



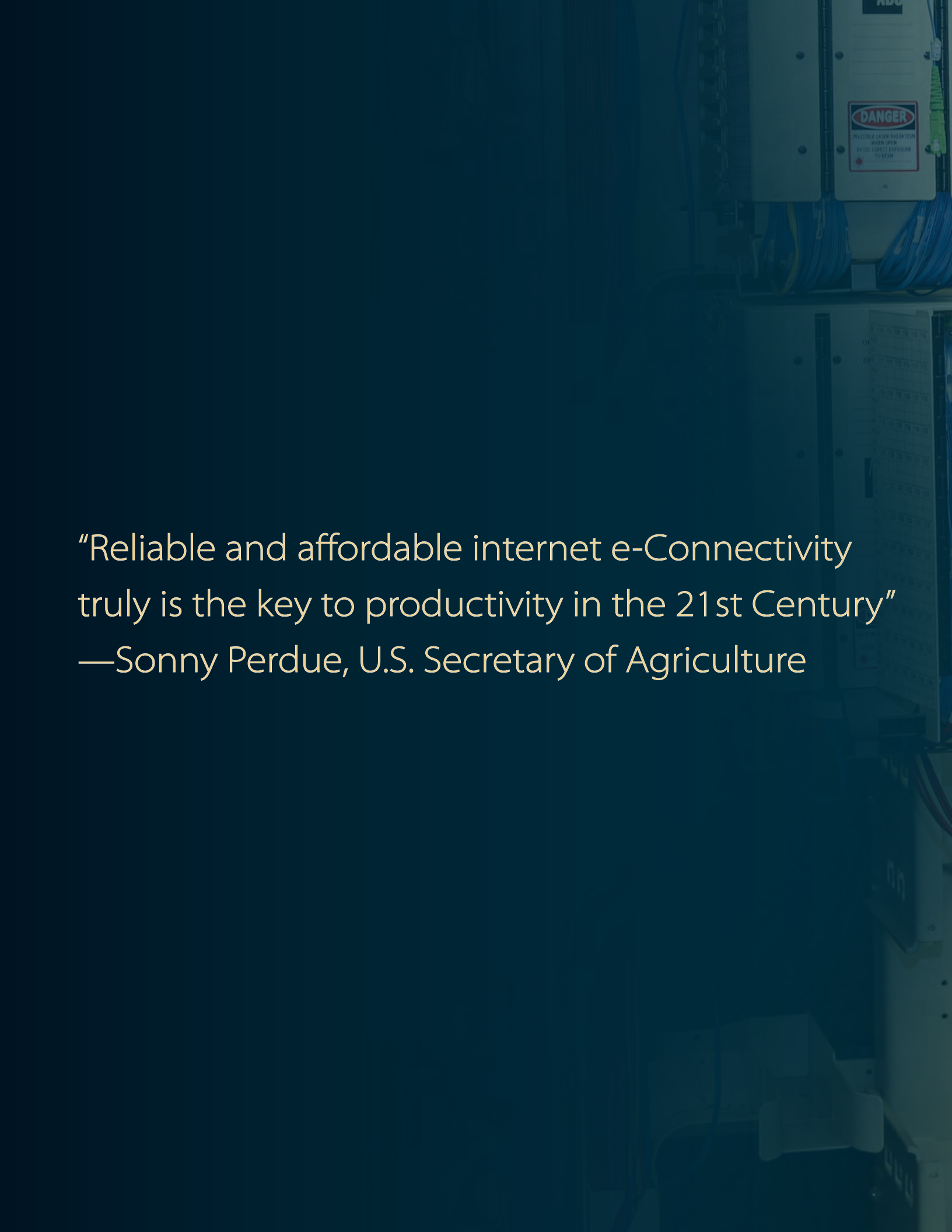
United States Department of Agriculture

e-Connectivity @ USDA

Broadband Resources for Rural America



Created by the USDA Rural Development Innovation Center



“Reliable and affordable internet e-Connectivity truly is the key to productivity in the 21st Century”
—Sonny Perdue, U.S. Secretary of Agriculture



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What Is e-Connectivity and Why Is It Important?

Reliable and affordable high-speed internet e-Connectivity, or electronic connectivity, is fundamental for economic activity throughout the U.S. It is the ability for all schoolchildren to have access to the best educational opportunities and for a community to offer the best health outcomes for its residents, at the lowest cost. It can stimulate job growth and innovative technologies leading to economic development. This is why USDA is prioritizing efforts and focusing programs on rural broadband expansion.



Rural broadband e-Connectivity is the digital superhighway for today and tomorrow. Just as rural electrification and the connection of rural telephone networks began to revolutionize the United States in the 1930s, we anticipate a significant transformation for rural America through e-Connectivity. In today's information-driven global economy, e-Connectivity is not simply an amenity. It is essential to safeguard America's economic competitiveness and give all citizens access to a world of opportunity. The economic benefits of e-Connectivity are significant not only for productivity but also education, healthcare, and public safety.

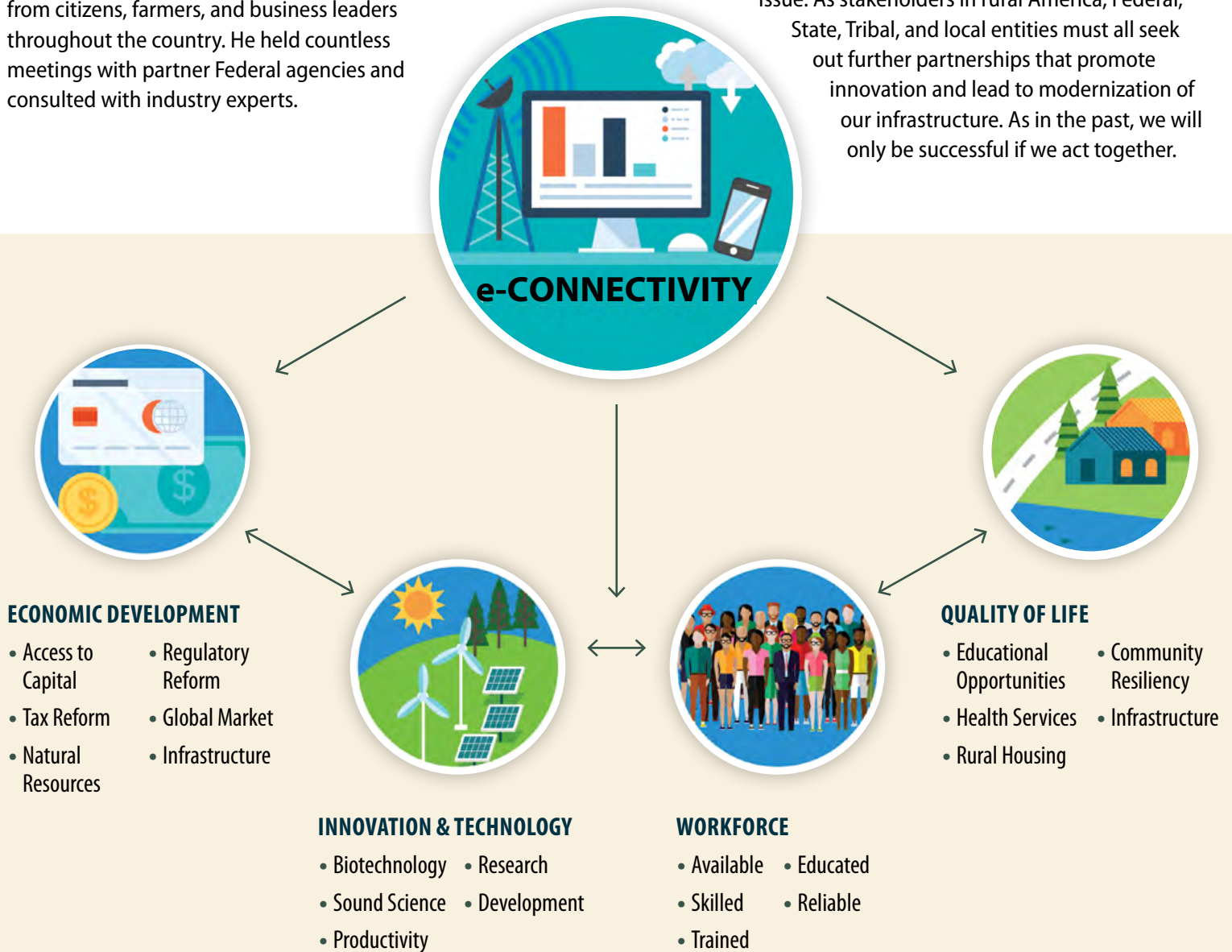
The challenge facing our country is connecting the 46 million people who live in rural America, which comprises roughly 72 percent of our land. A recent report from the Federal Communication Commission indicates that about 19 million of rural American households still lack reliable, affordable, high-speed internet. This absence of e-Connectivity prevents rural Americans from achieving the high quality of life that is considered the foundation of prosperity.

In contrast to their urban counterparts, rural Americans cannot reach full productivity in the workplace, obtain modern education at school, or access quality healthcare without e-Connectivity. Rural businesses rely upon an internet connection to process transactions, post job opportunities, as well as buy and sell products. Furthermore, to provide rural communities, organizations, and business with a skilled workforce, employees must have access to the specialized trainings and professional development resources found online. Without a connection at home, rural schoolchildren cannot learn from digital resources with the same opportunity as urban schoolchildren. They must travel to a local hotspot to participate in online homework assignments as well as apply to college, internships or apprenticeships posted online. Access to medical services, including telemedicine, is also severely limited in rural America without high-speed internet. Patients must often drive hours to the closest hospital to see specialists, placing an unfair time and financial burden upon them. As a country, we have the tools necessary to close this digital divide, but we must approach the need with the urgency it demands of us.

In April 2017, President Donald J. Trump established the Interagency Task Force on Agriculture and Rural Prosperity to identify legislative, regulatory, and policy changes that could promote agriculture and prosperity in rural communities. U.S. Secretary of Agriculture Sonny Perdue was selected to serve as chairman of the Task Force, which includes representatives from more than 22 Federal agencies, executive departments, and offices, as well as local leaders. Over the course of 6 months, Secretary Perdue traveled to 30 States to listen to the voice of rural America and gather recommendations from citizens, farmers, and business leaders throughout the country. He held countless meetings with partner Federal agencies and consulted with industry experts.

Secretary Perdue presented the Task Force’s findings to the President in January 2018. They included 31 recommendations to align the Federal Government with State, local, and Tribal governments to take advantage of opportunities that exist in rural America. These recommendations were organized around five key indicators of rural prosperity: Quality of Life, Rural Workforce, Technological Innovation, Economic Development, and e-Connectivity, serving as the key to unlocking their full potential.

Achieving rural e-Connectivity is not just a Federal issue. As stakeholders in rural America, Federal, State, Tribal, and local entities must all seek out further partnerships that promote innovation and lead to modernization of our infrastructure. As in the past, we will only be successful if we act together.



The Interagency Task Force on Agriculture and Rural Prosperity identified over 100 recommendations—centered around the five areas illustrated above—to help improve the quality of life in rural America. For more information about the Task Force’s work, its findings, and to view the report, visit www.usda.gov/ruralprosperity.

Illustrating USDA's Role in Rural e-Connectivity

The mission of USDA is to provide leadership on agriculture, food and nutrition, rural development, natural resources, and related issues based on public policy, the best available science, and effective management.

Strategic goals for fiscal years 2018-2022 are in place to help ensure USDA achieves its mission. The fourth goal aims to “facilitate rural prosperity and economic development,” for which rural e-Connectivity has been identified as crucial.

The telecommunication programs of USDA's Rural Utilities Service are the traditional source of funding for broadband in rural America. Each year, USDA offers more than \$700 million for infrastructure loans that can be used to provide or enhance broadband services to communities with populations under 5,000. In addition, the budget provides \$30 million in broadband grants and \$29 million in loans to create private-public partnerships that expand high-speed e-Connectivity to rural Americans and \$29 million for distance learning and telemedicine grants. USDA also launched the ReConnect Program, a pilot program authorized by the Consolidated Budget Act of 2018, to facilitate broadband deployment in areas of rural America that don't currently have sufficient access to broadband.

However, more than 20 additional USDA programs can be further leveraged to support e-Connectivity deployment. In addition to directly funding broadband infrastructure development, USDA bridges the gap between broadband infrastructure and its end use by:

- Supporting technology research
- Improving digital skills necessary to take advantage of connectivity
- Building capacity to expand broadband access
- Funding costs related to environmental, engineering, and archeological permitting processes for infrastructure growth
- Supporting access to broadband equipment
- Renovating community facilities

For instance, a farmer residing in a rural community can partner with a local university or a research institution to undertake agricultural technology research. A local cooperative can access various types of funding streams within USDA to obtain the needed technology skills and necessary equipment to implement innovative farming practices such as precision agriculture. A local government can finance broadband development planning and build partnerships to finance broadband infrastructure development and adoption using various USDA funding programs. A county hospital can undertake a feasibility study to incorporate telemedicine into its service and obtain the necessary equipment and facilities to implement such a project.

Through grant programs as well as direct loan, intermediary relending, and guaranteed loan programs, USDA offers its customers the opportunity to finance and pursue projects with reasonable terms. USDA also pursues ways to improve customer service and efficiencies through streamlining broadband infrastructure permitting processes and building the next generation workforce.

Other departments of the U.S. Government also support rural broadband e-Connectivity expansion, with grants and loans for similar activities such as equipment procurement, technical assistance, and planning support. A listing of such programs can be found at the [Department of Commerce's National Telecommunications and Information Administration \(NTIA\) website](#). NTIA also provides additional resources through its [BroadbandUSA](#) site, including a local broadband community planning toolkit, archived webinars about various broadband topics, and information about [State-level broadband programs](#).

The resource matrix and success stories in this e-Connectivity toolkit illustrate how USDA programs across our mission areas and agencies can be aligned to support a holistic approach to the development and deployment of broadband technology. However, each program has its own underlying eligibility criteria and priority that must be taken into careful consideration when deciding how to finance each project.



USDA e-Connectivity Resource Matrix

USDA has 27 programs that can be used to fund planning, construction, research and e-Connectivity activities. These are illustrated on the following pages and organized by customer and project type. More information can be found at www.usda.gov/broadband.



How to Use the USDA e-Connectivity Matrix

- STEP 1** ▶ Identify the type of customer (matrix rows) that will be applying and match it with the type of project (matrix columns) the community needs.
- STEP 2** ▶ Review the list of resources that are applicable to your customer and project types. To obtain more information on each resource, either click on its name to be taken to the relevant website (for online viewers) or find the corresponding number in the agency and resource description section starting on page 12 of this booklet (for print viewers).
- STEP 3** ▶ Reach out to the USDA specialist for each resource whose contact information is posted online at the locations detailed below.
- STEP 4** ▶ Discuss the eligibility of your project(s) and the application process with the USDA specialist to ensure feasibility.
- STEP 5** ▶ Develop an application timeline for your project, and closely review requirements, then proceed with the application process.
- STEP 6** ▶ Follow up with the USDA specialist if you have any questions before submission of an application, during the process, or after submission.

We have specialists available for each program to help you get started:

National Institute of Food and Agriculture: Use the [NIFA grant database](#) to find contacts for NIFA grant programs.

Natural Resources Conservation Service: Contact your local [NRCS Service Center](#) to learn more about conservation opportunities.

Farm Service Agency: Contact your local [FSA Service Center](#) to learn more about programs for farmers and ranchers.

Forest Service: Visit the [FS Special-Use Permits site](#) to learn more about use of FS lands.

Rural Development: Contact your local [RD State Office](#) or [Telecom General Field Representative](#) to learn more about RD loan, grant, and technical assistance programs.

Partnerships: Contact USDA's [Office of Partnership and Public Engagement](#) for partnership opportunities with USDA.

Community Solutions: Contact the [Rural Development Innovation Center](#) for creative solutions to your rural community's e-Connectivity needs.

For resources at other Federal agencies, visit the Department of Commerce's [BroadbandUSA site](#).

USDA e-Connectivity Resource Matrix



Customers:

Agriculture Technology Research: Innovative farming research using broadband technology.

Technical Assistance, Training & Workforce Development: Sharing information, expertise, instruction, and/or skills training in broadband technology use.

Planning: Needs assessment, formation of broadband development plans, or business plans.

Farmers & Ranchers: Individuals who operate a farm or ranch.

[2b\) Sustainable Agriculture Program](#)

[4c\) Agriculture Conservation Easement Program](#)

[3b\) Farm Ownership Loans](#)

[4a\) Agricultural Management Assistance](#)

[3d\) Guaranteed Farm Loans](#)

[4e\) Conservation Stewardship Program](#)

[3c\) Farm Microloans](#)

[4f\) Conservation Technical Assistance Program](#)

[1g\) Business and Industry Loan Guarantees](#)

[4g\) Conservation Innovation Grants](#)

[4d\) Environmental Quality Incentives Program](#)

[4b\) Regional Conservation Partnership Program](#)

[3a\) Direct Operating Loans](#)

[3b\) Farm Ownership Loans](#)

[3d\) Guaranteed Farm Loans](#)

[3c\) Farm Microloans](#)

For-Profit Businesses: Corporations, Limited Liability Companies, Competitive and Incumbent Local Exchange carriers, sole proprietorships, etc.

[2b\) Sustainable Agriculture Program](#)

[2b\) Sustainable Agriculture Program](#)

[1g\) Business and Industry Loan Guarantees](#)

[2a\) Agriculture and Food Research Initiative](#)

[2a\) Agriculture and Food Research Initiative \(AFRI\) Foundational and Applied Science Program](#)

[2c\) National Robotics Initiative 2.0](#)

[2d\) Cyber-Physical Systems Grant Program](#)

Government Entities: State or local governments, federally recognized Tribes, or Tribal organizations.

[2b\) Sustainable Agriculture Program](#)

[2b\) Sustainable Agriculture Program](#)

[1f\) Rural Business Development Grants](#)

[2a\) Agriculture and Food Research Initiative](#)

[4g\) Conservation Innovation Grants](#)

[1h\) Community Facilities Technical Assistance and Training Grants](#)

[2c\) National Robotics Initiative 2.0](#)

[4b\) Regional Conservation Partnership Program](#)

[1g\) Business and Industry Loan Guarantees](#)

[2d\) Cyber-Physical Systems Grant Program](#)

[1f\) Rural Business Development Grants](#)

[1h\) Community Facilities Technical Assistance and Training Grants](#)

Co ops & Nonprofits: Telecom and electric cooperatives, private non-profit schools, hospitals, libraries, faith-based organizations, etc

[2b\) Sustainable Agriculture Program](#)

[2b\) Sustainable Agriculture Program](#)

[1f\) Rural Business Development Grants](#)

[2a\) Agriculture and Food Research Initiative](#)

[4g\) Conservation Innovation Grants](#)

[1h\) Community Facilities Technical Assistance and Training Grants](#)

[2c\) National Robotics Initiative 2.0](#)

[4b\) Regional Conservation Partnership Program](#)

[1g\) Business and Industry Loan Guarantees](#)

[2d\) Cyber-Physical Systems Grant Program](#)

[2a\) Agriculture and Food Research Initiative \(AFRI\) Foundational and Applied Science Program](#)

[1f\) Rural Business Development Grants](#)

[1h\) Community Facilities Technical Assistance and Training Grants](#)

Universities & Higher Education Institutions: Universities, community colleges, technology institutes, vocational & technical schools, etc.

[2b\) Sustainable Agriculture Program](#)

[2b\) Sustainable Agriculture Program](#)

[1g\) Business and Industry Loan Guarantees](#)

[2a\) Agriculture and Food Research Initiative](#)

[4g\) Conservation Innovation Grants](#)

[4b\) Regional Conservation Partnership Program](#)

[2c\) National Robotics Initiative 2.0](#)

[2a\) Agriculture and Food Research Initiative \(AFRI\) Foundational and Applied Science Program](#)

[1f\) Rural Business Development Grants](#)

[1h\) Community Facilities Technical Assistance and Training Grants](#)

[2d\) Cyber-Physical Systems Grant Program](#)

Private Lenders: Banks, credit unions, intermediary lenders, etc.

[2a\) Agriculture and Food Research Initiative](#)

[2b\) Sustainable Agriculture Program](#)

[1g\) Business and Industry Loan Guarantees](#)

For Planning, Construction, Research, and Other Projects and Activities



Permits: Reimbursement for environmental, engineering, and archeological permits.

- [3b\) Farm Ownership Loans](#)
- [3d\) Guaranteed Farm Loans](#)
- [3c\) Farm Microloans](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [5a\) Forest Service Special Use Permits](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1g\) Business and Industry Loan Guarantees](#)

- [1g\) Business and Industry Loan Guarantees](#)



Broadband Infrastructure: Network plant and extension of broadband systems through fiber, poles, communication towers, wireless equipment, etc.

- [3b\) Farm Ownership Loans](#)
- [3d\) Guaranteed Farm Loans](#)
- [3c\) Farm Microloans](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1g\) Business and Industry Loan Guarantees](#)

- [1g\) Business and Industry Loan Guarantees](#)

- [1g\) Business and Industry Loan Guarantees](#)



Equipment or Facilities: Buying, improving or renting end-use equipment; constructing community centers, wireless access points, etc.

- [4a\) Agricultural Management Assistance](#)
- [4g\) Conservation Innovation Grants](#)
- [4b\) Regional Conservation Partnership Program](#)
- [3b\) Farm Ownership Loans](#)
- [3a\) Farm Operating Loans](#)
- [3c\) Farm Microloans](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1g\) Business & Industry Loan Guarantees](#)
- [1e\) Rural Economic Development Loans & Grants](#)
- [2e\) Small Business Innovation Research Program](#)

- [4g\) Conservation Innovation Grants](#)
- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1b\) Distance Learning & Telemedicine Grants](#)
- [1i\) Community Facilities Loans & Grants](#)
- [1g\) Business & Industry Loan Guarantees](#)
- [1e\) Rural Economic Development Loans & Grants](#)

- [4g\) Conservation Innovation Grants](#)
- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1k\) ReConnect Program](#)
- [1a\) Community Connect Grants](#)
- [1b\) Distance Learning & Telemedicine Grants](#)
- [1i\) Community Facilities Loans & Grants](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [2c\) National Robotics Initiative 2.0](#)
- [4g\) Conservation Innovation Grants](#)
- [1b\) Distance Learning & Telemedicine Grants](#)
- [1i\) Community Facilities Loans & Grants](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1j\) Community Facilities Guaranteed Loans](#)
- [1g\) Business & Industry Loan Guarantees](#)



Refinancing: New financing with a different provider for an existing debt owed.

- [3b\) Farm Ownership Loans](#)
- [3d\) Guaranteed Farm Loans](#)
- [3c\) Farm Microloans](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1d\) Telecommunications Infrastructure Loans](#)
- [1c\) Rural Broadband Access Loans](#)
- [1g\) Business & Industry Loan Guarantees](#)

- [1g\) Business & Industry Loan Guarantees](#)

- [1j\) Community Facilities Guaranteed Loans](#)
- [1g\) Business & Industry Loan Guarantees](#)

USDA Agency and Resource Descriptions



1) Rural Development

Rural Development (RD) operates programs designed to improve the rural economy in a holistic manner through financing infrastructure, businesses, housing and community facility projects. While telecom infrastructure programs directly fund the planning, development, and end use of broadband infrastructure, other programs that develop essential community facilities and grow businesses can also be used to finance various facets of e-Connectivity. Examples include conducting a broadband needs assessment or preparing a broadband development plan, purchasing equipment, as well as acquiring and/or upgrading community facilities such as schools and libraries where internet access will be provided to the public.

1a) Community Connect Grants

The Community Connect program helps fund broadband deployment in rural communities where it is not yet economically viable for private-sector providers to deliver service. The grants offer financial assistance to eligible service providers that will construct, improve, or expand broadband networks in rural areas.

1b) Distance Learning and Telemedicine Grants

The Distance Learning and Telemedicine program helps rural communities use the unique capabilities of telecommunications to connect to each other and to the world, overcoming the effects of remoteness and low population density. For example, this program can link teachers and medical service providers in one area to students and patients in another.

1c) Rural Broadband Access Loans

The Rural Broadband Access Loan program furnishes loans and loan guarantees to provide funds for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide service at the broadband lending speed in eligible rural areas.

1d) Telecommunications Infrastructure

Loans

This Telecommunications Infrastructure program provides financing for the construction, maintenance, improvement and expansion of telephone service and broadband in rural areas.

1e) Rural Economic Development Loans and Grants

The Rural Economic Development program provides funding for rural projects through local utility organizations. USDA provides zero-interest loans to local utilities which, in turn, pass through to local businesses (ultimate recipients) for projects that will create and retain employment in rural areas. The ultimate recipients repay the lending utility directly. The utility is responsible for repayment to USDA.

1f) Rural Business Development Grant

The Rural Business Development program offers a competitive grant designed to support targeted technical assistance, training, and other activities leading to the development or expansion of small and emerging private businesses in rural areas that will employ 50 or fewer new employees and earn less than \$1 million in gross revenue. Programmatic activities are separated into enterprise or opportunity-type grant activities.

1g) Business and Industry Loan Guarantees



The Business and Industry program bolsters the availability of private credit by guaranteeing loans for rural businesses. This program improves the economic health of rural communities by increasing access to business capital through loan guarantees that enable commercial lenders to provide affordable financing for businesses in eligible rural areas.

1h) Community Facilities Technical Assistance and Training Grants

The Community Facilities Technical Assistance and Training program provides associations with technical assistance and/or training with respect to essential community facilities programs. Furthermore, it assists communities, Indian Tribes, and nonprofit corporations to identify and plan for existing regional community facility needs. Once those needs have been identified, the grantee can assist in identifying public and private resources to finance those identified community facility needs.

1i) Community Facilities Loans and Grants

The Community Facilities program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings.

1j) Community Facilities Guaranteed Loans

This program provides loan guarantees to eligible private lenders to help build essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area and does not include private, commercial, or business undertakings.

1k) ReConnect Program Grants and Loans

This new program offers three types of funding options for broadband infrastructure to connect rural families, businesses, farms, ranches, schools, libraries, and public safety facilities to modern, high-speed internet. A rural area is eligible if it currently does not have sufficient access to broadband. The ReConnect grants, grant and loan combinations, and low-interest loans can be used to construct, improve, and acquire facilities that provide internet services to customers' premises, with reliable technologies that are suitable for the type of rural community and the type of high-speed internet use.



2) National Institute of Food and Agriculture

The National Institute of Food and Agriculture (NIFA) provides leadership and funding for programs that advance agriculture-related sciences. NIFA applies an integrated approach to ensure that groundbreaking discoveries in agriculture-related sciences and technologies reach the people who can put them into practice. Programs can be used to conduct research that uses broadband technology (e.g., precision agriculture) to enhance agricultural production performance. NIFA's programs can also be used for education and training as well as for the implementation of innovative technologies to improve the competitiveness and efficiency of American agriculture.

2a) Agriculture and Food Research Initiative – Foundational and Applied Science 🔍

The Agriculture and Food Research Initiative is the Nation's leading competitive grants program for agricultural sciences. The Foundational and Applied Science program focuses on building a foundation of fundamental and applied knowledge in food and agricultural sciences critical for solving current and future societal challenges. The goal of this program is to invest in agricultural production research, education, and extension projects for more sustainable, productive, and economically viable plant and animal production systems. Grants are awarded in six Farm Bill priority areas: Plant Health and Production and Plant Products; Animal Health and Production and Animal Products; Food Safety, Nutrition, and Health; Bioenergy, Natural Resources, and Environment; Agriculture Systems and Technology; and Agriculture Economics and Rural Communities.

2b) Sustainable Agriculture Research and Education – Professional Development 🔍

The Sustainable Agriculture Research and Education Professional Development Program provides training, grants, and resources for agricultural professionals to build awareness, knowledge, and skills related to sustainable agriculture concepts. The program includes two key components: (1) competitive grants awarded at the regional level for the development of training curricula, outreach efforts, communications projects and similar work and (2) a network of State coordinators, working part-time for the program in each State and island protectorate, who hold workshops and field days to share sustainable practices and research results, provide travel scholarships for ag professionals to attend training events, and generally serve as sustainable agriculture resources in their State.



2c) National Robotics Initiative: 2.0: Ubiquitous Collaborative Robots

The National Robotics Initiative: 2.0 program supports fundamental research in the United States that will accelerate the development and use of collaborative robots (co-robots) that work beside or cooperatively with people for a seamless integration of co-robots to assist humans in every aspect of life. The program supports four main research thrusts that are envisioned to advance the goal of ubiquitous co-robots: scalability, customizability, lowering barriers to entry, and societal impact. Collaboration between academic, industry, nonprofit, and other organizations is encouraged to establish better linkages between fundamental science and engineering and technology development, deployment, and use.

2d) Cyber-Physical Systems (Joint National Science Foundation) Competitive Grant

The goal of the Cyber-Physical Systems (CPS) program is to develop the core system science needed to engineer complex cyber-physical systems that people can use or interact with and depend upon. These systems are engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and physical components. Advances in CPS will enable capability, adaptability, scalability, resiliency, safety, security, reliability, and usability that will far exceed the simple embedded systems of today. Furthermore, they will transform the way people interact with engineered systems - just as the internet has transformed the way people interact with information. New smart CPS will drive innovation and competition in sectors such as agriculture, energy, transportation, building design and automation, healthcare, and manufacturing.

2e) Small Business Innovation Research

The Small Business Innovation Research program offers competitively awarded grants to qualified small businesses to support high-quality research related to important scientific problems and opportunities in agriculture that could lead to significant public benefits. The program stimulates technological innovations in the private sector and strengthens the role of Federal research and development in support of small businesses. The program also fosters and encourages participation by women-owned and socially or economically disadvantaged small businesses.



3) Farm Service Agency

The Farm Service Agency (FSA) provides America's farmers and ranchers with a financial safety net, while also helping to protect natural resources and enhancing food security. FSA offers loan funds to farmers, ranchers, and those starting a career in agriculture. An increase has been seen in these borrowers' use of loan funds for the purpose of investing in technology and innovative improvements in farming and ranching operations. These investments include but are not limited to Global Positioning System (GPS) units and software, seed technology, drone technology, management software (fiscal, herd, etc.), and related precision agriculture improvements.

3a) Direct Operating Loans

Direct Operating Loans are used to purchase livestock and feed, farm equipment, fuel, farm chemicals, insurance, and family living expenses; make minor improvements or repairs to buildings and fencing; and fund general farm operating expenses. For new agricultural producers, direct farm operating loans provide an essential gateway into agricultural production by financing the cost of operating a farm.

3b) Direct Farm Ownership Loans

Direct Farm Ownership Loans are used to purchase or enlarge a farm or ranch, construct new or improve existing farm or ranch buildings, and for soil and water conservation and protection purposes. There is no current or previous farm ownership requirements, and 100 percent financing is available. Direct farm ownership loans are a valuable resource to help farmers and ranchers become owner-operators of family farms, improve and expand current operations, increase agricultural productivity, and assist with land tenure to save farmland for future generations.

3c) Farm Microloans

Farm Microloans are direct farm ownership and operating loans focused on the financing needs of small and beginning farmers, as well as niche and non-traditional farm operations. These can include truck farms, farms participating in direct marketing and sales (such as farmers markets or Community Supported Agriculture), restaurants and grocery stores, or those using hydroponic, aquaponic, organic, and vertical growing methods. Microloans have a shortened application process and reduced paperwork.

3d) Guaranteed Loans

Guaranteed Loans enable lenders to extend credit to family farm operators and owners who do not qualify for standard commercial loans. Farmers receive credit at reasonable terms to finance their current operations or to expand their business; financial institutions receive additional loan business and servicing fees, as well as other benefits from the program, such as protection from loss.



4) Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) works with farmers, ranchers, and forest landowners across the country to help them boost agricultural productivity and protect our natural resources through conservation. Their approach combines locally led solutions with science and research; landowner stewardship; partnerships; and proven conservation practices to produce results for agriculture and the environment. Landowners can apply to participate in programs that provide technical guidance and financial assistance to obtain and use technology equipment that needs connectivity. Examples include acquiring and using technology to conduct yield monitoring, grid soil sampling, remote-sensing applications, and drip irrigation.

4a) Agricultural Management Assistance

Agricultural Management Assistance provides financial and technical assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Producers may construct or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. It is available in 16 States where participation in the Federal Crop Insurance Program is historically low: Connecticut, Delaware, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming.

4b) Regional Conservation Partnership Program

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

4c) The Agricultural Conservation Easement Program Community Connect Grants

The Agricultural Conservation Easement Program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Over the past 25 years, NRCS has worked with landowners to protect more than 4.4 million acres of wetlands and agricultural lands, a value of over a billion dollars in a diversified real estate portfolio that has resulted in improved soil health, water and air quality and wildlife habitat. Under the Agricultural Land Easements component, NRCS helps American Indian Tribes, State and local governments, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.

4d) Environmental Quality Incentives Program (EQIP)

From weather to pests, and from a lack of time to markets, each American farmer faces a unique set of challenges. The Environmental Quality Incentives Program (EQIP) helps agricultural producers confront those challenges – all while conserving natural resources like soil, water, and air. This voluntary conservation program helps producers make conservation work for them. Together, NRCS and producers invest in solutions that conserve natural resources for the future while also improving agricultural operations. Through EQIP, NRCS provides agricultural producers with financial resources and one-on-one help to plan and implement improvements, or

what NRCS calls conservation practices. Using these practices can lead to cleaner water and air, healthier soil, and better wildlife habitat, all while improving agricultural operations. Through EQIP, you can voluntarily implement conservation practices, and NRCS co-invests in these practices with you.

4e) Conservation Stewardship Program (CSP)

The Conservation Stewardship Program (CSP) helps producers build on existing conservation efforts while strengthening their operations. Whether you are looking to improve grazing conditions, increase crop yields, or develop wildlife habitat, NRCS can custom design a CSP plan to help meet those goals. NRCS can further help schedule the timely planting of cover crops, develop a grazing plan that will improve a forage base, implement no-till to reduce erosion, or manage forested areas in a way that benefits wildlife habitat.

4f) Conservation Technical Assistance Program (CTA)

The voluntary Conservation Technical Assistance Program delivers conservation technical assistance and is available to any group or individual interested in conserving natural resources and sustaining agricultural production. The program functions through a national network of locally based, professional

conservationists located in nearly every county of the United States.

4g) Conservation Innovation Grants

Conservation Innovation Grants (CIG) are competitive grants that drive public and private-sector innovation in resource conservation. Authorized by the 2002 Farm Bill, CIG uses Environmental Quality Incentives Program funds to award competitive grants to non-Federal governmental or nongovernmental organizations, American Indian Tribes, or individuals. Through the program, public and private grantees develop the tools, technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges. CIG projects inspire creative problem-solving that boosts production on farms, ranches, and private forests, ultimately improving water quality, soil health, and wildlife habitat. Annually, a portion of CIG funding is set aside for projects that support historically underserved, new and beginning, as well as military veteran producers in farming and ranching.

5) Forest Service

The Forest Service, part of USDA, manages National Forest System (NFS) lands comprised of 154 national forests and 20 national grasslands in 43 States as well as Puerto Rico and the U.S. Virgin Islands. The Forest Service currently administers more than 4,000 special use authorizations for communications uses (wired and wireless). NFS lands contribute to our Nation's telecommunications needs by authorizing uses that provide critical services to rural communities and urban areas. The facilities included in these authorizations support more than 10,000 wireless uses and 563 wired uses (fiber optic rights-of-way).

5a) Special Use Permits

Each year, the Forest Service receives thousands of individual and business applications for authorization for use of NFS land for such activities as water transmission, agriculture, outfitting and guiding, recreation, telecommunication, research, photography and video productions, and granting road and utility rights-of-ways. The Forest Service carefully reviews each application to determine how the request affects the public's use of NFS land. Today, our growing population and mobile society

have created a demand for a variety of uses of these Federal lands. Often these diverse needs require specific approval. The Forest Service provides services that support our national policy and Federal land laws. The Agency's special-uses program authorizes uses on NFS land that provide a benefit to the general public and protect public and natural resources values. Currently there are over 74,000 authorizations on the NFS lands for over 180 types of uses.

Success Stories

The following examples highlight how customers have used USDA e-Connectivity resources to expand rural broadband in their communities.

Infrastructure: Fiber Broadband Speeds Trade for Small Town Agricultural Business

Telecommunication Loan

Every few minutes, the numbers on Gary Smith's computer screen flicker and change. Outside his office window in Lovington, Illinois (population 1,100) are 14 grain bins, an elevator, and a dryer, with a total storage capacity of 3.5 million bushels. As the Operations Manager, Smith relies on the three computers in his office to track prices, make bids, run reports, and monitor the levels of the grain elevators in the Okaw Grain Farmers Cooperative (Okaw) storage system. For decades, these computers have depended on a copper digital subscriber loop, commonly known as DSL, a technology that is becoming outdated faster than the data can download. The speed at which the numbers are conveyed between Lovington and the Chicago Board of Trade, one of the Nation's largest agricultural commodity exchanges, can mean significant profits or heartbreaking losses for this rural business. Smith says, "If there's a delay, we're losing money." Okaw's not the only one sustaining this loss; so are the 300 rural farmers that comprise its membership.

However, Smith isn't worried. In the agricultural marketplace, where milliseconds can mean thousands of dollars are lost or made, Okaw will now receive information on grain prices and be able to submit bids instantly.

Early in 2017, the Moultrie Independent Telephone Company (MITCO), Lovington's long-standing business, received a \$4 million award from USDA's Rural Utilities Service Telecommunications



Okaw Grain Farmers Operations Manager Gary Smith depends on high-speed internet to connect local farmers to the Chicago Board of Trade, a major commodity exchange and futures market, that in recent years has shifted to electronic trading.

Loan Program. This loan provided funding for a comprehensive network upgrade in Lovington, which includes new fiber to the home access for 800 premises. From existing DSL wire to leading-edge fiber technology, MITCO now provides its customers with access to tenfold higher speeds at deals comparable to the prices customers already pay.

With the next harvest around the corner, this upgrade comes at a pivotal moment for Smith and Okaw. Recognizing the urgency and universal need for competitive telecommunications, Smith reminds us all, "Optic fiber, whether it helps 1 or 100, is needed."

Planning: A Technology Action Plan for South Carolina Low Country

Rural Business Development Grant

Through a Rural Business Development Grant, the South Carolina Low Country region conducted a broadband needs assessment and identified its top priorities for improving broadband access, adoption, and use. The broadband team was then able to develop a Technology Action Plan that can be used to bring high-speed internet access, adoption, and use to families, businesses, and communities in the six-county region.

Equipment: Addressing the Opioid Epidemic Telemedicine

Distance Learning and Telemedicine Grant

Southern Tier Health Care Systems, Inc. in Olean, New York, received a \$133,000 grant to deploy telecommunications equipment that helped train and certify emergency responders dealing with opioid overdoses. Overall, the goal of this distance learning and telemedicine project is to help reduce the human cost of loss of life. The rural health network serves three counties in southwestern New York and is further deploying its new distance learning and telemedicine (DLT) network to three additionally end-user sites located in the towns of Salamanca, Cuba, and Gerry. The project supports education for emergency response personnel as well as community service agencies in

Allegany, Cattaraugus, and Chautauqua counties, including the Allegany Indian Reservation Volunteer Fire Department.

The telecommunications equipment will help in the delivery of certification training to rural emergency medical service (EMS) agencies that struggle for basic operational funds and have been strained by the demands of the opioid epidemic. One of Southern Tier Health Care System's initial training sessions for EMS providers will include the use of Narcan, a medication used to counter the effects of opioids. Another educational session will focus on preventing misuse of prescription drugs, including opioids, by increasing awareness of proper drug disposal. Education will also be available to community agencies surrounding the sites. Furthermore, the Allegany Indian Reservation site will be able to provide education that preserves the linguistic and cultural heritage of the Seneca Nation.

Equipment: Improving Access to Safe and Timely Medical Care Through a Rural Communication Center

Rural Economic Development Grant Program

Spencer Municipal Utilities worked through the Rural Economic Development Grant Program to make a loan to the City of Spencer to purchase equipment for a new Emergency Communications Center and create five new jobs. The equipment will improve emergency response time, leading to enhanced community safety and medical care.

Partnership: New Center of Excellence for Permitting Training

Job Corps Training Program

Forest Service Job Corps Centers provide students the training they need to meet the demands of an ever-changing workplace. Built on a foundation of accountability, commitment, and positive social skills, the first class of Job Corps trainees in Franklin, North Carolina, started in October 2017 in the new Special Uses Center of Excellence at the Lyndon B. Johnson Job Corps Civilian Conservation Center.

Through investments in fiber optic internet infrastructure to the Job Corps site, broadband internet connectivity will be provided not only to the Job Corps trainees but also to several thousand people and businesses in the community. Student trainings will prepare them for entry-level jobs in the administration of special use permits, a program experiencing a high percentage of employee loss due to retirement and job turnover. As a result, they will have real world experience in permitting land use and recreation authorizations. Furthermore, successful Job Corps graduates will have opportunities to transition to full-time employment within the permitting field.

Research: Building and Using New Internet-Based Infrastructure to Advance Learning and Practice in the Northeast

Sustainable Agriculture Research and Education - Professional Development Program

Through a combination of more than \$111,000 in Federal funds and nearly \$28,000 in matching non-Federal funds, faculty, academic staff, and instructional technology specialists from Cornell University and Pennsylvania State University, Cooperative Extension educators from New York and Pennsylvania, natural resources educators from civic organizations, and forest owners from both States were engaged in developing an online system for teaching and learning about forest farming. A learning communities approach (also known as a community of practice) was applied to enhance the quantity, quality, and organization of information in the online resource center and is now hosted online and is freely accessible to users everywhere.

Thirty-two educators from the two States interacted with project leadership during the life of the project to help build and pilot test the learning resources. A face-to-face workshop brought the leadership team together with 12 educators (6 from each State) and 2 graduate students to initiate the project and create a plan for contributing information to the Resource Center. A video conference was held a year later. In the meantime and thereafter, a variety of online communication tools was used to develop course material and plan for pilot tests. Three initial, simultaneously replicated online pilot courses were conducted to teach the concepts and practices of forest farming to Extension educators and forest owners. They included, altogether, 20 different educators (8 of the original 12, and 12 others) and 65 forest owners whom the educators recruited. The educators identified three to four landowners that they hoped to support as they pursued forest farming. The 9-week forest farming courses were facilitated by members of the project leadership team to test the concept.

Subsequently, a different course was developed, not to learn about forest farming per se, but rather how to use "MOODLE," the Forest Lake, MN, Area High School's online learning system and other resources to develop and teach a course in forest farming. It should be noted that this training in development and teaching could be applied not only to forest farming but also other topics of interest to Extension education. This 8-week pilot course engaged 25 Extension educators, 7 who participated in an original pilot test and 18 new recruits.

A final course extended testing from the pilot to the prototype stage. Designed and conducted by an Extension educator who participated in both the forest farming content-oriented course and the subsequent "how-to-develop/teach using MOODLE" course, she recruited 44 landowners from 22 counties in 3 States who paid \$60 each to participate for 10 weeks. While she facilitated the course independently, the project leadership observed the process.

Forest farming is an agroforestry approach to forest and woodlot management that has a high potential in the Northeast for generating income and enhancing environmental values through the deliberate cultivation of specialty crops. The diversity of suitable crop types and the comparatively long lead time to maturity for many of them combined with the high variability of site conditions throughout the region, the novelty of the approach, and the uncertainty of success has resulted in limited investment in science-based knowledge generation and outreach.

As a result of the project, 32 natural resources educators and approximately 109 forest owners in New York and Pennsylvania have gained experience with forest farming through online learning. Participants evaluated the pilot courses which the project conducted, and findings were used to improve our understanding of the requirements of success in online learning about forest farming and, by inference, other subject matter as well. This insight was used to shape subsequent courses, to enhance the content and tools in the Resource



Facilities: Connecting Social Services With Broadband Service

Community Facilities Grant

With a population of less than 3,000, the town of Crisfield in Somerset County, Maryland, was able to extend broadband service to its local hospital and library through a Community Facilities Grant provided to the Maryland Broadband Cooperative, Inc. The Cooperative received additional funding to provide a similar broadband extension service to the county's Department of Roads and the Department of Health located in the neighboring town of Westover. Having access to high-speed internet, especially during times of disaster or inclement weather, will enable the government entities to better respond to the residents' needs. The Town of Westover has a population of 4,245 and a median household income of \$43,143.

Infrastructure: Fiber Broadband Helps Rural Schools Surpass State Standards

Telecommunication Loan Program

In rural Georgia, a high school graduate can earn an extra \$12,000 per year. But according to the last census, only 75 percent of the working population in Candler County, Georgia, a rural school district, had attained that educational degree.

Building on his predecessors' vision, Superintendent Fred Longgear and his colleagues focus on keeping students engaged throughout the school career. During the year, more than 1,600 students and their teachers interact with smart boards, virtual reality, 3D printers, and computers at the Innovative Learning Center (ILC), which is connected to the Title I elementary and middle schools. Last year, 550 high school students worked as ILC interns, tutoring the younger students. However, without community and technical support, the ILC wouldn't have found success.

A USDA partner since the 1950s, Pineland recently received two multimillion-dollar awards from the USDA's Rural Utilities Service (RUS) to build 1,800 miles of fiber and deploy expanded video and gigabit-enabled broadband packages. Thus, in 2014, the schools gained access to fiber broadband, which provides the reliability and bandwidth needed to ensure that a school like ILC operate smoothly. "We had a dream and a vision for high-speed connectivity and 21st century equipment in every classroom," said Dr. Longgear. At the time, the schools had access to digital subscriber loop technology, which couldn't provide the needed support. Hearing the concerns, Pineland Telephone Cooperative eagerly sought to help.



Candler County's Innovative Learning Center captivates the minds of students and enhances the staff's ability to meet State academic standards and learning goals.

This year, the high school graduated more than 90 percent of its students, well surpassing the State average. "Due to enhanced broadband capability, there's more flexibility in ways to engage students," said Dr. Longgear. This milestone is a testament to the dedicated staff and innovative relationships that have been cultivated over the years, he said. Innovative relationships that bind the public schools to private companies like Pineland and private companies to Federal agencies like RUS continue to leverage resources and build networks that support all students, regardless of location or economic status.

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- (2) fax: (202) 690-7442; or
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United States Department of Agriculture

RD 20002
December 2018
Slightly Revised February 2020