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RURAL BROADBAND AVAILABILITY AND ADOPTION IN OKLAHOMA

Brian E. Whitacre
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Rural areas generally lag behind their urban counterparts in terms of broadband Internet access, a discrepancy commonly known as the "digital divide." Nationally, the divide was approximately 12 percentage points as of 2009, with 54% of rural households adopting broadband access compared to 66% in urban areas (NTIA, 2010). A large body of work has attempted to uncover the underlying causes of the divide, with the implication that shrinking the gap will positively benefit rural communities economically and socially (Strover, 2001; Malecki, 2003; Whitacre, 2010). The policy prescriptions resulting from this work have focused on one of two sides: supply—the availability of broadband infrastructure, such as cable Internet lines or Digital Subscriber Lines (DSL)—and demand—increasing adoption rates when broadband is available. In particular, the American Reinvestment and Recovery Act (ARRA) included funding both for broadband infrastructure grants/loans and for programs to encourage sustainable adoption.

This paper uses the state of Oklahoma as a case study in examining both the availability of broadband access and adoption rates in rural vs. urban areas in three distinct time periods: 2003, 2006, and 2009. As might be expected, wired broadband availability first clustered in urban areas across the state, but diffused rapidly over time and became nearly equal by 2009. Similarly, adoption rates increased dramatically across the state, and although a significant rural-urban gap still exists, it has noticeably decreased as infrastructure and Internet awareness becomes more prevalent in rural areas. The paper concludes with a discussion of policy implications, noting that future efforts to close the rural-urban digital divide should emphasize demand-side policies rather than the traditional supply-side focus.

Supply Data

The federal government's primary source of data regarding broadband infrastructure is the Federal Communication Commission's Form 477. However, these data reveal where broadband subscribers currently exist and not necessarily where the infrastructure itself exists. Since Form 477 collects data from all providers of broadband access and asks them to report ZIP codes where they have customers, a single satellite subscriber in a rural area could give that ZIP code the illusion of having "wired" access. This is one reason why Form 477 indicated that as of December 2005, 99.9% of the most populated ZIP codes had broadband access, and even showed that 96.2% of the least-populated ZIP codes had broadband access. Thus, using this data source might suggest that there is little problem with broadband availability in rural America.

However, the noted issues with this data suggest that alternative sources should be used to attempt to map out the existence of broadband infrastructure. In particular, the two dominant sources of residential broadband infrastructure have been cable Internet and DSL, together making up over 80% of the residential market (FCC, 2009). Maps of the availability of cable Internet access are documented in Warren Publishing's annual *TV and Cable Factbook*, which lists every cable system in a state, denotes the communities served, and indicates whether or not cable Internet is offered. Similarly, the National Exchange Carrier Association Tariff #4 Dataset lists all telephone central offices in a state, the communities they serve, and whether or not they offer DSL access. These sources can be mapped to ZIP codes to document the existence of wired broadband infrastructure across a state. Data were collected from these sources in 2003, 2006, and 2009.

The use of ZIP codes is not a precise representation; no publicly available information exists on the exact locations passed by either cable Internet or DSL lines in Oklahoma. In particular, some large ZIP codes depicted as having access may not be fully served, particularly for the more rural portions. However, in the absence of service provider maps, the data used is the next-best alternative.

Figure 1 displays a map of the rural and urban ZIP codes in Oklahoma, taken from approximations to rural-urban commuting area (RUCA) codes provided by the U.S. Department of Agriculture's Economic Research Service. Codes 1-3 of this categorization are considered urban, while codes 4-10 are considered rural. Maps displaying the availability of broadband infrastructure in 2003, 2006, and 2009 are shown in Figures 2—4.

Figure 1: Rural and Urban ZIP Codes in Oklahoma

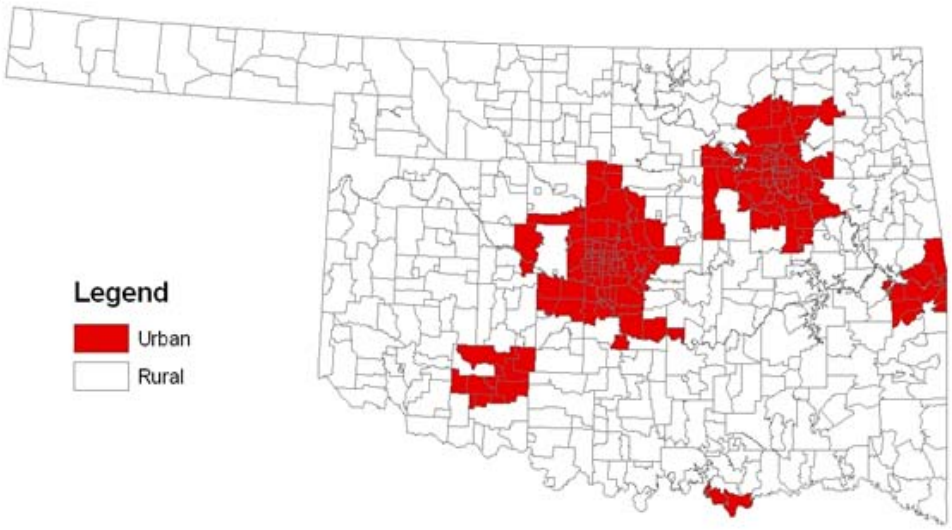
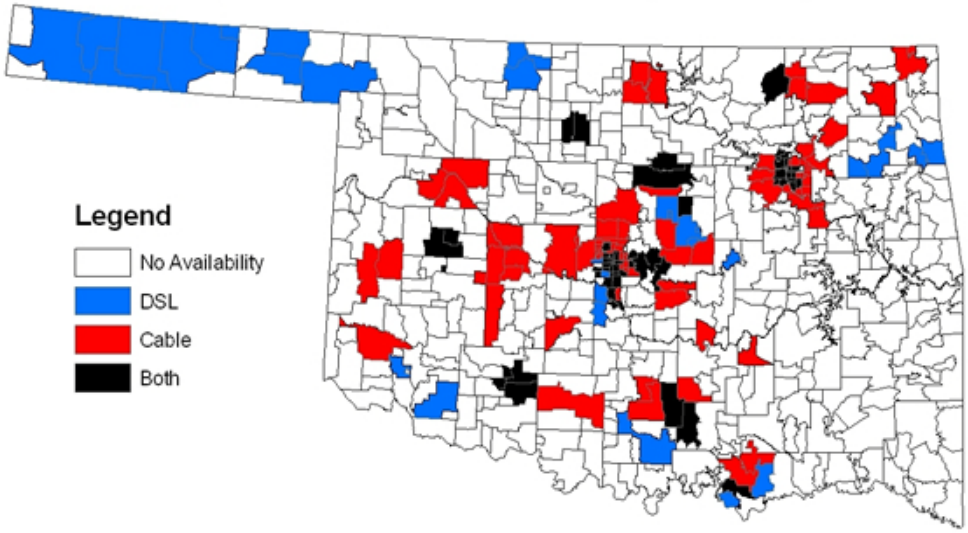


Figure 2: 2003 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)



As these figures indicate, the initial placement of broadband infrastructure by DSL and cable providers was focused on the more urban locations across the state. However, a notable exception is the western panhandle, which is extremely rural and yet was serviced by DSL in 2003. Broadband infrastructure diffused notably over the years and became much more available by 2009, although the heavily forested southeastern part of the state remains mostly unserved. Figure 5 shows the percentage of rural and urban

residents with broadband infrastructure available to them in each of the three years.

Clearly, urban residents had significantly higher levels of infrastructure availability in 2003. By 2006, however, the gap had shrunk significantly; and by 2009, availability was nearly equal. It is worth noting that the Oklahoma legislature passed a broadband parity bill in 2002, which was widely credited with increasing DSL deployment across the state. This bill ended the requirement for incumbent telephone providers to share their lines with competitors across the state, and the percentage of telephone central offices offering DSL increased dramatically: from 10% of all offices in 2003, to 21% in 2006, and to 66% by 2009.

Figure 3: 2006 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)

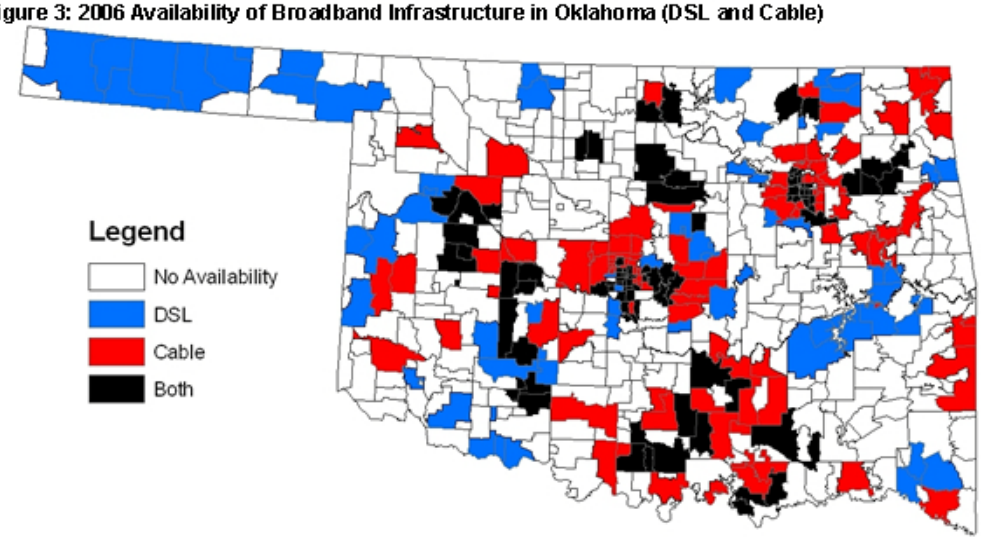
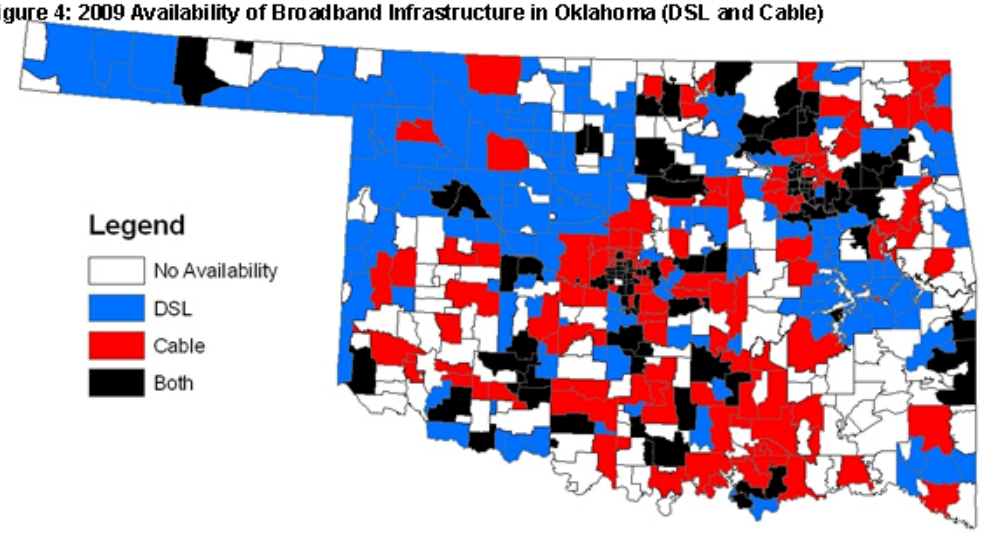


Figure 4: 2009 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)

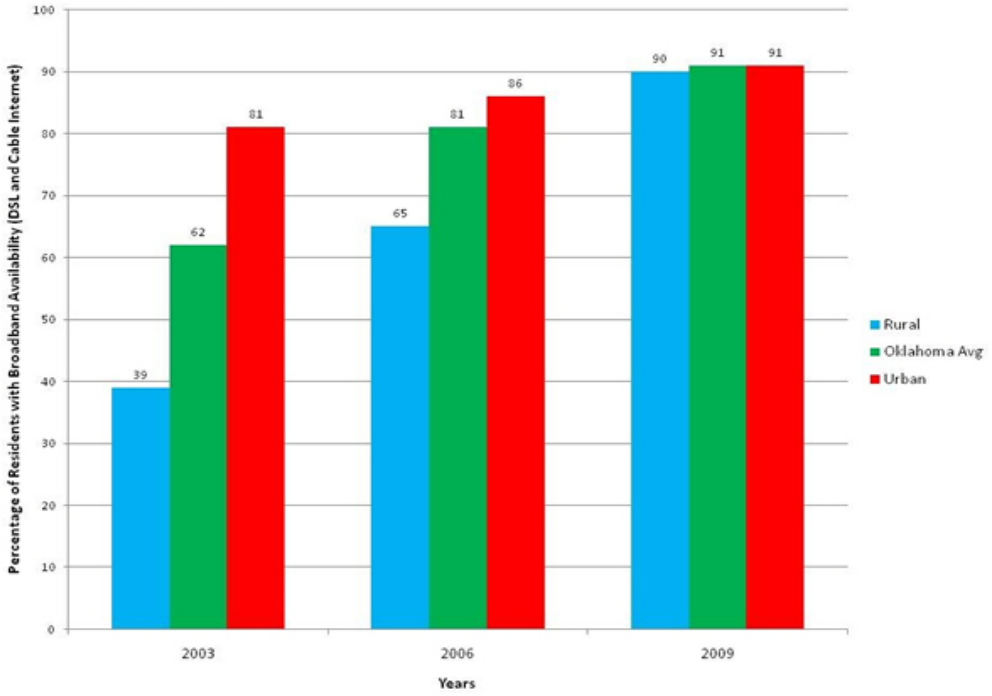


Demand Data

Data on levels of broadband adoption came from three distinct surveys. In 2003 and 2006, the Bureau for Social Research at Oklahoma State University conducted telephone interviews of approximately 1,200 households across the state. The households interviewed were not the same in both years, but were representative of the state when survey weights were applied. In 2009, the Current Population Survey

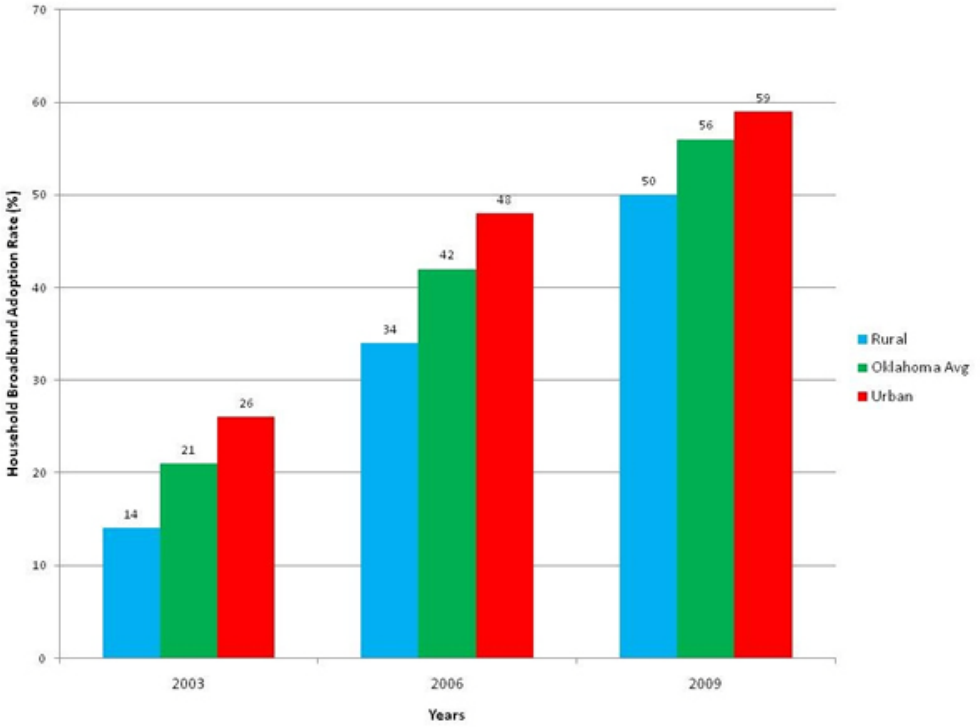
conducted a national level telephone survey regarding broadband adoption, and in doing so contacted 1,500 households in Oklahoma. Respondents were asked demographic questions in addition to inquiries into their use of broadband Internet from home. “Rural” households were determined by ZIP-code level RUCA approximations in 2003 and 2006, and traditional Office of Management and Budget definitions in 2009. Both definitions use the same cutoff point of population less than 50,000 for determining whether a location is rural, so the results are comparable. Figure 6 shows the rural, urban, and state averages for broadband adoption rates over the three years.

Figure 5: Percentage of Rural and Urban Oklahoma Residents with DSL or Cable Internet Availability, 2003 – 2009



The general pattern of increased adoption rates for the entire state speaks to both the increased availability of infrastructure and higher levels of awareness about the benefits of broadband access (Whitacre, 2010). While the rural-urban gap in adoption rates slightly increased between 2003 and 2006 from 12 percentage points to 14 percentage points, it shrunk to 9 percentage points in 2009. This is similar to what has occurred nationwide, with the rural-urban broadband digital divide decreasing from 15 percentage points in 2007 to 12 percentage points in 2009 (NTIA, 2010). Another interesting point from the NTIA report is the decreased reliance on dial-up Internet access in both rural and urban areas. Nationally, use of dial-up Internet service was cut in half over the period 2007-2009—from 19% to 9% for rural areas and from 9% to 4% for urban centers .

Figure 6: Household Broadband Adoption Rates for Rural and Urban Oklahoma Residents, 2003 - 2009



Policy Implications

Both the maps of infrastructure availability and the household adoption data suggest that broadband access is increasing in popularity across Oklahoma. While a significant rural-urban digital divide remains, it decreased over the period 2006-2009. Assuming that policy makers have a goal of increasing broadband adoption rates in rural areas, what are the best steps forward?

To date, most federal policies dealing with rural broadband have focused on the supply side of the picture. In particular, Community Connect grants and rural broadband loans from the U.S. Department of Agriculture have funded new broadband infrastructure in rural and underserved areas, providing over $1.5B in funding since 2002 to projects impacting more than 1,500 communities. However, the vast majority of broadband infrastructure investments was made by private companies providing cable and phone service, and resulted from their own response to market conditions. Since 2002 the state of Oklahoma has received numerous federal grants related to broadband infrastructure. Twenty Community Connect grants are on record; but nearly all of these were for wireless systems associated with relatively small numbers of recipients. Most rural Oklahomans received infrastructure improvements as a result of their cable or phone companies' investments.

More recently, the American Reinvestment and Recovery Act (ARRA) included approximately $7.2B for rural broadband efforts, and again focused mostly on the provision of infrastructure. This funding was split between the Rural Utilities Service ($2.5B) and the National Telecommunications and Information Technology ($4.7B). $350 million was included in the NTIA funding to develop and maintain comprehensive maps of existing broadband service capability and availability. These maps should be constructed at a lower level of detail than the ZIP-code level maps created in this article, and should help with future allocation of infrastructure funding by showing exactly where such infrastructure is lacking. The ARRA funding included some explicit demand-side programs, such as the $250 million allocated to the NTIA to encourage sustainable adoption. This represents less than 3.5% of the total broadband-related funding included in the act. A review of the available empirical evidence, however, implies that prioritizing supply-side funding is misguided.

Most academic research on the topic suggests that policies seeking to raise rural broadband adoption rates should focus primarily on the demand component. When asked why they did not have broadband access from home, the dominant response for rural households was “Don’t need/not interested” (NTIA, 2010). “Not available” ranked as #4 on the list of reasons, behind “too expensive” and “no computer.” Introducing rural individuals to broadband access and demonstrating why it is useful for them will likely have the largest impact on broadband adoption rates in rural areas. At least two recent papers have focused on existing demand-side programs and discuss many potential solutions, including subsidizing access and digital literacy programs (Hauge and Prieger, 2009; Atkinson, 2009). Hauge and Prieger (2009) also point out the need for rigorous program evaluation, since most efforts fail to compare their results to a counterfactual—what would have happened in absence of the program. This is particularly important as knowledge about broadband continues to diffuse to the general population, regardless of whether or not a demand-side program is in place.

Of some concern to rural advocates is the recent goal set by the FCC of “100 Squared”—100 million homes using 100 megabits per second (Mbps) service by the year 2020 (Genachowski, 2010). This goal is part of the National Broadband Plan developed by the FCC. The current average U.S. broadband speed is only 3.9 Mbps. While not a formal policy with any funding behind it, this goal nevertheless indirectly suggests that a disparity in the speed of service provided is acceptable. If driven by market conditions, as the initial broadband roll-out was, there is little doubt that the 100 million homes served would primarily be found in urban areas. By pushing for only 100 million homes and not ubiquity, the FCC is essentially encouraging a next-generation digital divide where rural areas cannot accomplish the same online tasks as their urban counterparts.

Education to Improve Rural Broadband Adoption

Since most Extension faculty at land-grant universities across the nation interact with rural constituents, they and others can play a significant role in encouraging rural broadband adoption. For example, many farm assistance programs offer courses on QuickBooks or other financial programs. These could easily be extended to how to use the Internet to do simple tasks like using eForms to complete and submit a Farm Service Agency program form, monitor prices on their products, or order inputs. Those involved in health education can show residents what trusted sources of medical information are out there, and discuss best practices in using the information. This would include using online information in conjunction with, not as a substitute for, a visit to the doctor. Videos discussing impending medical procedures can be particularly useful. Similarly, individuals involved in rural development often interact with small business owners who can benefit from courses on basic website setup or selling their product using online retailers. Many programs have already been developed under the Southern Rural Development Center’s e-commerce curricula, discussed elsewhere in this issue, and are ready for implementation. Regardless of the program, the focus should be on demonstrating to a rural resident why they should make the investment in broadband—what is the benefit to them?

In Oklahoma, Extension personnel have implemented an extensive e-commerce curricula focusing primarily on small business owners. Individual workshops are hands-on in nature, typically performed in a computer lab with broadband connections. A multitude of concepts are demonstrated that small business owners might find useful, from planning and actually building a website to search engine optimization and incorporating social networks into a business plan. Other workshops promote general knowledge about the benefits of broadband, such as “social networking for everyday people” which attracts retirees wanting to learn about Facebook, provides examples of how Twitter can be used professionally, and demonstrates how Internet forums can connect people with shared interests. Future plans include taking Hauge and Prieger’s suggestion to heart, and performing detailed program evaluation that demonstrates the benefits provided to the rural communities engaged.

Ultimately, improving broadband access rates in rural America requires that broadband infrastructure be available, and that the benefits to rural citizens exceed their costs. Data from Oklahoma suggest that the availability of two dominant sources of broadband infrastructure has made dramatic improvements during the 2000s, and rural availability rates are now similar to those in urban areas. Future supply-side policies will likely be required to address individual cases of neglected communities, aided by availability maps that are created on the census block level. More important, however, are demand-side policies that encourage adoption. While debates will likely continue over the best programs to influence adoption—including increased competition, subsidized access, or computers—land-grant faculty and others can play a role by

disseminating knowledge about the benefits of broadband in the context of their current programs.

For More Information

Atkinson, R.D. (2009). Policies to increase broadband adoption at home. *The Information Technology and Innovation Foundation*. Available online: http://www.itif.org/files/2009-demand-side-policies.pdf .

Federal Communications Commission (FCC), Industry and Analysis and Technology Division. (2009). High-speed services for Internet access: Status as of June 30, 2008. Available online: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296239A1.pdf .

Genachowski, J. (2010). Broadband: Our enduring engine for prosperity and opportunity. Prepared remarks of FCC chairman for NARUC conference. Available online: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296262A1.pdf .

Hauge, J.A., and Prieger, J.E. (2009). Demand-side programs to stimulate adoption of broadband: What works? *Social Sciences Research Network*. Available online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1492342 .

Malecki, E.J. (2003). Digital development in rural areas: Potential and pitfalls. *Journal of Rural Studies*, 19(2), 201-14.

National Telecommunications and Information Administration (NTIA). (2010). Digital nation: 21st century America's progress toward universal broadband Internet access. U.S. Department of Commerce. Available online: http://www.ntia.doc.gov/reports/2010/NTIA_internet_use_report_Feb2010.pdf.

Strover, S.L. (2001). Rural Internet connectivity. *Telecommunications Policy,* 25(5), 331-47.

Whitacre, B.E. (2010). The diffusion of Internet technologies to rural communities: A portrait of broadband supply and demand. *American Behavioral Scientist,* 53(9), 1283-1303.

Brian Whitacre (brian.whitacre@okstate.edu) is an Assistant Professor in the Agricultural Economics Department at Oklahoma State University.