



E-CONNECTIVITY IN RURAL AMERICA: PUBLIC RESEARCH UNIVERSITIES ADVANCING DIGITAL INCLUSION

A concept paper by the Association of Public and Land-grant Universities



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THE CHALLENGE IN BRINGING BROADBAND ACCESS TO RURAL AMERICA

“In today’s information-driven global economy, e-connectivity is not simply an amenity - it has become essential. E-connectivity, or electronic connectivity, is more than just connecting households, schools, and healthcare centers to each other as well as the rest of the world through high-speed internet. It is also a tool that enables increased productivity for farms, factories, forests, mining, and small businesses. E-connectivity is fundamental for economic development, innovation, advancements in technology, workforce readiness, and an improved quality of life. Reliable and affordable high-speed internet connectivity will transform rural America as a key catalyst for prosperity.”

– Report to the President of the United States by the Task Force on Agriculture and Rural Prosperity, October 2017

Rural residents and businesses need access to high-speed internet service. The challenges of long distances and low population and business density make access to high-speed internet and digital services even more important in the nation’s rural areas than in areas in which the doctor, the grocery store, the school, the theater, or a helpful neighbor are a short walk or drive away. Some observers have called digital services deficiencies in rural areas compared to urban areas a “rural penalty.”¹ The penalty limits the ability of rural residents to effectively use information, eroding productivity, competitiveness, and quality of life.

But these same challenges of distance and density make it difficult for the private sector to offer high-speed internet services in rural areas using the same technologies and business models that they use in more densely populated places. Current technologies exhibit economies of scale and business models respond to those scale demands.

This reality has long been recognized. The Telecommunications Act of 1996 required the FCC to “encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans....”² Thus, the FCC published its first broadband progress report in 1999, and the most recent report was issued in February 2018.³ The gaps revealed by these reports and others led to substantial investments in rural broadband. For example, the American Recovery and Reinvestment Act of 2009 included \$7.2 billion for broadband grant and loan programs, with \$2.5 billion administered by the U.S. Department of Agriculture to be focused in rural areas;⁴ the Rural Utility Service of USDA has invested 4.5 billion in grants and loans since 2001;⁵ and Congress has also funded other programs subsidizing broadband services such as e-rate, which requires providers

¹ Malecki, Edward J. “Digital Development in Rural Areas: Potentials and Pitfalls.” *Journal of Rural Studies* 19, no. 2 (April 1, 2003): 201–14. [https://doi.org/10.1016/S0743-0167\(02\)00068-2](https://doi.org/10.1016/S0743-0167(02)00068-2).

² The Telecommunications Act of 1996. Title 3, sec. 301. Retrieved from fcc.gov.

³ <https://www.fcc.gov/reports-research/reports/broadband-progress-reports>

⁴ Condon, Stephanie. “Stimulus bill includes \$7.2 billion for broadband. C/net, Feb 17, 2009. <https://www.cnet.com/news/stimulus-bill-includes-7-2-billion-for-broadband/>

⁵ Kruger, Lennard G. “Broadband Loan and Grant Programs in the USDA’s Rural Utilities Service,” Congressional Research Service, October 16, 20-18.

to serve libraries and schools,⁶ and the Rural Health Care Fund, which provides subsidies for telecommunications services for rural hospitals.⁷

These investments have made a difference. According to the FCC, 69 percent of the population in rural areas has access to fixed terrestrial broadband at the benchmark speeds of 25 Mbps/3Mbps in 2016, up from 46 percent in 2012.⁸ Mobile LTE with speed of 5 Mbps/1 Mbps reaches 98 percent of rural households, up from 63 percent in 2012.

Yet the gap between rural and urban access remains. Virtually all (98%) of households in urban areas have access to fixed broadband, a difference of 29 percent. While there is a slim gap between urban and rural areas in the deployment of mobile LTE with speeds of 5 Mbps/1 Mbps, deployment of mobile LTE with a median speed of 10 Mbps/3 Mbps is still much lower in rural (70 percent) than in urban (91 percent) areas.⁹ In rural counties with either isolated, sparsely settled geography or high-poverty/high-minority regions, this gap is even greater according to Rural America at a Glance 2017.¹⁰ The population on tribal lands has only 65 percent of the population with access to terrestrial broadband at the benchmark speed.¹¹ Particularly in situations where poverty has already become too much a part of the local economy, the additional hindrance imposed by inferior e-connectivity further limits the opportunities for residents to experience a higher quality of life, tap appropriate education and workforce training opportunities, leverage technological innovations, and develop viable economic opportunities.

THE CHALLENGE IN BRINGING BROADBAND ACCESS TO RURAL AMERICA

How can the nation's public research universities advance the important work of helping regions and individuals in need of connectivity? How can universities help them reach their individual and collective potential through vital network connectivity, content, and digital literacy? In May 2018, USDA's National Institute of Food and Agriculture's Rural Regional Development Centers (RRDCs), convened a stakeholder meeting around e-Connectivity in rural America.¹² The meeting participants defined a framework describing a spectrum of assistance universities can provide to help build capacity for effective e-connectivity.

⁶ "The History of the Future of E-Rate and Affordable Internet Access at Schools." Hack Education, March 8, 2017. <http://hackeducation.com/2017/03/08/history-of-e-rate>.

⁷ "Industry Voices—The FCC's Rural Health Care Fund Is a Victim of Its Own Success | FierceHealthcare." Accessed December 11, 2018. [/regulatory/rural-health-fund-fcc-telemedicine-remote-monitoring-finance](http://regulatory/rural-health-fund-fcc-telemedicine-remote-monitoring-finance).

⁸ The FCC defines the benchmark speed for meeting "advanced telecommunications capability: at 25 Mbps download/3 Mbps upload (25 Mbps/3 Mbps). See FCC, "2018 Broadband Deployment Report." Federal Communications Commission, February 5, 2018. <https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2018-broadband-deployment-report>. page. 6

⁹ FCC 2018, page 24.

¹⁰ U.S Department of Agriculture, "Rural America at A Glance, 2017 Edition" <https://www.ers.usda.gov/publications/pub-details/?pubid=85739>

¹¹ FCC 2018, p. 22

¹² The RRDCs, supported by the National Institute of Food and Agriculture (NIFA), provide rural communities access to the research and educational outreach capacity of public universities. For more information about RRDCs, see <http://rrdc.info/index.html>.

This spectrum of technical assistance and community development opportunities span six key areas:¹³

- **Awareness of Relevance**—Universities and their partners can help to raise awareness in communities about the benefits of broadband and encourage community leaders to consider taking steps to advance access. This involves educating the community about the potential opportunities as well as convening key stakeholders, gathering multi-generational input, and assessing community readiness.
- **Access and Availability**—How might stakeholders in areas currently lacking broadband infrastructure work together to change that? Universities can work with community partners to help a community gain or increase access to broadband by facilitating strategic planning, conducting feasibility studies, hosting stakeholder input meetings, and providing technical assistance for writing grant proposals. Affordability is a key concern among lower income populations that may have the most to gain from e-connectivity.
- **Adoption**—Providing broadband infrastructure is not sufficient to encourage adoption. Universities and their partners can help people, businesses, and governments within areas that recently acquired broadband infrastructure understand and take the steps required to access the infrastructure and the services it provides. People might need to be convinced of the value of the resources required—both the time invested to learn how to use it and the financial requirements. The costs and benefits must be clearly outlined and communities must consider how to help those with limited financial resources connect in ways that will have a meaningful impact on their lives.
- **Utilization**—Once people have access to broadband and have decided it makes sense to use it, how do they acquire the skills needed to find and use the information, applications, and opportunities to improve their business, their decision making, their productivity, and their quality of life? Universities can work with partners to provide multi-layered digital literacy training with consideration for the needs of various audiences that may need assistance. This training will be most effective by building community-level partnerships among entities that can provide the direct assistance with training needs. Additionally, training on cyber security issues is essential to protect these new users from potential harm.
- **Content**—Universities provide content that makes broadband access valuable for rural residents, farmers, businesses, and communities, including online degree programs, outreach/extension training for small businesses, and data-driven decision support for public officials.

¹³ “Regional Rural Development Centers” <http://rrdc.info/rural-america/rrdc-full-packet-updated.pdf>

- **Research and Technology Development for Alternative Broadband Provision Models**—Universities research alternative business models and technologies for providing broadband access that reduce the cost of access especially for rural areas. APLU member universities are already working on a variety of alternative broadband access models. Additionally, research that informs policy decisions, clarifies barriers to adoption and utilization, and explores linkages between access and quality of life issues such as health outcomes and education are vital to closing the digital divide.

UNIVERSITIES EXPANDING E-CONNECTIVITY: AN ECONOMIC AND COMMUNITY DEVELOPMENT OPPORTUNITY

Public research universities have long been engaged in rural communities, contributing to



the economic welfare, well being, and quality of life of communities across the nation. Land-grant institutions, through their Cooperative Extension programs, work directly with rural populations on wide ranging topics including broadband access and e-connectivity. More broadly, university units supporting community engagement, public service, and outreach allow institutions to maximize benefits to rural communities through a variety of programs and services including engagement with K-12 schools, improving public health, advancing food security, and providing environmental and agricultural technical assistance. Rural

communities also benefit from university efforts to build economic resilience by advancing the technological and entrepreneurial ecosystems of their states and communities.

Included in all these areas of work are efforts to expand broadband access, uptake, and valuable content in rural areas, develop new business models for broadband, and develop and test technologies that reduce the per-user cost of broadband in sparsely populated areas. Universities have already contributed to the development and adoption of the Internet, and now they are working to ensure that Americans reap the rewards of technology that can connect them to opportunities for learning, business, and improved quality of life.

The examples highlighted here are only a fraction of what universities can and should do to assist rural communities in gaining access to and benefiting from e-connectivity in ways that residents, institutions, and businesses in urban areas take for granted.

Each of these efforts is realizing important impacts. However, each addresses only one or two parts of the broader set of barriers to broadband access and utilization. There is a considerable opportunity for universities and their partners to strategically address not just one but **all six** of the opportunities described above. These collective efforts will not only expand e-connectivity and access but also ensure such access yields societal and economic advancement for rural America.

APLU WORKS WITH MEMBERS ACROSS NORTH AMERICA

The Association of Public and Land-grant Universities (APLU), North America's oldest higher education association convening the presidents, provosts, senior research officers and other decision makers across 241 public research universities, university systems and partner organizations across the U.S., Canada, and Mexico, proposes an initiative to expand e-connectivity in rural America by addressing challenges in awareness, access, adoption, utilization, content, and research. APLU's Office of Economic Development and Community Engagement will lead this project in collaboration with APLU's Office of Food, Agriculture, and Natural Resources and key internal and external stakeholders.

NEXT STEPS:

- Research existing approaches to determine which might provide the best opportunity to achieve scale.
- Develop strategies for scaling business models, training, content, and technologies that will enable and maximize the benefits of improved connectivity to rural areas.
- Implement scaling through partnerships with local, state, and national policy makers, universities, and their stakeholders.

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UNIVERSITIES LEADING BROADBAND ACCESS AND USAGE IN RURAL AREASⁱ

AWARENESS OF RELEVANCE

The University of New Hampshire's New Hampshire Broadband Mapping and Planning Program (NHBMPP) investigates broadband availability in New Hampshire, researches how it can be made more widely available in the future, and demonstrates methods for increasing broadband adoption and usage. The mapping aspect of this program includes a broadband availability inventory and mapping effort and a suite of planning and technical assistance initiatives. In addition, the program assists in the identification of barriers to broadband adoption and their potential solutions, including the development of a broadband funding and solutions toolkit. A resource team is available to assist communities in assessing their readiness to begin implementing broadband plans.

North Carolina State University's ReCONNECT program is focusing, in 2019, on how and why North Carolinians need to be more connected. One of the important issues being discussed in this series of forums is the importance of broadband internet in every community of the state.

Oklahoma State University's e-commerce program assists small businesses in understanding why e-commerce is important and how they might use the internet to grow sales and improve their efficiency.

The Carl Vincent School of Government at the University of Georgia conducted a survey of households about the availability and sufficiency of broadband internet. With 12,400 responses, the survey was used to inform policy makers about the need for additional resources to make broadband available in the state and to design the Georgia Broadband Initiative.

Penn State University's X-Lab has developed a national broadband mapping initiative that tests broadband speeds at the household level and maps the results. To date, over 11 million responses have assisted in mapping broadband speeds across Pennsylvania in the past year.

Purdue University manages the Intelligent Communities Extension Program (ICEP). ICEP was first developed in Mississippi but is currently being piloted in Indiana and Nebraska rural communities. ICEP is community driven and utilizes the community development self-help approach and the Intelligent Community framework to help rural communities transition to, plan for, and prosper in the digital age. The ICEP is a process that consists of awareness, asset mapping, implementing & documenting, and recognition. Extension personnel and resources play a critical role in this process.

ⁱ These examples are derived, in part, from a survey conducted by APLU in February of 2019. We received 25 responses to the survey as of March 29, 2019. These survey responses identified web sites and contact information for each of the projects. APLU staff used the contact information provided in the survey to obtain information and summarize each project.

Washington State University Extension has developed a **Broadband Action Team** model to help increase broadband awareness, access and use. Broadband Action Teams include representatives from leaders of public, private and non-profit organizations to interested citizens and elected officials. These teams meet regularly to discuss broadband challenges and opportunities, expanding local knowledge and the capacity to take action to improve broadband.

ACCESS AND AVAILABILITY

Michigan State University is a partner in the **MERIT** network in Michigan. Governed by 12 public universities in the state of Michigan, MERIT provides a backbone of support to community-facing organizations, including networking, security, and community services.

Northern Illinois University's Division of Information Technology partnered with school districts, colleges, municipalities, hospitals, and federal labs to create NIUNet. Funded with a \$68 million grant from the National Telecommunications and Information Administration's (NTIA's) Broadband Technologies Opportunities Program (BTOP) **NIUNET** is a roughly 175-mile fiber optic loop throughout the western Chicago suburbs and greater northern Illinois region, consisting of both newly constructed segments and previously unused leased underground fiber. NIU established Illinois Fiber Resources Group (iFiber) a not-for-profit to own and operate the network.

A 10 county region now has 100 Gigabit high-speed broadband access capabilities directly into NIU and the state's education network. These efforts have led to over 600 Community Anchor Institutions (CAI's) that have high speed broadband access capabilities which includes: 7 Community Colleges, 227 K-12 Buildings, 51 Libraries ; 221 Health Care Organizations; 90 Public safety offices, and 126 State, county, and local government offices. NIU is also the founder of Illinois Rural HealthNet (IRHN), a high-speed, 3,100-mile, fiber-optic network revolutionizing healthcare in rural areas by creating a fiber-optic network linking hospitals and clinics to a statewide Health IT network. The IRHN allows healthcare providers to connect to the fiber backbone and exchange vital information over a dedicated healthcare network at speeds up to 1 Gig. NIU has assisted in the design, development and implementation of many other northern Illinois networks including Illinois Technology Triangle for Economic Development (NITT), Illinois Municipal Broadband Communications Association for Economic Development (IMBCA), Northwest Municipal Broadband Authority (NBMA), DeKalb Advancement of Technology Authority (DATA), and TriLightNet a medical network for HIE development and healthcare.

Ohio University is conducting the US 33 Corridor Broadband Feasibility study—a plan to guide the potential future development and deployment of broadband internet services in the areas of Athens, Hocking, Meigs, Morgan, Perry, and Washington Counties in Ohio. The study will identify assets, services, and other key material that would contribute to the designation of US Route 33 from Groveport to Belpre as a new “high tech corridor.”

Oklahoma State University's Division of Agricultural Sciences and Natural Resources plans to enhance broadband access to residents in some of the state's more rural areas by partnering with select public libraries--currently eleven libraries with plans to add new ones each year. Each library receives multiple hotspot devices with unlimited data for a full year. These devices can be lent to patrons to provide broadband access.

Penn State University's X lab is a key partner in the [TV Whitespace network](#) that is closing the homework gap and providing reliable broadband service to local businesses by extending library bandwidth to more residents and businesses.

Purdue University's Center for Regional Development works with local communities in partnership with the Indiana Office of Community and Rural Affairs to conduct broadband readiness planning for local communities.

The University of Illinois helped establish the [Urbana-Champaign Big Broadband \(UC2B\)](#) project, receiving over \$22 million in funding through [NTIA's](#) Broadband Technology Opportunity Program. UC2B is both an internet service provider and a physical fiber-optic broadband infrastructure. The success of UC2B at the local level was supported by stakeholders representing public, private, and governmental institutions, including the University, the City of Urbana, the City of Champaign, and service provider 13Broadband.

University of Tennessee, Knoxville Extension has a [Rural Library Mobile Internet Hotspot Program](#) that provides mobile hotspots to the public libraries in Bledsoe, Hancocks. and Wayne counties. The hot spots are available to residents at no cost for two or three days. Using data from a survey completed by the program's users, the university will evaluate the program's impact on users' quality of life.

The University of Texas at Austin's [Technology and Information Policy Institute](#) has several projects that investigate the effectiveness of a variety of digital inclusion strategies, including rural library-based mobile hotspot programs. The team has developed a "best practices" guide for rural hotspot lending.

Virginia Tech has an [e Corridors Program](#) that works with communities, private-sector, and municipal partners to facilitate rapid development of advanced, fiber optic, wireless, and "next generation" internet infrastructure across Virginia's southern region with plans to expand into the east and north. Through multiple community and regional based initiatives, this program proposes to put the world's most advanced communications infrastructure within reach of every community in Virginia. Virginia Tech has also received a grant from [NTIA's](#) Broadband Technologies Opportunities Program (BTOP) to extend Virginia's open-access fiber optic backbone from Bedford to Blacksburg - passing through several rural under-served communities in Montgomery, Giles, Craig, Botetourt, Roanoke, and Bedford counties. The university partnered with Mid-Atlantic Broadband Cooperative (MBC) to build and operate the fiber as an extension of MBC's open-access network.

The Ohio State University's 100 Gbps Network & Innovation Center has been instrumental in ensuring Ohio leads the nation in the broadband internet speeds. They are also leading the Ohio Middle Mile Consortium to develop a comprehensive statewide plan to expand broadband infrastructure throughout the state. With Connecting Rural Ohio, they are helping underserved communities achieve broadband internet connectivity through wireless technologies.

The University of North Carolina System is an important partner in [MCNC](#), a nonprofit operator of the North Carolina Research and Education Network, providing broadband connectivity, support, and technology services to community anchor institutions for almost 30 years.

Washington State University Extension has a Stevens County/Spokane Tribe [Broadband Action Team](#) that has completed many projects to improve access, adoption, and awareness of rural broadband issues in Stevens County and beyond. This team has raised awareness of the lack of broadband adequacy in Stevens County for fighting wildfires and other essential needs for education, economic development and healthcare. Team members have presented to multiple funders and potential partners at the Washington statewide infrastructure conference technical teams, national broadband webinars, submitted comments to federal policy and program rural making requests and developed recommendations for improving federal broadband maps.

Wayne State University is a founding partner in the [Community Telecommunications Network](#), which aims to enhance learning and quality of life in southeast Michigan through the creative use of telecommunications and digital technologies.

ADOPTION

Michigan State University, North Dakota State University, Ohio State University, Texas A&M, University of Georgia, University of Maine, University of Wisconsin, and Washington State University are partnering with the National 4-H Council (the youth outreach program of the Cooperative Extension Services and the United States Department of Agriculture) and Microsoft to empowering teens to create opportunities for people to participate in the digital world in unique ways. Teens work with 4-H educators, broadband service providers, community members, civic leaders, Microsoft, and Extension educators to help people understand and benefit from the high-speed connectivity provided by broadband access.

Mississippi State University's [Bricks to Clicks Marketing Program](#) helps businesses develop and implement plans to use e-commerce and social media to increase their revenue.

Penn State University's [Center of Rural Education and Communities](#) has convened a Rural Telecommunications Working Group comprised of faculty and K-12 educators who are exploring different options for providing broadband and digital literacy in rural areas.

Purdue University Extension Community Development Digital Ready initiative advances the capacity of small businesses to strengthen their knowledge and application of broadband strategies. Through interactive workshops and online courses led by a statewide team of Purdue trainers, participants learn about the importance of the digital economy, how to incorporate digital strategies in the workplace and build technical knowledge.

The University of Wisconsin Extension Center for Community & Economic Development has launched a “Connected Aging Community” project. Funded by Bader Philanthropies, the project pairs elderly residents with youth to improve intergenerational social infrastructure, help older adults adopt technology, and ensure independent living by elderly residents.

Washington State University Extension Stevens County partnered with the Stevens County Library System to put together a “gadget garage”—a box of digital tools that help interested individuals and businesses test out various devices for accessing the internet. They have also done tech expos that include workshops and booths to help people learn about and choose internet service providers as well as test driving gadgets and computers. The team has supported coding events, a rural high school robotics team and offered digital skills training.

UTILIZATION

Georgia Southern University’s Business Innovation Group operates an **Innovation Incubator** that provides space for entrepreneurs along with assistance and access to reliable internet service and other technology.

Mississippi State University’s The Southern Rural Development Center manages the **National Digital Education Extension Team**, which is made up of Extension professionals and interested partners passionate about digital applications. NDEET believes Extension can play a unique and significant role in educating communities across the country on the challenges and opportunities of the digital age. NDEET is also a network of faculty, educators, and specialists that compiles a list of educational and planning resources used to increase awareness, access & availability and adoption & utilization of broadband. In addition, NDEET conducts research to further contribute knowledge and best practices to these efforts.

North Carolina State University has partnered with the Research Triangle Institute to host a workshop funded by the National Science Foundation (NSF) entitled, “Taking Data Science to America’s Emerging Workforce.” At this workshop, participants discussed how Cooperative Extension might assist in building capacity for data science in rural areas.

Purdue University’s Intelligent Communities Extension Program (ICEP) is a pilot that was first developed in Mississippi but is currently being applied in Indiana and Nebraska rural communities. ICEP is community driven and utilizes the community development self-help approach and the Intelligent Community framework to help rural communities transition to, plan for, and prosper in the digital age.

The ICEP consists of awareness, asset mapping, implementing & documenting, and recognition. Extension personnel and resources play a critical role in this process.

Virginia Tech has been involved in access to the internet for Blacksburg for a very long time. In 1991, Virginia Tech's Vice President for Information Technology developed the concept for the Blacksburg Electronic Village or BEV, as an outreach project; it officially launched in 1993. The goal of the project was to develop an online community linking the entire town via a municipal broadband network, with assistance from the Town of Blacksburg and then Bell Atlantic (later renamed Verizon). Extensive outside research had been done by sociologists and computer scientists on this project. It has been noted as one of the most important assets that Blacksburg has besides Virginia Tech itself. Over the years, the initiative has contributed to the modernization of internet service throughout Blacksburg, as 87% of Blacksburg residents used the Internet regularly by the late 1990s. In 1998, the town was chosen by Guinness World Records as the "Most Wired Community." If it were not for the BEV, it would be doubtful that the town could have achieved such a record.

Northern Illinois University, through its development of Illinois Fiber Resources Group (iFiber), is designing and developing high-speed fiber optic build outs to numerous business incubators, industrial and technology parks throughout northern Illinois bringing economic development and expansion to many rural regions. It is fostering the development of e911 in rural regions along with other similar collaborations designed to bring together key government programs and services to better serve rural areas.

Penn State University's Pennsylvania Technical Assistance Program has developed a broadband communities program that works with local communities to plan, design, and deploy improved broadband service. They have also assisted businesses in effectively using websites and social media for increasing revenue.

The University of Georgia provides [cyber security training for small businesses](#), with advice on protecting business data, training employees on proper security etiquette; preventing a hacker from using your business as a gateway to another company's systems; and finding ways to grow business as a result of having a strong cyber security strategy.

The University of Illinois Digital Leadership Innovation program is partnering with Extension to improve digital literacy skills statewide. The goal of DILP is to expand opportunities for entrepreneurship, innovation and economic and social development through digital manufacturing and fabrication, digital media production, and data analytics.

Washington State University Extension Stevens County, in partnership with the regional Economic Development District has developed and delivered "digital day camps" working side-by-side with businesses to improve their marketing and revenue with digital tools such as Facebook and Mailchimp.

DEVELOPING CONTENT

Oregon State University Cooperative Extension offers Klamath Community College graduates an opportunity to work toward an Oregon State University online bachelor's degree in agricultural sciences and receive on-the-ground mentorship and support during their studies. This is just one example of the programs being offered through [OSU Open Campus](#), a community-based education partnership convened by Oregon State University and providing local access to learning that addresses the unique educational needs of Oregon's communities.

Northern Illinois University's Center for Governmental Studies offers local governments its CGS Local Efficiency Assessment Plan (LEAP) Dashboard, which provides information needed to improve the efficiency of service delivery in Illinois local governments. It allows practitioners to compare school districts, counties, municipalities, and pension plans on subjects such as revenue composition, spending by purpose, staffing levels, and property tax rates.

Penn State University's The Pennsylvania Technical Assistance Program offers a variety of content for entrepreneurs via webinars. Subjects include building management, energy efficiency, alternative revenue generation models, etc.

University of Nevada Cooperative Extension provides several of its programs fully online, including a 4-H volunteer training, an online pesticide safety training, and a child care provider training.

University of New Hampshire Cooperative Extension has begun developing much of their farmer education in online platforms that can be accessed from anywhere using Zoom.

Washington State University Extension has developed a national award-winning distributed conference model that uses broadband to reach multiple rural communities simultaneously offering national expertise and facilitated work sessions on topics including women in agriculture, entrepreneurship, opioid issues, and workforce development opportunities.

RESEARCH AND TECHNOLOGY DEVELOPMENT FOR ALTERNATIVE BROADBAND PROVISION MODELS

Cornell University has conducted research on how rural broadband adoption affects economic outcomes in rural areas; they have also explored the economic feasibility of alternative business models for rural broadband provision.

Georgia Southern University's Wireless Internet and Networking Systems (WINS) Laboratory is located at the Department of Computer Science, Georgia Southern University, Statesboro Campus. WINS strives to create cutting-edge research and development efforts in the wider range of telecommunications and wireless connectivity for the betterment and improvement of lifestyles.

Iowa State University's College of Engineering [received an NSF grant to develop CyNet](#), a network that collects information from different sources and stores the data in a cloud. The CyNet cloud will be located on campus in a database. CyNet will absorb data, such as phenotypes of plants in agriculture, or gather data from vehicles to study. This network will make retrieving data more efficient by quickening the time it takes to gather information and allowing researchers to study the data on campus without having to leave their offices.

Massachusetts Institute of Technology incubated [Altaeros Energies](#) when two of its founders were MIT students who received a Small Business Innovation Research (SBIR) award. Altaeros provides airborne telecommunications platforms that can make rural mobile broadband more cost effective than tower-deployed technologies.

Michigan State University's [Quello Center](#) focuses on research that informs the public debate on a myriad of media, communications and information issues including internet access. [A recent study](#) examined the potential for using wireless technologies to leverage fiber backbone networks and cost-effectively extend high-speed connectivity deeper into the nation's currently underserved communities such as in deep rural and distressed areas.

Penn State University's [Information Communication Technology for Development Consortium \(ICT4D\)](#) conducts research that quantifies the economic benefits of information technology investments and the costs of inadequate broadband access for rural communities.

Penn State University's [Institute for Information Policy](#) is conducting research of issues related to broadband policies and their impact on broadband access and utilization in rural areas.

Purdue University's Center for Regional Development has produced a [Digital Divide Index](#) that combines several variables that measure broadband infrastructure and adoption for each census tract in the United States. This index is being used to support research about the factors that influence the digital divide as well as its impacts.

Purdue University's Department of Agricultural and Biological Engineering is working with the [Wabash Heartland Innovation Network \(WHIN\)](#) to assess the potential of Smart Agricultural technologies to improve yields and reduce costs of farmers in north-central Indiana.

University of Georgia's Carl Vincent Institute of Government has provided overall research, surveying, and technical support for the Georgia Legislature in developing legislative proposals to address the digital divide.

University of Georgia's [CyberArch Program](#) is working with Two communities in Georgia — Hart County and Griffin/Spalding County — to pilot the CyberArch program, which connects business and civic leaders with faculty from UGA Public Service and Outreach, the UGA Institute for Cybersecurity and Privacy and the broader Georgia Informatics Institutes for Research and Education at UGA. The initiative will help businesses and communities identify ways to safeguard against potentially devastating cyberattacks.

Virginia Tech's e corridors program developed a series of in-depth reports providing a roadmap for revitalization through investment in advanced network infrastructure.

Washington State University Extension's Stevens County/Spokane Tribe Broadband Access Team was one of a dozen teams selected to participate in the National Telecommunication and Information Administration (NTIA) Broadband Connectivity Assessment Tool beta test pilot. The project provided access to data and other resources resulting in a report to guide team activities. This team, and a similar extension-led Ferry County team, have designed and delivered community broadband surveys to determine what Internet services are available in the counties, home Internet access, how it is used, interest in additional Internet services, and the barriers to obtaining adequate service



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