCS 2021). Clear and consistent evidence across forms of TA, production systems, and geography shows that TA is most effective when done in the context of long-term relationships, place-based knowledge, and trust (Bernacchi and Wulfhorst 2017; R Smith and Normile 2021; CBF 2022; SWCS, 2024). This is a clear strength of the classic NRCS and CD model, with local staff who can both support the bureaucratic side of accessing TA and FA for conservation practices and provide that TA themselves in the field. Studies have also found that producers tend to seek information from multiple sources before making decisions about conservation practices (Witzling, Wald, and Williams 2021). TA providers and producers alike could benefit from a more orderly list of techniques used, which would home in on TA standards and increase reportability of conservation outcomes (Katz 2015). Collaborative working relationships between NRCS offices, CDs, and partners that have the trust of producers can also facilitate this type of TA. For example, a recent public-private partnership supported by an AFA allows a producer-owned cooperative and its agricultural advisors to work alongside NRCS and local CD staff to support conservation practice implementation (NFWF 2021). NRCS leads have in certain cases also brought producers in to train local staff in place-based practices, which demonstrates a mutual respect and commitment to shared learning (Drecker-Waxman, Greco, and Findley 2023).

> TA is most effective when there is a slow and steady build that includes outreach, communication, planning, and then decision-making about specific implementation.

In addition to having a solid foundation of relationships, TA is most effective when there is a slow and steady build that includes outreach, communication, planning, and then decision-making about specific implementation (Olsovsky, Strong, and Berthold 2021; Berthold, Olsovsky, and Schramm 2021; SWCS, 2024). As one recent study summarized, "it is not the [conservation] plan itself, but rather the sustained interaction with natural resource professionals, that makes a difference in the use of conservation

RON NICHOLS, USDA NRCS

practices" (Morris and Arbuckle 2021). Informal training and peer-to-peer learning that precedes formal CTA and planning is an important first step for engaging people in making changes (Oliver and Gazal 2021; Drecker-Waxman, Greco, and Findley 2023). There is an especially important role for informal and place-based TA when working with historically underserved and marginalized communities. As noted in a recent guidebook co-developed by the Soil and Water Conservation Society and Meridian Institute, "the most effective conservation efforts are those led by and for the people who inhabit the land" (SWCS, 2024: 3). This approach has been embedded in the NRCS and CD model of locally appropriate conservation for close to a century. Considering the positionality and the setting in which TA is being delivered is another angle on a similar theme: social context for information sharing and decision-making influences the efficacy of TA as measured by implementation and maintenance of conservation practices (Epanchin-Niell et al. 2022).

Challenges in Current Technical Assistance Systems

The overwhelming consensus about the main challenge in the TA system is the lack of formal capacity to support planning as well as design, implementation, and maintenance that uses federal funds. Challenges prevalent across systems include capacity limitations within the educational pipeline and a lack of trained professionals, generational turnover and loss of local knowledge, and challenges in public TA provider salaries compared to private ones.

Challenges specific to NRCS

Because most of the TA and FA for conservation practices on working lands comes directly from NRCS staff or indirectly through contracted relationships between TA providers and NRCS, some challenges are unique to this part of the formal TA system.

Human capacity to address producer interest in conservation programs

Challenges with human capacity have led to a backlog of an estimated 100,000 applications (Fatka 2023), which represents 13.8 million acres awaiting planning for enrollment (Drecker-Waxman, Greco, and Findley 2023). To address the backlog just in the Chesapeake Bay watershed, an estimated 30% increase in TA capacity is needed (Chesapeake Bay Commission 2017). However, in 2023, NRCS lost almost 40% of its 800 hires from the previous year (Fatka 2023). One reason that Congress created the TSP program in 2002 was to address some of these challenges by further delineating roles and responsibilities for NRCS staff versus approved service providers. The TSP program, however, has been critiqued by a wide cross-section of stakeholders and policymakers as being overly burdensome on TA providers in terms of qualifications and paperwork and as challenging for producers to find approved expertise in their area (Baird and Spanberger

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RON NICHOLS, USDA NRCS

2023; Drecker-Waxman, Greco, and Findley 2023). Specifically, the qualification process is onerous and too narrow to reflect diversity of lived experience of TA providers. For NRCS to approve an individual to provide TA for a specific CPS, a TSP must have either a specified certification and some years of experience or a certain education level and some years of experience. Only about 30% of CPS have an experience-only approval option (NRCS 2024c), which limits the ability of individuals from the semi-formal system to bring their capacity to the formal system. Many CPS require a bachelor's degree for TSP certification, or a recognized credential like CCA or CPSS, credentials which similarly require a bachelor's degree. Agency-acquired TA providers, on the other hand, do not have to meet the same training and qualification standards but instead can be approved based on verification of the conformance of their past work to CPS and agency requirements (Keith Campbell Foundation 2023).

Funds to increase the types of capacity needed

Funding allocation challenges focus on the need for more funds and capacity to support the early steps in the CTA process. CTA time and funds support the development of a conservation plan, which is a required first step toward implementing conservation practices and applying for cost-share reimbursement from Title II Farm Bill Programs. CTA funds have not kept pace with increases in Title II dollars, but no Title II dollars can be spent without a conservation plan (Keith Campbell Foundation 2023; Drecker-Waxman, Greco, and Findley 2023; R Smith and Normile 2021). This mismatch of funding and thus the human capacity available to support the first step in conservation practice initiation is one of the reasons for the backlog of producers interested in but not currently accessing NRCS FA to implement conservation practices.

Another funding challenge that creates bottlenecks in TA provision and could undermine access to conservation practice implementation is the fact that cost-share requirements for part of the services provided by TSPs (the CPAs) have limitations because funds come from the FA funding line. For example, for CSP and EQIP, a producer who contracts with a TSP can only be reimbursed by NRCS FA for 75% of the total cost of implementing conservation practices (e.g., cost of TA services as well as needed materials and labor), or 90% of the total of implementation for socially disadvantaged producers (Keith Campbell Foundation 2023; Baird and Spanberger 2023). Reimbursement rates are set at the state level by practice, which means

that rates for the cost of implementation might be higher or lower for an individual producer given variation in the cost of TA, labor, and materials across regions of the state. NRCS cost-share allows for reimbursement of costs up to 75% of the rates set at the state level (90% for socially disadvantaged producers), meaning that if rates are at or lower than actual cost, the proportion of costs that a producer will have to cover could be substantial. Even the 10% cost-share requirement for underserved producers can be a barrier to access, and the 25% general match required dissuades many producers from pursuing third-party TA services (Drecker-Waxman, Greco, and Findley 2023). In contrast, NRCS staff and TA providers contracted directly by NRCS state and local offices are paid at a rate unrelated to cost-share requirement, which means their services are more attractive to producers because there is no financial outlay associated with receiving the TA. As noted above, however, capacity from NRCS staff and contracted service providers cannot meet demand, and it can put producers in a challenging position if they want to access FA for conservation practices but must match more of the cost for TA by using a TSP.

Challenges across TA systems

Some challenges cut across the formal, semi-formal, and informal TA systems. These include the recruitment and retention pipeline, and collaboration among TA providers and across systems.

Pipeline for TA provider recruitment and retention

Across TA systems, both those that support producers accessing NRCS funds and those that support the implementation of conservation practices with a variety of other funding mechanisms and priorities, several challenges persist. Gaps in expertise due to generational turnover and lack of training in new and innovative practices exist across production systems (with specific gaps described in the following sections). Recruiting young people into agricultural professions is a challenge, although most of the recent literature on decision making about working in agriculture comes from developing countries rather than from the US. Gaps in the education and training pipeline limit quick backfilling of vacated positions, and livelihood challenges for aspiring

> Gaps in the education and training pipeline limit quick backfilling of vacated positions, and livelihood challenges for aspiring TA providers include low pay (especially in the public sector) and the trade-offs that come from being based in rural areas.

TA providers include low pay (especially in the public sector) and the trade-offs that come from being based in rural areas (challenges include lack of child care, lack of jobs for other family members, and lack of professional community). Retention of TA providers in the government and non-profit sectors is especially difficult because of low pay (e.g., half of what TA providers can make in the private sector as crop advisors or working in carbon markets (Fatka 2023)). For all types of TA providers, especially those in the public sector, the bureaucratic sides of conservation positions can also be a challenge (SWCS 2021).

Generating information and evidence by researchers, practitioners, and producers themselves is not sufficient. Knowledge needs to be translated into formats that are usable by producers and TA providers in planning and implementing practices in complex, dynamic natural and social systems. Decision support tools (McConnell and Burger 2011; P. Ranjan et al. 2020), access to data sets and services that can show impact (Keith Campbell Foundation 2023), and peer-led education about both the process and outcome of adoption (Oliver and Gazal 2021; Rachel Smith and Normile 2021; Epanchin-Niell et al. 2022) are pathways to enhancing knowledge translation and effective implementation of conservation practices. These needs will require updating and expanding the educational and training pipeline for future TA providers to reflect degrees, skills, and interests that speak to 21st century conservation goals and practices (e.g., "climate smart" practices, whole farm planning), and a

need to increase transparency and integration of information and data to support holistic conservation planning. Addressing both the training pipeline and information challenges is especially important as the nation's TA workforce, like many other parts of the agricultural system, is disproportionately older and closer to retirement. This generational transition comes with many opportunities for workforce development and the infusion of new ideas and skills into a strong history of conservation planning and the implementation of TA in the country. However, these changes will also lead to knowledge and skills gaps in specific production systems and geographies that could negatively impact agricultural and conservation landscapes if unaddressed.

Collaboration across TA systems

Collaboration and coordination across the TA system can be challenging, especially between the public and private sectors. Specific conflict of interest limitations on private consultants may apply if they receive federal dollars (via reimbursement, cooperative agreements, etc.) for TA when they are employed by a private input firm, as is the case with many crop advisors. However, there are many other opportunities for the public and private sectors to collaborate on TA and information exchange for producers. With declining budgets for cooperative extension and other public formal TA providers, crop advisors have become a key source of trusted information for producers (Prokopy et al. 2015), and crop advisors see themselves as a potential source of conservation practice information (Eanes et al. 2019; Haigh et al. 2015). Cooperative extension and private consultants could work together to build on the trusted advisor relationships that many consultants have with producers to bring university research and outreach on conservation practices to wider audience (Eanes et al. 2017; Bernacchi and Wulfhorst 2017). One study of crop advisors found that the main barriers to these and other collaborative relationships are perceived differences in mission and territoriality among types of TA providers (Eanes et al. 2019). Some critiques of CDs identify similar challenges with territoriality and localism. The structure of CDs, with local volunteer boards and a mandate to focus on local resource issues, can make larger scale collaboration or prioritization at the state level a challenge (Scarlett 2011).

Several US lawmakers introduced a bipartisan bill in 2023 into both the US House and Senate intended to address TA workforce shortages and increase access to Farm Bill conservation programs. The Increased TSP Access Act (Baird and Spanberger 2023) focuses on streamlining the TSP certification process and ensuring pay and reimbursement parity across all types of TA providers receiving payment through federal FA. The Act also includes a provision to require USDA to create processes to allow third-party entities to certify TSPs. One example of this approach already exists in the partnership between the ASA and NRCS, who announced in 2023 a partnership to allow ASA-certified CCAs to be 'recommended' for the TSP registry to streamline the TSP approval process (ASA 2023).

LANCE CHEUNG, USDA

Equity in access to technical assistance and conservation practice implementation

Many of the challenges overviewed above focus on baseline capacity and availability of formal and semi-formal TA across the US. For historically underserved and marginalized producers, the broader political and social context of the US creates a separate set of challenges that intersect with the contemporary TA system in agriculture. As succinctly described in a recent report,

> *"moving forward from this historical context requires a commitment to rectifying past injustices and building a more inclusive and equitable future in conservation. By acknowledging the systemic barriers that have marginalized certain communities and perpetuated inequity, we can take meaningful steps toward addressing these issues. This involves not only recognizing the importance of diverse perspectives and traditional knowledge in conservation efforts, but also actively centering historically underserved producers and communities in decision-making processes" (SWCS 2024: p.7).*

Within communities that have been historically marginalized by federal agencies and other institutions, a much larger gap in TA capacity as compared to need is likely. For example, Figure 9 shows that only a handful of Tribal colleges and HBCUs offer degrees in agriculture and forestry fields, and the majority of these are in natural resources

fields rather than more focused programs in forestry, range management, agricultural engineering, or crop science and agronomy. In addition to educational pipeline challenges, the general barriers to becoming an approved TSP provider exacerbate access issues for underserved communities by disadvantaging individuals who might come from or live within these communities, including communities of color, Indigenous and Tribal communities, and new and beginning producers.

In addition to availability of formal TA providers, challenges associated with access and equity for underserved producers persist. In the context of Farm Bill conservation programs access, NRCS programs require a high degree of bureaucratic literacy and are easier to navigate if you have already participated in the past (SWCS 2024). This learning curve creates challenges for producers who have for a variety of reasons historically not engaged in federal programs to support agriculture and forestry (Drecker-Waxman, Greco, and Findley 2023; Casey 2019). Other challenges include the need for multilingual TA providers and documents, and a multicultural understanding of the social and economic structures of agricultural production in different communities across the US and its territories. To address these availability and access issues, USDA announced the Equity in Conservation Outreach Cooperative Agreement program in 2023 (NRCS 2023c). These cooperative agreements are meant to increase capacity for semi-formal TA providers to support producers in connecting to Farm Bill programs, with the goal of increasing equity in access to federal funds.


PRESTON KERES, USDA

Specific challenges persist in implementing conservation practices via the formal TA system for historically underserved communities in the US related to land access and land tenure. In Native nations, producers often lease Tribal trust land, which shifts the return-on-investment (ROI) calculations for individual land managers and in some cases requires shared decision-making about new practices. For instance, the Bureau of Indian Affairs has a specific type of management jurisdiction on Tribal lands that requires engagement by TA providers in the conservation planning process (US Commission on Civil Rights 2018). Fractionated land is also a challenge, with many individuals owning areas too small for effective implementation of common conservation practices (Rachel Smith and Normile 2021). In African American and Black communities, mostly in the southeastern US, heirs' property systems can make planning and decision-making a challenge. In contrast to the challenge of fractionation, in which property is subdivided and passed

down to individual heirs each generation to create smaller and smaller titles, heirs' property is a system in which each subsequent generation receives a share of the total land inherited and all heirs collectively hold a single title to the land (Casey 2019). These land title arrangements can make heirs property owners ineligible for many federal programs and some private-sector opportunities. TA providers, especially those working in the forestry sector, are not well-trained in navigating these land tenure issues (Gaither et al. 2019).

Gaps in the evidence base

Producers, policymakers, and the public want confidence that conservation practices will achieve ecological and economic goals related to long-term resilience. Empirical, direct measurement data, and mechanistic models that build on empirical data provide a critical evidence base for understanding and predicting the outcomes of conservation practice adoption (M. V. Johnson et al. 2015). However, confidence in the evidence base on the ecological and economic benefits of conservation practices varies considerably by practice, geography, and other contextual factors (Buma et al. 2024; Schechinger 2024). Specifically related to climate-oriented conservation practices, a lack of scientific consensus exists on the impacts of practices on soil carbon sequestration and even somewhat on soil GHG emissions (Buma et al. 2024; Stanley et al. 2023; Wang et al. 2021). An inadequate evidence base also persists for practices related to water and irrigation management (Mitchell et al. 2023). However, a high degree of agreement and evidence exists for the ecological benefits of some key conservation practices, including agroforestry, soil carbon amendments, forest management, and the use of continuous cover (Buma et al. 2024).

As a recent GAO report noted, the feasibility of implementing practices on the ground is an important dimension of estimating anticipated impacts and thus prioritizing investments (GAO 2017; Boyd, Epanchin-Niell, and Siikamaki 2015; R Smith and Normile 2021). Within USDA programs, a lack of clear ROI analysis is a key driver of dropped practices (Wallander et al. 2019). A separate survey of producers found a high degree of variability in perceived ROI from different conservation practices. Importantly, some of the conservation practices noted above to have a high degree of certainty in the evidence base and the ecological impacts, including agroforestry and soil carbon amendments, were listed by farmers as practices with the lowest perceived ROI (Fiocco et al. 2024). A 2022 survey of farmers found as well that ROI analyses are gaps for producers when considering technology adoption and participation in carbon markets (Fiocco et al. 2022).

Specific Needs and Gaps in the Current Technical Assistance Systems

This section reviews the needs and gaps in expertise and TA capacity by production system. Because TA is most effective and efficient when the provider and the information being shared is specific to a producer's context, TA providers focus their expertise on specific production systems and the conservation practices and evidence base that are most relevant to them.

Needs by production system

This section focuses on specific TA needs within distinct types of production systems: row crops, specialty crops, grazing livestock, dairy livestock and other confined animals, agroforestry, and forestry with an eye toward emerging needs as climate change intensifies and risk, mitigation, and adaptation TA needs increase.

Table 2 summarizes the relative needs and gaps in key dimensions of the TA systems by production system. Note that the consensus across TA systems and production

Table 2. Relative needs and gaps in TA systems by production system

Production system	Dominant TA provider	Overall capacity	Evidence base	Educational pipeline	Geographic distribution	Expertise in emerging practices
Field crops	Formal, private	✓	—	✓	✓	—
Specialty crops	Formal, public	—	—	—	—	—
Grazing land	Semi-formal	—	—	—	✓	—
Confined animals	Formal, public	✓	—	✓	—	—
Agroforestry	Formal, public	—	✓	✗	✗	✓
Forestry	Formal, private	—	✓	—	✗	✓

✓ = **Adequate** — = **Moderate** ✗ = **Inadequate**

systems is that there is not enough TA capacity to meet producer demand and conservation. Thus, the rating presented in Table 2 is relative to other production systems, not a benchmarking against an absolute 'gold standard' for what is adequate. For example, as shown in Table 1 and Figure 5, there is more formal TA capacity for field crops compared to other productions systems, and thus the capacity is considered relatively adequate.

Field crops

Field crop systems (including row crops for human food and animal feed, and some vegetables) make up the second largest use of agricultural land in the US (313 million acres are in cropland, second only to 430 million acres pastureland (NASS 2024)) and corn and soybeans alone account for 25% of total US agricultural sales (NASS 2024).


PRESTON KERES, USDA

The row crop systems of the US Midwest and Southeast thus have been a test bed of sorts for many federal conservation practices and programs. Cover cropping and reduced or no tillage are the most common conservation practices used in row crop systems, and are incentivized by conservation programs of Title II, but also by the Conservation Compliance[10] requirements that set soil erosion standards to maintain access to other Farm Bill programs like crop insurance (Claassen 2012). However, despite the observation that row crop systems have become increasingly homogenous over the past several decades, or perhaps because of this observation, row crop systems have a strong need for TA that emphasizes diversification to improve resilience. Decisions about annual versus perennial cover crops (Park et al. 2023), the type of seed mix used (Gutknecht et al. 2023), the row crop species themselves that can be intercropped, and how these decisions differ depending on whether a cover crop is following corn or soy – all of these and more opportunities for diversification will require TA that understands how to achieve healthy soil in different geographic locations and soil types, and under a range of production systems (Midwest Row Crop Collaborative's guiding principles (MRCC 2024)).

10 Conservation Compliance requires that producers agree to "maintain a minimum level of conservation on highly erodible land and not to convert wetlands to crop production" (Stubbs 2016). Many producers meet this requirement by using reduced tillage and cover crops.

» **GEOGRAPHY:** Field crop systems exist across the country but are most concentrated in the Midwest, West, and Southeast. Field crop system TA and resources come from the extension and university research of these states, as well as from the private sector. States with smaller areas in field crops or in which the field crops grown are less dominant commodities could be lacking in TA, but assessing true capacity by geography is difficult. For example, there are 16 TSPs on the registry in Nebraska who are certified in cover crops, compared to only 6 in Colorado. Whether this coverage is proportional to the potential need and demand by producers is challenging to assess through available data.

» **TYPES OF TA PROVIDERS:** The types of TA available for field crop systems are abundant, reflecting the diversity in field crop systems. TA providers come from the formal government and private-sector actors, as well as semi-formal and informal organizations. Row crop producers often see CCAs and other private-sector formal TA providers as trusted sources of information (Eanes et al. 2017). Increasing opportunities are available for CCAs to build their capacity to support conservation practices through continuing education and other training in topics like organic production, integrated pest management, and intercropping (Green et al. 2021). For other types of field crops, like pulses and legumes, regional resources like cooperative extension and checkoff groups provide agronomic support for these less common crops (NPGA 2024).

» **EMERGING PRACTICES OR TECHNOLOGIES:** The emerging practices or technologies available to row cropping system include precision agriculture techniques such as an auto-steer and guidance system that track and visualize the position of farm equipment, re-carbonizing row crop farms, livestock and row crop integration, autonomous tractors, pivot systems with global positioning system (GPS) technology, water limited ag systems, and artificial intelligence (AI) used for pest identification (Becker 2024; Wright 2020). Affordable robotic solutions are being adopted to cope with seasonal variation in cover crop management as more row crop producers show interest in cover cropping and other regenerative methods (Cerrato et al. 2023). Adoption of such technologies is correlated with the size of the operation (McFadden and Njuki 2023; Kasemi, Lammer, and Vincze 2022). As the population of farmers is getting older, the worker pool getting more expensive, and crop yields are declining, the use of AI and robotics can provide some solutions to the problems faced in agriculture today (Becker 2024). Some of the main

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barriers that keep farmers from implementing new technologies are data protection and incompatibility between hardware and software. Another significant barrier is cost, resulting in many large-scale farmers ending up adopting more than small scale farmers (Kasemi, Lammer, and Vincze 2022).

Specialty crops

Specialty crops make up a third of US crop production sales and are grouped as fruits; some vegetables; tree nuts; honey; hops; maple syrup; mushrooms; culinary herbs and spices; medicinal plants; nursery crops (including Christmas trees); and floriculture (Astill, Perez, and Thornsbury 2020). Specialty crop systems are highly heterogeneous and require TA attuned to specific species, climates, and economic pressures.


PEGGY KREB, USDA

The diversity of specialty crop systems and their vulnerability to climate hazards has led to FA programs focused more on risk than on conservation (Raszap Skorbiansky, Thornsbury, and Effland 2022), and limited opportunities currently exist for accessing Title II funds for specialty crop producers. However, opportunities to enhance and expand CPS for specialty crops can draw on the evidence base built by the Specialty Crops Research Initiative (SCRI) of the USDA (Bass 2023). The SCRI aims to address the critical needs of the specialty crop industry by awarding grants that support TA, research, and extension (USDA NIFA 2024).

The geographical distribution of specialty crops across the US is continuously being affected by extreme and changing climates; regions that might have excelled in one specialty crop might now need to adapt to new production practices, varieties, or species due to climate conditions (Ahmed and Stepp 2016; Kistner et al. 2018; Parker et al. 2022; D. Johnson et al. 2023). Increased pest and weed pressures combined with increased temperatures and extreme weather events are especially challenging for specialty crop systems (Kistner et al. 2018). Some producers are shifting to tunnel production to address both pest and temperature pressures, while others are selecting varieties with different flowering and fruiting timing to take advantage of longer growing seasons or to decrease pest pressures (McDermott 2024; Kistner et al. 2018; Houston et al. 2018). Private TA providers might focus on varietal selection or specific technologies like high tunnels, which are often highly specific to a given species or geography.

» **GEOGRAPHY:** Specialty crops are cultivated nationwide, though most species are found only in certain geographies. Some states have specialty crop TA through CDs (see for example California's specialty crop TA hubs (CARCD 2020)). As shown in Table 1, few horticultural specialists are certified in the US and over half of the states have no certified horticultural capacity (ASHS 2024).

» **TYPES OF TA PROVIDERS:** Because mitigating risk has been focused on more than on conservation in many specialty crop systems, TA providers tend to come from either cooperative extension or specific parts of the federal government not directly associated with NRCS and Farm Bill programs (Raszap Skorbiansky, Thornsbury, and Effland 2022). The Technical Assistance for Specialty Crops program of the USDA Foreign Agriculture Service includes annual funding opportunities for TA to address sanitary and technical barriers that involve the export of US specialty crops (FAS 2024). AMS administers the Specialty Crop Block Grant Program, a competitive grant program that funds market research, market promotion, and new technology projects that benefit specialty crop producers (AMS 2024c). Strong support is present for this formal, public TA to continue (SCFBA 2023).

» **EMERGING PRACTICES OR TECHNOLOGIES:** Consumer demand for year-round fresh produce challenges the specialty crop market to think about innovation in storage, labor, and sensitivity to extreme and unpredictable weather. Automation and mechanization within specialty crop systems have been emerging technologies funded by the USDA for the past ~15 years (Astill, Perez, and Thornsbury 2020). Specialty crops are more dependent on laborers for production, harvest, and processing; consequently, interest is growing in technology that reduces human labor demands, including adjustable trellis systems for easier harvesting of berries or mechanical thinners and pruners for vineyards and orchards (Astill 2020). Pairing renewable energy and specialty crop production (known as agrivoltaics) is also an emerging area of interest across the country (USDA Climate Hubs 2024b). TA providers with crop-specific expertise in pest management (Warneke et al. 2021) and precision technologies (Pitla et al. 2020) can also help specialty crop producers make whole-system changes that allow for the implementation of additional conservation practices. Outside of the context of NRCS conservation practices, many opportunities are emerging in specialty crop value chains to reduce waste and improve producer livelihoods through the application of value-added technology (Rodriguez Izaba et al. 2023; Astill, Perez, and Thornsbury 2020). Although these are not practices used directly on working lands, specialty crops supply chains are often short enough that it is producers undertaking value-added activities who can decrease the overall footprint of the product.

> Consumer demand for year-round fresh produce challenges the specialty crop market to think about innovation in storage, labor, and sensitivity to extreme and unpredictable weather.

PEGGY KREB, USDA

Grazing lands

On grazing lands, mostly in the arid western US, the evidence base for the ecological impacts of conservation practices takes decades to build because of the slow pace of change in key metrics like soil carbon and native plant and animal species. Currently, many information and evidence gaps exist that limit TA for grazing management (Briske et al. 2017). For example, the carbon sequestration potential of soils in the arid West is difficult to assess or measure over timescales that align with market incentives (Bell et al. 2023; Stanley et al. 2023). In addition, NRCS and other public agencies with a stake in grazing lands (mostly the Bureau of Land Management and the Forest Service) have conflicting orientations toward prescribed fire (Augustine et al. 2021; Wilbur et al. 2021; Olsovsky, Strong, and Berthold 2021), virtual fencing (Horn and Isselstein 2022), and the role of native and non-native species in landscape-scale processes (Maher et al. 2023; Augustine et al. 2021). Emerging technologies like virtual fencing, which NRCS intends to add to practice standards in 2025, have potential for widescale use, but few TA providers are currently able to support producers in planning and implementing grazing practices that use them due to the fencing system's high cost, presenting a barrier for adoption (Golinski et al. 2022).

An additional need in grazing lands, much like in forest and agroforestry systems, is for increased coordination among federal agencies, as well as between federal TA providers and private landowners and managers. The Grazing Lands Conservation Initiative

(GLCI) is one example of a collaborative approach to supporting conservation on grazing lands. GLCI has had a budget line item in the Farm Bill since the 1990s, which was defunded and then reinstated in the late 2000s (Turner 2022). Funding remains lower than in the past, however, which limits the TA and FA that can be provided to support conservation practices on grazing lands.

» **GEOGRAPHY:** Grazing lands dominate the Western and Plains regions of the US, so most of the research and programs available are in these regions. However, cattle grazing integration in cropping systems is a growing research interest and strength in the Southeast as well (Wright 2022).

» **TYPES OF TA PROVIDERS:** GLCI awards cooperative agreements for conservation practices on grazing lands and other TA for livestock producers (NRCS 2023a). As of 2023, these federal funds supported $20 million for 49 cooperative agreements. Other formal providers include the National Grazing Lands Coalition, cooperative extension, and CDs (Rosenberg and Wallander 2022). Many ranchers rely on private grazing and rangeland consultants as well; however, current disconnects exist between the long-term management information and tools provided by the federal government, cooperative extension, and private grazing consultants (Briske et al. 2017).

» **EMERGING PRACTICES OR TECHNOLOGIES:** The Rangeland Analysis Platform (RAP) is the key platform that provides a view of vegetation annual percent cover maps and depicts changes in vegetation over time (Randall 2018). Grass-Cast is another program that uses satellite data to provide information for ranchers in the northern Great Plains on estimated total plant production based on current weather predictions, providing ranchers with access to data-driven decision making for drought decisions, annual pasture stocking rates, and grazing rotations (Stephenson 2019). Precision livestock farming technologies like virtual fencing (a solar powered, GPS enabled livestock necklace that enables the producer to draw a virtual fence anywhere) can enhance animal welfare while increasing control on livestock (Aquilani et al. 2022).

Confined animals

Confined animal systems for meat, dairy, and eggs, are highly managed, with an emerging focus on sensors, remote monitoring, and data analysis for decision-making support (MassChallenge 2023; Tedeschi, Greenwood, and Halachmi 2021). Many conservation practices in dairy and confined livestock systems, both CPSs and those invested in through carbon market projects, focus on manure management to reduce methane emissions from anaerobic decomposition (Happ 2024). For example, the longstanding AgSTAR program, jointly administered by the US Environmental Protection Agency (EPA) and the USDA, provides FA and TA to install anaerobic digesters for biogas recovery (EPA 2014). The recently announced Global Methane Pledge (launched at COP26 in 2021) highlights the food and agriculture system as one of three pathways for methane reduction (Global Methane Pledge 2024). Building on

this general pledge, actors across confined animal supply chains have shown interest in monitoring and measuring methane emissions. The Dairy Methane Action Alliance, for example, includes many large consumer package goods companies, and is supported by the Environmental Defense Fund with TA provided by Ceres (EDF 2023).

Recent global assessments find that the majority of GHG emissions in livestock systems come not from manure but from enteric fermentation (UNEP 2021). Some relatively common CPSs like pasture and hayland planting have the potential to decrease the digestion burden on livestock and thus the enteric methane emissions (Happ 2024). Confined animal operations also have been shown to impact nutrient cycling in the soil, water, and air (Long et al. 2018; Hribar and Schultz 2010; Bist et al. 2023). The social concept of 'manuresheds,' which define a landscape within which nutrients are flowing from animals back to croplands (Spiegal et al. 2020), is a coordination and collaboration among TA providers to ensure that the application of nutrients in manure do not undermine conservation goals associated with soil emissions, water equality, etc.

One specific and emerging need in confined livestock systems is TA to support producers in addressing contamination from per- and polyfluoroalkyl substances (PFAS). PFAS are present in municipal waste and for decades, producers used that waste as fertilizer on pasture and crop lands. However, soils and waters are now

DEPOSITPHOTOS.COM

Much of the livestock sector is managed through highly consolidated supply chains, and TA is often provided by the contracting firms as well as the commodity groups that advocate for various parts of the supply chain.

contaminated from this practice. Producers need TA to help them develop management and conservation plans that can rehabilitate soils (Drecker-Waxman, Greco, and Findley 2023). TA will also be needed to support producers in accessing the federal funds set aside through USDA programs to compensate them for dairy losses and to remediate pasture soils (CEQ 2023).

» **GEOGRAPHY:** Finishing feed lots for beef and pork exist across the country but are most prevalent in the Midwest and California. Poultry production is concentrated in the Southeast. Dairy production is concentrated in the upper Midwest, the Northeast, and pockets of California and the West.

» **TYPES OF TA PROVIDERS:** Much of the livestock sector is managed through highly consolidated supply chains, and TA is often provided by contracting firms as well as the commodity groups that advocate for various parts of the supply chain. However, substantial Title II funds go to manure management projects with TA provided by the formal system (Happ 2024). EPA staff and contracted organizations provide most of the TA for the AgSTAR, including through the AgSTAR partner program (which includes state government, universities, and NGOs).

» **EMERGING PRACTICES OR TECHNOLOGIES:** Manuresheds introduce a way of advancing nutrient cycling in agriculture so that surplus manure nutrients can be transported for use on nutrient-deficient croplands (Spiegal et al. 2020). Livestock waste to bioenergy generation opportunities are available but have yet to reach the scale of the larger operations (Cantrell et al. 2008). On the enteric emissions side, feed additives are still largely in the research phase (Palangi and Lackner 2022; Kelly and Kebreab 2023; Tseten et al. 2022), as are vaccines to limit methane production (Baca-González et al. 2020).

Agroforestry

Agroforestry is the integration of trees into crop and livestock systems. This approach is being deployed across the globe as a strategy to engage across stakeholders and to enhance productivity, profitability, and environmental stewardship of agricultural operations across the US (Patel-Weynand, Bentrup, and Schoeneberger 2017; Ramil Brick et al. 2022). In the US, the 2022 Census of Agriculture found that overall use of agroforestry practices increased by 6% from 2017 to 2022 (NAC 2024a). Within the federal government, agroforestry sits at an ambiguous intersection between forestry (NAC sits within the US Forest Service) and agriculture (several of the most common conservation practices are agroforestry practices (Lu et al. 2022)). In the private sector, agroforestry is seen as both multifunctional conservation practices and a pathway to carbon credits for the voluntary market (TNC 2023; ASD 2024).


SUSAN BOYER, USDA

The evidence base for the conservation impacts of agroforestry is agreed to be strong (Hastings Silao et al. 2023; Buma et al. 2024). However, the overwhelming consensus is that more FA and TA is needed to support agroforestry systems (Wilson and Lovell 2016), and a recent coalition of NGOs has been advocating for increased federal funding for regional research and TA centers (Carbon180 2023). More individuals trained in integrated and holistic planning that incorporates trees into crop and grazing lands, more communication about the evidence base showing co-benefits of agroforestry practices, and increased flexibility in who can provide agroforestry TA that supports accessing NRCS conservation funds is needed (Swenson 2022; M. M. Smith et al. 2022; Zinngrebe et al. 2020).

» **GEOGRAPHY:** Because agroforestry always intersects with another agricultural sector, it can be implemented on farms and ranches across the country. Agroforestry is most used in places where drought or erosion occurs (Ortolani 2017). However, with five main practices – silvopasture, windbreaks, riparian forest buffers, alley cropping, and forest farming – producers implement agroforestry in highly dynamic and diverse ways across ecosystems.

» **TYPES OF TA PROVIDERS:** Due to the diversity of practices and productions systems in which producers implement agroforestry, formal and semi-formal TA providers tend to focus geographically, with several organizations working in the Midwest and Appalachia.

Formal TA tends to come from NRCS or NAC staff, as well as CDs. A few cooperative agreements and TSP providers like the Savanna Institute round out the formal sector. Private sector interest and investment is also growing, and the firms (like Propagate) that broker this investment often provide TA as well (Levesque 2023).

» **EMERGING PRACTICES OR TECHNOLOGIES:** Geospatial technology used in agroforestry can provide insights into agroforestry decision making and policy – geospatial technology includes spatial extent mapping, production of tree species spectral signature, carbon sequestration assessment, and suitability mapping (Sharma et al. 2023). A review of current studies shows that continued research in real time, spatial, and temporal measurements could benefit the industry and its applications (Ramil Brick et al. 2022).

Forestry

Forest management and associated conservation practices are well-established in the US and have a clear network of TA professionals through NRCS who support forest landowners in developing and implementing management plans. However, these activities are not always well-aligned with existing sources of FA for conservation practices, especially those from NRCS. For example, state foresters and private foresters provide the majority of support to private forest landowners, but state foresters must be approved as TSPs to provide TA to support forest landowners in accessing NRCS TA (R Smith and Normile 2021). USFS Cooperative Forestry Unit provides private landowners TA and FA to implement conservation practices included in the Farm Bill (Riddle 2023). One specific challenge for TA providers looking to support producers in accessing NRCS or USFS resources is that the qualifications for employment or TA status often require a degree in forestry. However, as shown in Figure 7, relatively few forestry departments are providing four-year degrees in the US given the amount of forested land. Interdisciplinary degree programs, many of which require a certain number of classes in common forestry practices, could provide an individual with adequate knowledge to provide TA for forest conservation practices.

USDA

» **GEOGRAPHY:** Private non-commercial forests are most common in the eastern half of the US, especially along both sides of the Appalachian front, the Piedmont of the southeast, the Ozark Plateau, and the upper Midwest (USFS 2020). Land tenure and lack of active management on forest lands are also challenges that require specific TA expertise. Forty-four percent of family forestlands (approximately 117 million acres) are controlled by absentee owners who do not reside on their forestland, though many of them do invest in management (Hewes, Butler, and Liknes 2017; Snyder et al. 2020; R Smith and Normile 2021).

» **TYPES OF TA PROVIDERS:** As shown in Table 1, there is limited TA capacity in the USFS Cooperative Forestry Unit. Some NRCS and CD staff, as well as State Forestry Agencies, also provide TA. However, many private forest owners interested in conservation-oriented management turn to private consultants to provide TA that better aligns with their priorities as small non-commercial landowners (vonHedemann and Schultz 2021).

» **EMERGING PRACTICES OR TECHNOLOGIES:** Forests across much of the US are experiencing pest and wildfire pressures as temperatures increase, and private forest owners need TA to create forest management plans that balance forest health with carbon benefits (Janowiak 2022; Northwest Climate Hub 2024). Advanced technology for harvesting machines, the increased use of biomass for energy, and advanced building products are all ways forestry technology is evolving to support conservation priorities (McEwan et al. 2020). 'Smart forests' are increasingly using technology for data collection, processing, and analysis, including drones and unmanned ariel vehicles (UAVs), remote sensors, light detection and ranging (LIDAR), and AI technology to process data (Gabrys 2020; Guimarães et al. 2020).

USDA NRCS

Cross-cutting needs

In addition to TA needs that are specific to each production system, several cross-cutting needs are applicable to many production and geographic contexts. Knowledge of decision-support tools, business planning, and market opportunities are all elements of TA that could enhance the efficacy and utility of TA for conservation practices.

Decision-support tools

Given the complex and holistic nature of decision-making within many operations, data and tools that interpret that data in an integrated framework to highlight tradeoffs can support producers and TA providers in the conservation design process (Epanchin-Niell et al. 2022). Decision-support tools are becoming increasingly common for conservation practice planning and design (Terribile et al. 2015; Pranay Ranjan et al. 2019). However, many TA providers are no more familiar with these tools than producers themselves. Critiques have been made that NRCS data and associated planning models are not made available to TSPs in the same way that they are to NRCS staff and other partners (Keith Campbell Foundation 2023). Little research or training has been done with NRCS staff and other TA providers in the utility and applicability of decision-support tools (P. Ranjan et al. 2020).

Business management

Many elements of business and financial management relate directly to decisions about implementing conservation practices. TA providers need to enhance their capacity to support producers in making those decisions related to the ROI of conservation practices. For example, producers need support and structure to assess the short- and long-term costs and benefits of implementing a conservation practice (R Smith and Normile 2021; Piñeiro et al. 2020). The long-term benefits are more challenging to value but should be considered in the context of a bottom line to ensure that producers are not undervaluing the potential outcomes of conservation practices. One study found that producers tend to drop practices in conservation plans and contracts that do not show a clear private benefit (Wallander et al. 2019). Without tools and frameworks that help explain the short- and long-term costs and benefits of conservation planning and practice implementation, practices will continue to be dropped and conservation benefits lost (Boyd, Epanchin-Niell, and Siikamaki 2015). Producers also need support in understanding how crop insurance can be an affordable and supportive tool to enhance conservation practice adoption rather than an alternative to adoption (Fleckenstein et al. 2020). Finally, especially in production systems where land tenure can create challenges to adopting conservation practices, TA expertise in navigating land sales and consolidation could enhance access to conservation practice FA in the future (Openlands 2024).

Navigating market opportunities

Downstream of conservation practice implementation is the need for the long-term financial sustainability of practices, ideally by identifying a market that values the additional cost and effort undertaken by a producer for practice implementation. These markets could be for the raw materials for more producers to implement conservation practices (like tree seedlings for agroforestry or cover crop seed mixes) (Swenson 2022). They could also be markets for the ecosystem services created by the conservation practices (e.g., carbon credits, water quality credits, and biodiversity credits (Tamburini et al. 2020; Wittwer et al. 2021)). Market opportunities that add value to the agricultural or forestry commodity itself are still in development, but some labeling schemes – those that use statements like 'climate friendly,' 'bird friendly,' and 'pollinator friendly' – highlight and market the conservation practices that were a part of production (Lin and Nayga 2022; Carlsson et al. 2022). Many commodity programs provide this type of marketing support, including for marketing products and credits associated with conservation and climate-friendly practices. For example, US Dairy, the dairy checkoff program, leads the US Dairy Net-Zero Initiative, which focuses on providing TA for practices and on market communication and expansion for sustainably produced dairy products (US Dairy 2024).

MARY ASHBY, USDA

Emerging and Innovative TA Programs and Practices

Both within the federal government and beyond, many of the limitations and challenges of the current TA system for conservation practices on working lands are being addressed through innovative programs and practices. This section highlights several new initiatives announced by the federal government in 2023 and 2024 and provides an example of approaches to TA being invested in outside of the federal system.

New federal investments

Over the past two years, the federal government has announced a series of new and innovative programs aimed to increase the adoption of conservation practices on working lands that have climate change mitigation and adaptation benefits for producers and the public. These include the Working Lands Climate Corps (WLCC) (part of the American Climate Corps (ACC), which also includes the Forest Corps focused on public lands forests, announced by the White House in 2023), the Partnerships for Climate-Smart Commodities Program (PCSC) (announced in 2021 and initiated in 2022), and a commitment to develop a registry of TA providers for voluntary carbon markets (announced in 2024). In addition, a bipartisan bill currently in Congress (the Increased TSP Access Act) aims to address some of the bottlenecks for TSPs as well as several other specific options to enhance TA opportunities that are ready to be implemented.

Working Lands Climate Corps (WLCC)

In 2023, the Biden Administration announced the ACC as a new, multipronged AmeriCorps program. The overall purpose of the program is consistent with existing AmeriCorps programs that provide workforce development opportunities to volunteers, bring capacity to underserved communities, and enhance the implementation and efficacy of programs that increase community resilience and wellbeing (The White House 2023a). In early 2024, the White House announced the WLCC program, which will be implemented by the USDA and will specifically focus on climate-smart agriculture and forestry (USDA 2024a). Both the overall goal of the ACC and the specific framing of the WLCC is that the job training and experience the corps volunteers receive will help track them into careers in the USDA (including streamlined or preferential hiring

into federal service (The White House 2023a)). WLCC volunteers will be placed with public and non-profit organizations that apply to host and will be supported through training and ongoing professional development opportunities provided by the National Association of Conservation Districts (NACD) (USDA 2024a).

The WLCC can provide volunteers with hands-on training and experience integral to effective TA. Volunteers will not be required to have any specific education or experience coming into the program, which can enhance equitable opportunities to participate and can create space to value many types of expertise. Creating on-ramps for WLCC volunteers into federal employment at the end of their service could bolster the NRCS workforce (although the numbers will be small compared to the overall number of NRCS employees and TA providers, and it will take time for the first cohorts of volunteers to make that professional transition) and expand the diversity of credentials held by NRCS employees who provide TA. The inclusivity of the WLCC process (in terms of required credentials, types of placements, and hands-on opportunities) stands in contrast to the requirements for TSPs and other third-party providers, which may create barriers to WLCC volunteers who wish to bring their experience to other types of settings outside of the federal government. While they might have an expedited path to federal employment, many will likely not be approved as individual TSPs or staff of TA providing organizations when their WLCC service is complete because they lack specific degrees and certifications required of third-party TA providers (but not necessarily of NRCS staff, for whom a combination of coursework and experience can substitute for a specific agriculture-related degree). Given the growing role of non-profits and the private sector in supporting conservation practices on working lands, ensuring that the training and experience provided by WLCC can translate into TA positions in a variety of sectors is key.


LANCE CHEUNG, USDA

Partnerships for Climate-Smart Commodities (PCSC) Program

USDA announced the PCSC Program in late 2021 and began making awards in early 2022. The program is providing $3.1 billion over five years from the Commodity Credit Corporation to 140 projects across the country to help build climate-smart agriculture and forestry products markets, which implement and sustain conservation practices that provide climate change mitigation benefits (USDA 2024b). From the producers'

standpoint, the program is similar to participating in Farm Bill conservation programs because the eligible practices generally reflect a current NRCS CPS, although some practices without a CPS have been approved, and the structure of producer incentive payments similarly shares in the cost of practice design and implementation between the project and the producer (incentive payments are structured in many ways, including on a per acre or per practice basis, and might or might not cover the full cost of practice implementation). However, the focus of the PCSC is to quantify the climate change mitigation benefits of conservation practices (enhancing GHG sinks or reducing GHG sources) and to build market pathways that place a monetary value on those benefits. The goal is to jumpstart a market for climate-smart products that will provide consistent financial returns to producers who choose to invest time and resources in implementing conservation practices on working lands.

The PCSC has been critiqued from many angles in its first two years of existence. For example, some critiques maintain that the investment is an overreach or inappropriate use of Commodity Credit Corporation funds, though the GAO found these concerns to be unfounded legislatively (GAO 2023). In addition, concerns have been raised regarding the evidence base that underlies NRCS CPS' and whether all of the conservation practices included in the PCSC do in fact have climate change mitigation benefits (Schechinger 2024). Project partners have raised concerns that the amount of FA and associated TA required to implement PCSC projects will amplify scarcity and competition for TA providers, especially in geographies with many PCSC projects and/or a lack of TA providers for specific types of practices (anonymous personal communication). In addition, much like the WLCC, TA providers for PCSC projects are not required to meet NRCS TSP requirements, because they are not being reimbursed through the cost-share mechanisms required by the Farm Bill conservation programs. The capacity and experience being built by TA providers in PCSC projects could create similar challenges to those of WLCC members, who will have experience in the field but not necessarily the required credentials to support producers in accessing traditional NRCS FA for conservation practices as approved as TSPs in the future (anonymous personal communication).

Greenhouse Gas Technical Assistance Provider and Third-Party Verifier Program

In February 2024, the USDA announced that the Department will establish a Greenhouse Gas Technical Assistance Provider and Third-Party Verifier Program, with the goal of supporting producers in accessing voluntary carbon markets. The authorization for a registry of qualified TA providers, verifiers, and protocols is in the GCSA of 2022 (included in the Consolidated Appropriations Act of 2023). Concurrently, the USDA undertook an assessment of agriculture and forestry in US carbon markets (USDA 2023a) to identify the most impactful pathways for implementing the mandates of the GCSA. The study identified challenges for producers in navigating carbon market opportunities. The announcement in early 2024 that the USDA will

establish a registry for TA providers in the voluntary carbon market highlights the fact that the federal government does not have the authority to establish a carbon market but can play a role in supporting transparency and equity for producers when accessing and receiving benefits from carbon markets (USDA 2024d). The process to establish a registry will require setting guidelines for 'what counts' as qualified TA, and this process could inform updates to the NRCS TSP requirements. In particular, the recommendation for the NRCS process of shifting from a credential-oriented approval framework to an outcomes-oriented one (Keith Campbell Foundation 2023) will likely be a key starting point for the new GHG TA registry and could provide a blueprint for shifting NRCS approval frameworks.

SUSTAINS Act Public-Private Partnerships for Conservation

The Consolidated Appropriations Act of 2023 also included the SUSTAINS Act, which authorized USDA to accept private donations for conservation programs (G. Thompson 2022). USDA announced in February 2024 that it will begin a consultation process with stakeholders to determine how to implement the provisions of the SUSTAINS Act. A key question in the implementation process is whether private funds will be used to pay or reimburse for the TA required to access current Farm Bill conservation programs, and if so, what requirements will be placed on TA providers. Notably, the law does not significantly expand current authorities to accept donations or enter into partnership agreements that could utilize private funds.

New approaches across TA systems

Beyond the specifics of TA required to access federal Farm Bill FA, many new and innovative approaches are emerging to provide TA to support producers to implement conservation practices on working lands. This section highlights a few emerging strategies of note.


LANCE CHEUNG, USDA

Leveraging technology to enhance technical assistance

Leveraging technology can help increase access to information and TA for producers interested in conservation practice implementation, including using data and decision-support tools to enhance conservation planning and taking advantage of virtual technologies. Three decades ago, the emerging role for computer technology in TA for agriculture was described to enhance and manifest the "collective memory" that exists in all agricultural research and practice (Holt and Sonka 1995). In the past, TA phone hotlines like

the National Center for Appropriate Technology's 'Ask an Ag Expert' were a key source of information for producers across the country (NCAT 2024). Over the past decade, additional virtual options including computer-based 'chatting,' email, and other information and communication technologies have expanded opportunities for producers to seek information from TA providers and in many cases from peers (Walter et al. 2017). Similarly, mobile technologies for information delivery have been leveraged in developing countries by the US government and many other development organizations (Gray et al. 2018). These virtual communication tools have the potential to build, expand, and sustain agricultural communities of practice in ways that increase access to knowledge, expertise, and support for producers and TA providers (for one example, see Materia, Giarè, and Klerkx 2015). Access to adequate internet and cell phone reception remains a barrier in many rural communities in the US, and the USDA is investing in rural broadband to support access to many types of information, including informal TA resources for producers (USDA 2023c).

As described earlier in this report, many opportunities exist to enhance the knowledge translation of the evidence base for conservation practice implementation by building data products and decision-support tools that are accessible to TA providers and producers during the planning and design process (Pranay Ranjan et al. 2019; P. Ranjan et al. 2020; McConnell and Burger 2011). However, data from public agencies is not always available to TA providers or producers in formats that are approachable or applicable, and decision-support tools struggle to balance detail with usability (Keith Campbell Foundation 2023; Rosenstock et al. 2024). Tools that are focused on specific geographies and production systems and are contextualized in local knowledge are seen are most useful and applicable to producers (Bodrud-Doza et al. 2023; Schwartz et al. 2018; Roesch-McNally et al. 2021). For example, RAP was developed in the Northern Great Plains with the goal of creating a 'spatially comprehensive' visualization platform showing rangeland vegetation to link management decisions to outcomes (Jones et al. 2020). The format and presentation of data on RAP was ground-truthed and adapted for use with ranchers and land managers over ten years, and the USDA recently announced that ARS has taken over management and further development to expand coverage and add metrics (ARS 2024).

> Tools that are focused on specific geographies and production systems and are contextualized in local knowledge are seen are most useful and applicable to producers.

Place-based and peer-to-peer learning is crucial to facilitate and sustain practice adoption

A key finding in this report and in the evidence base about the strengths of the federal TA system, what makes effective TA, and the utility of emerging programs and technologies, is that the information and evidence base that underlies conservation practices on working lands is best communicated in ways and by individuals with a stake in the game. TA providers, and the knowledge and tools they bring to the table, need to be place-based and production-system specific. At their best, the local NRCS and CDs offices along with local cooperative extension agents can build relationships with producers to provide consistent TA in ways that are appropriate to the local context. Increasingly, producer cooperatives are hiring and providing their own TA that both meets NRCS requirements and supports the specific goals and values of the cooperative (Eckelkamp 2024). Several recent projects in Europe are also piloting the use of more structured peer-to-peer learning networks that connect producers to peer-mentors to learn about new conservation technologies and techniques (Elphick 2020; Materia, Giarè, and Klerkx 2015). Place-based and peer-to-peer learning is especially important for individuals and communities that have been underserved or otherwise marginalized historically by dominant TA systems, as a source of trusted information and relationships.

BRANDON O'CONNOR, NRCS

Key Conclusions About the Current State of TA for Conservation Practices on Working Lands

This section synthesizes the literature reviewed in this report to highlight key conclusions and their implications for the TA system for conservation.

Conclusions and recommendations

1 **Thousands of qualified professionals are working across the TA system and their expertise could be more fully leveraged to support producers and conservation outcomes. At the same time, there are concerns about whether the workforce pipeline is up to the challenge given a steady increase in demand from producers. The capacity of the TA system can be enhanced by:**

- Aligning professional requirements and compensation for TA across all types of providers that receive NRCS cost-share reimbursement.
- Providing a path to TSP approval based on outcomes and performance in addition to credentials
- Utilizing the third-party licensing/approval option from the 2018 Farm Bill to enhance capacity to certify TSPs.
- Expanding cooperative agreements and AFAs to more partners with a focus on equity and expertise in underrepresented production systems and geographies.
- Improving the data and information sharing technologies and processes between TSPs and other TA providers and NRCS field offices.

2 **New and innovative federal conservation programs should be leveraged into pathways that can support long-term professional TA positions. For example, the following questions should be considered:**

- How will experience gained by PCSC TA providers be appropriately considered or incorporated into the formal TA system when the program is complete?
- Will a WLCC member be able to find a place in the formal TA system not limited to NRCS staff positions?

3 **The education and training pipeline is strong but should be expanded and enhanced to provide opportunities for appropriate training, including in ways that support providers within the informal TA system, to build skills related to conservation on working lands. This should include:**

- Ensuring that education and training opportunities from youth through post-secondary and continuing education reflect the current state of knowledge and information related to new and emerging conservation practices.
- Encouraging four-year institutions to maintain or expand forestry and rangeland education.
- Encouraging two-year institutions to expand and diversify degree offerings in production and conservation.
- Supporting HBCUs and Tribal colleges in expanding specialized programs related to range management, forestry, and agricultural engineering.

4 **Equitable access to TA services should be supported by investing in TA providers and systems that are embedded in local communities and production systems. Semi-formal and informal TA providers are especially well-positioned to enhance equity by:**

- Building trust with individuals and communities that have not historically been connected to the formal TA system and increasing access to FA for underserved producers for conservation practices.
- Providing contextually appropriate information and forms of communication, including focusing on reducing the logistical and bureaucratic challenges of navigating the formal TA system.

5 **Targeted investments in TA systems should focus on gaps in capacity that are specific to each production system. These include:**

- For field crops, enhanced expertise, and evidence for emerging and innovative practices, including diversification in conservation cover mixes and intercropping.
- For specialty crops, increased capacity for formal TA from the private sector.
- For grazing lands, increased capacity across the formal TA system.
- For confined animals, expanded evidence for existing and new conservation practices, including low-tech manure management to reduce costs.
- For agroforestry, enhanced educational pipeline and geographic distribution of TA providers.
- For forestry, expanded geography of TA providers.

6 **Supporting and enabling collaboration across TA systems maximizes the impact of FA, TA, and the evidence base for conservation practices. Each TA system has its strengths and weaknesses, and producers often seek multiple sources of information when making decisions, so collaboration should focus on:**

- Providing transparent and complete access to the evidence base for specific conversation practices to ensure accurate planning, design, and implementation of conservation practices.
- Identifying the most appropriate and impacts sources of FA for specific producers and production systems, including public funds, private investments, and market incentives.
- Empowering informal TA systems, comprised of producer-led organizations and networks, to share information and real-time learning with formal and semi-formal TA systems and vice versa.

Directions for future research

There are many challenges to fully assessing the current state of the TA systems that support producers to implement conservation practices on working lands. In this section we highlight a few key areas for further research that could provide specific and actionable information about which TA systems could be strengthened and improved.

1 **Assess the true unmet needs for TA for conservation practice implementation within specific production systems and geographies, and in what circumstances producers need TA that qualifies them to access federal assistance programs.**

- It is difficult to quantify whether any production system in any geography has truly adequate TA capacity and to define what 'adequate' means in an absolute sense. Producers and local TA providers are best positioned to reflect on these place- and system-specific needs.
- Recent work explores the necessary conditions for TA to be accessible and appropriate in different types of historically underserved communities. However, more investments need to be made in understanding when formal TA and access to federal funds are most helpful, and what role semi-formal TA can and should play when there are market incentives or other sources of funds to support practices implementation.
- Given their potential for climate change mitigation, adaptation, and other positive conservation outcomes, more exploration of the nuanced TA needs in field crop systems is needed.
- There are very few private TA providers in the formal TA system for grazing lands and agroforestry, and a focused exploration of the barriers and disincentives for building more formal TA capacity is needed.

2 **Further explore the relationship between the scientific evidence base, practices with a CPS, and TA provider capacity to support practice implementation.**

- An assessment, like the CEAP process or something similar, that can provide systematic information about whether and under what conditions CPSs and the FA behind them have a solid scientific evidence base would build confidence and trust of producers, TA providers, and the public.
- An assessment of new and innovative practices that have a solid evidence base that are not yet eligible for federal FA could provide an opportunity to innovative producers ('early adopter') to be supported by semi-formal and informal sources of funding and TA providers.
- Focused questions for TA providers about their capacity to draw from the evidence base that does exist and support effective conservation practice implementation could identify technological or educational needs to enhance effective implementation. One key question is whether capacity differs for new and emerging practices as compared to well-established practices.

3 **Explore whether and how the educational pipeline is preparing the next generation of TA providers.**

- This report provides numbers about the quantity of programs and disciplines in the current educational pipeline. However, further assessment of the quality and accessibility of current agriculture and natural resource programs would be helpful to identify changes that are needed to align training with contemporary TA and conservation needs. For example, one specific area of uncertainty is how many of the agriculture and natural resources programs offer a focus on conservation practices and/or adaptation to climate variability.
- Understanding the goals and intentions of students within agriculture and natural resources two-year and four-year degree programs could help to identify barriers or gaps between students' interest and their eventual career paths.
- Given the diversity of experience and training that is relevant and at times necessary to provide effective TA, it is important to understand how well the broader educational pipeline is providing skills and expertise that aligns with TA needs and opportunities. For example, it is difficult to ascertain from secondary data how well certificate and other non-degree programs are preparing new TA providers to begin their career paths, and how useful these programs are for existing TA providers to continue and diversity their training and expertise.

Conclusion

As more farmers, ranchers, and forest owners across the US seek to implement conservation practices, demand is increasing for an enhanced TA system which can meet their diverse needs, interests, and priorities. Conservation can play a key role in both climate change adaptation – to support resilient farm, ranch, and forest sectors in the face of increasing climate variability – and mitigation. This report focuses on a review of existing literature and information to provide a starting point to evaluate what is known about the state of the TA system that support farmers, ranchers, and forest owners in implementing conservation practices on working lands. We acknowledge that for elements of the TA system, information is more complex or less readily available than for others. The TA Accelerator project will build on the information captured in this report and solicit knowledge and insight from interest holders and individuals with direct experience, with the goal of generating a synthesis of existing knowledge that can be shared publicly to contribute to the national conversation around technical assistance for conservation.

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