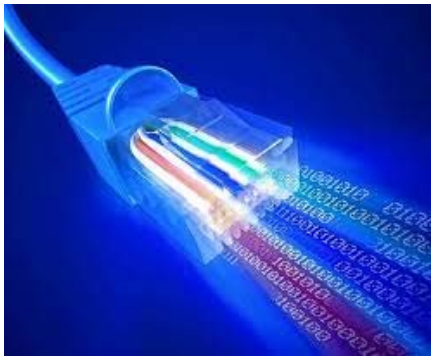

Broadband and Data Infrastructure

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Oklahoma State University

Presentation for Farm Foundation Round Table
Bettendorf, IA
June 7, 2018

Agenda

- What is “Broadband,” anyway?
  - Fixed vs. Mobile
  - The Rural – Urban Digital Divide
- Federal Broadband Programs
- Academic research on rural broadband
- Current Federal / State Policy

What is “Broadband”, Anyway?

- It depends!
- Historically, anything > 200 kilobytes per second (kbps) in at least 1 direction was considered broadband
  - Dial-up modems provided ~56 kbps
  - Some datasets still use this!! (FCC’s Adoption Data)

- Current FCC Definition (2015+):
  - 25 MBPS down, 3 MBPS up
- Previous FCC thresholds:
  - 200 KBPS at least 1 direction (prior to 2008)
  - 786 KBPS down (2008)
  - 4 MBPS down, 1 MBPS up (2010)

ANY Technology (cable, fiber, wireless, satellite, etc.) that can meet this threshold is officially “broadband”

Fixed vs. Mobile

- "Fixed" technology:
  - Includes what most think of as "wired:" Cable, Digital Subscriber Line (DSL), Fiber
  - Also includes: Fixed wireless and satellite

Some satellite companies now claim to provide 25 /3

- Mobile technology:
  - Cellular networks (i.e. wireless)
  - Generations of wireless networks & download speeds:
    - 3G (~3 MBPS)
    - 4G (~10 MBPS)
    - 4G LTE (~40 MBPS)
    - 5G is coming!* (~10GBPS+)

Mobile technology typically comes with monthly data limits

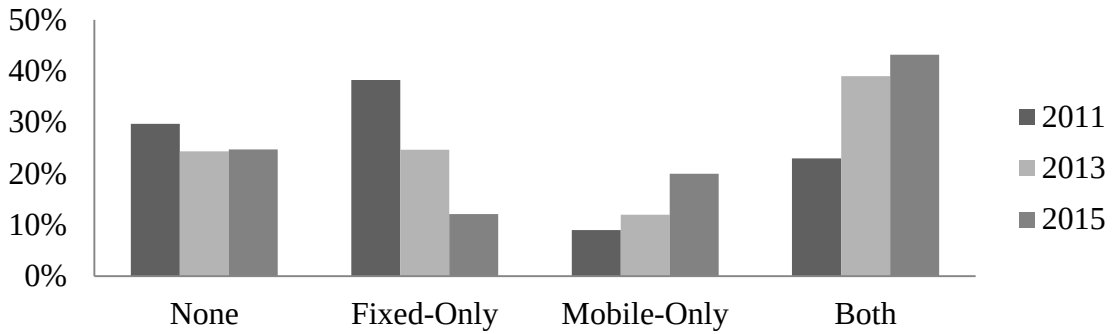
*Rural areas won't be the first served (as usual)

Fixed vs. Mobile

- Are they complements? Or substitutes?
- FCC's 2018 Broadband Report:
  - "…there are salient differences between the two technologies"
  - "…clear variations in consumer preferences / demands for fixed and mobile services"
  - "…we disagree with those that argue that mobile services are full substitutes for fixed service."

- Dramatic shift towards mobile access since 2010

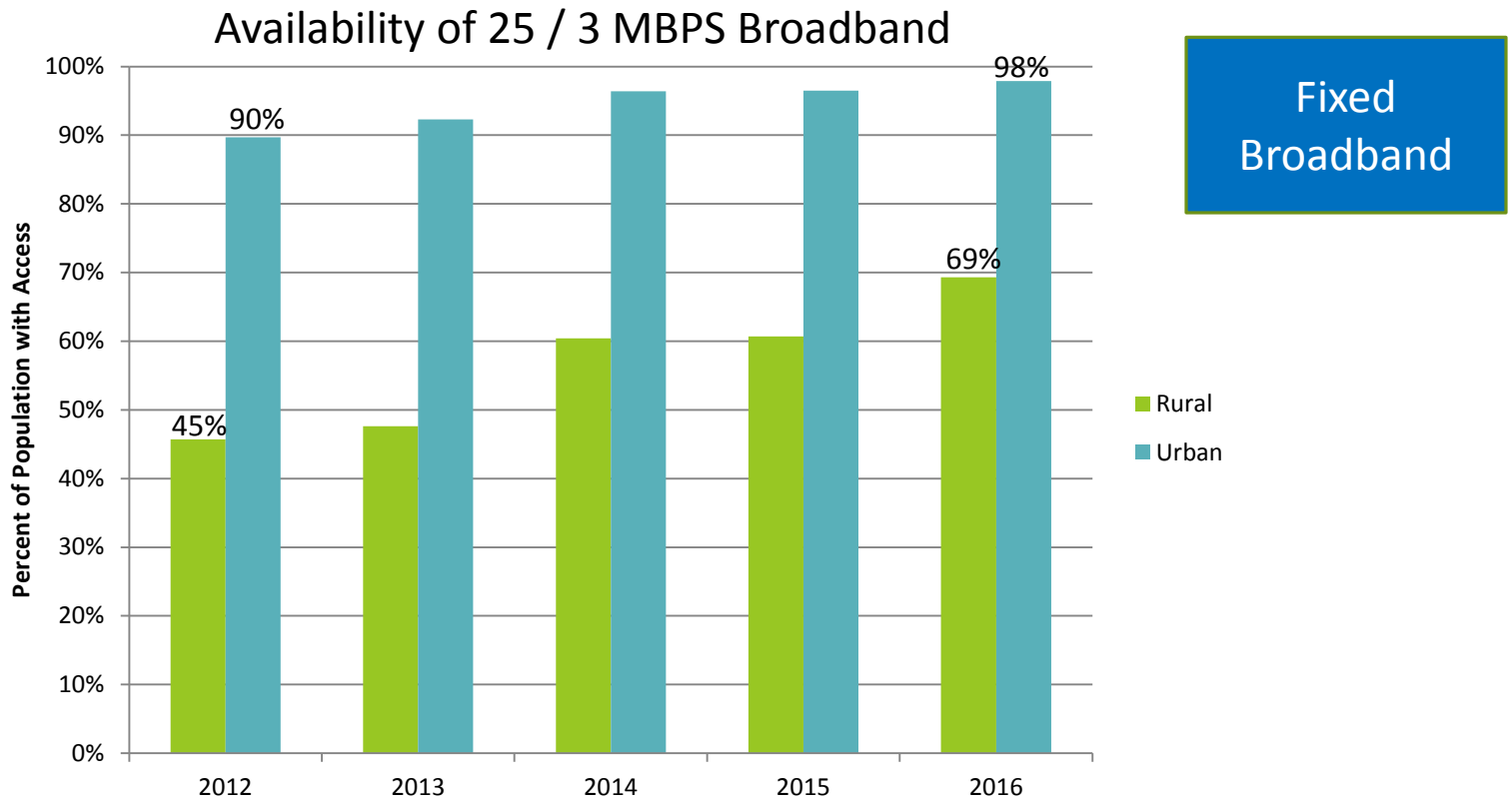
Figure 1. Household Internet Connection Type by Year



Source: Manlove and Whitacre, 2018

The Rural – Urban Digital Divide

- Rural areas lag behind in broadband availability

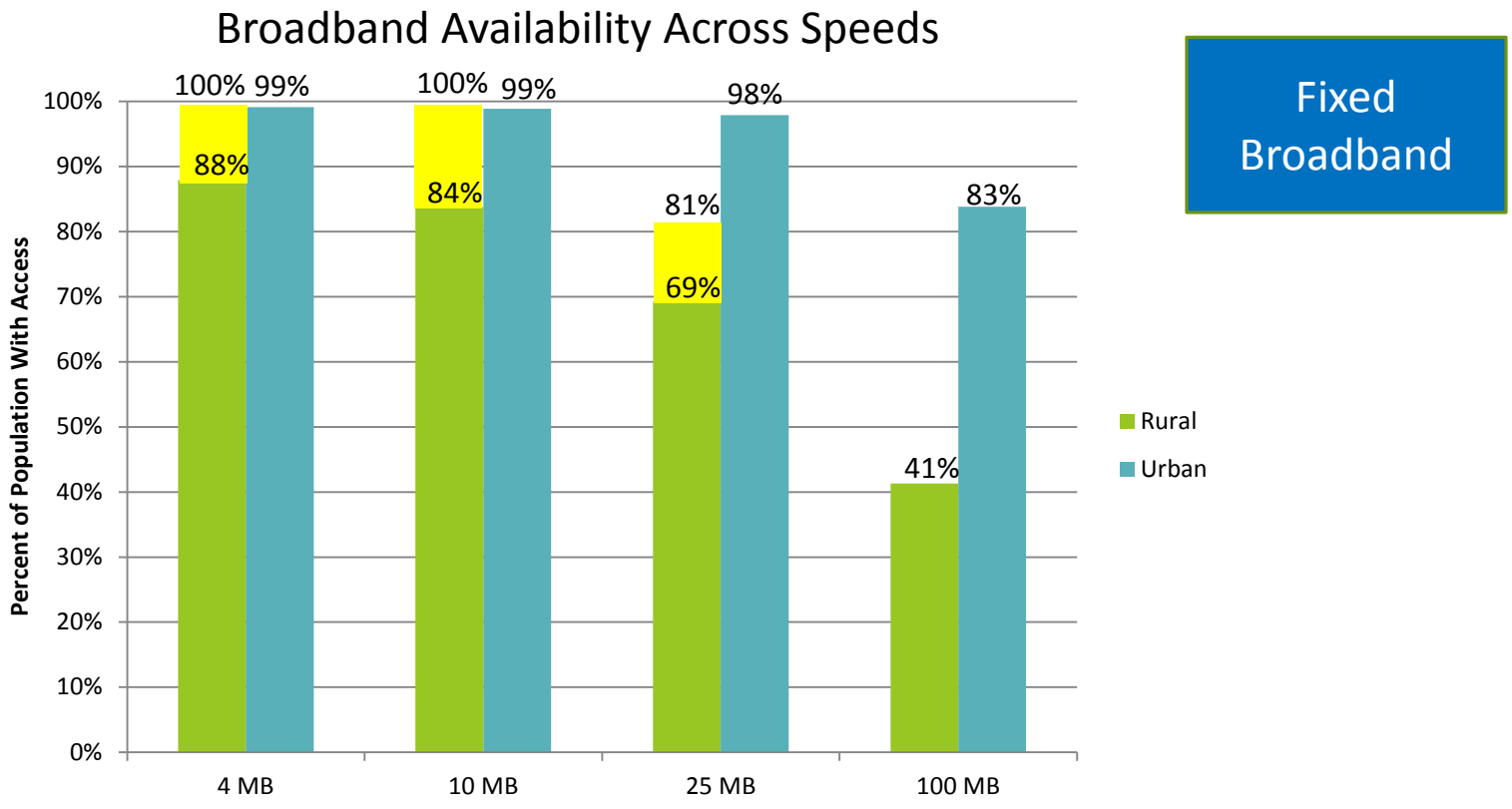


Source: 2018 Broadband Deployment Report (FCC), Table 1. Dec. 2016 Data.

Note: These statistics do not include satellite

The Rural – Urban Digital Divide

- The gap gets bigger as speeds increase

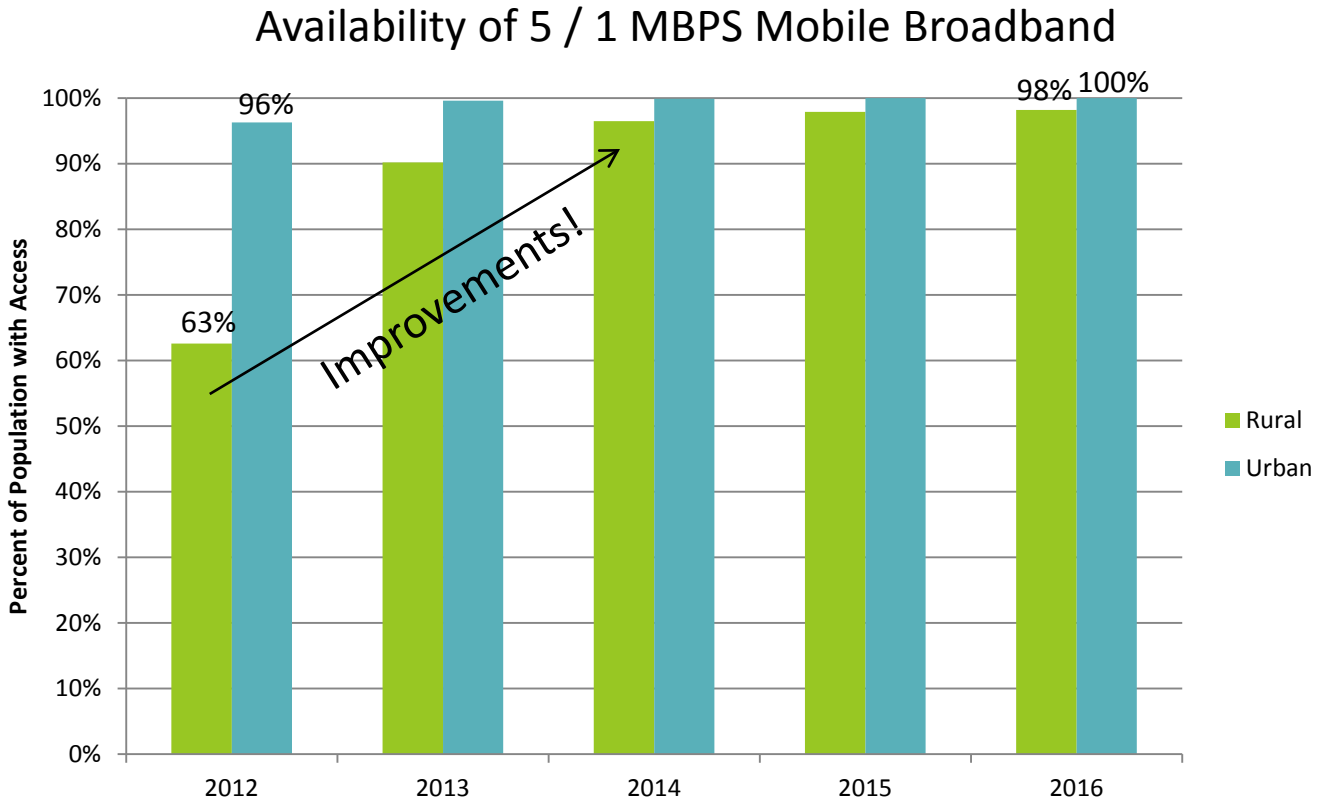


Source: Dec. 2016 FCC Form 477 Data

Note: These statistics do not initially include satellite.

The Rural – Urban Digital Divide

- Some claim rural is well-served by mobile…



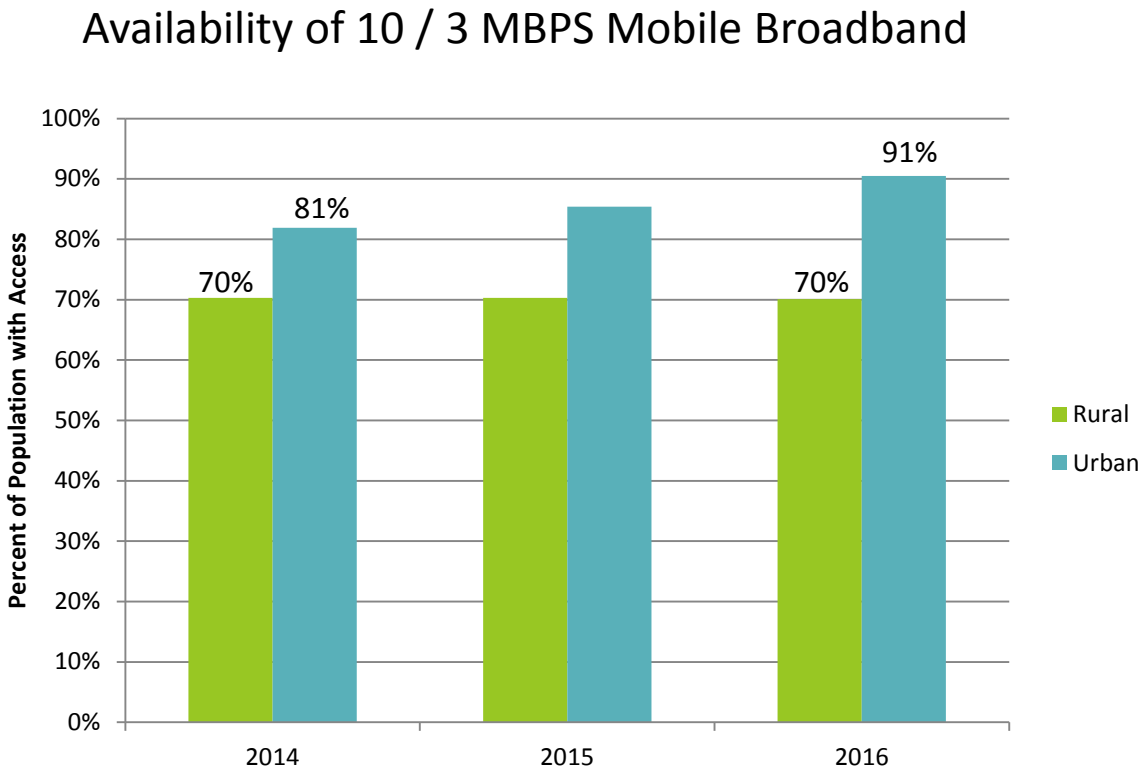
Mobile Broadband

Note that these statistics focus on population, not land area

Source: 2018 Broadband Deployment Report (FCC), Table 2a. Dec. 2016 Data.

The Rural – Urban Digital Divide

- BUT, for higher mobile speeds – rural still lags behind



Mobile Broadband

Note that these statistics focus on population, not land area

Source: 2018 Broadband Deployment Report (FCC), Table 2b. Dec. 2016 Data.

How Much Speed Is Needed?

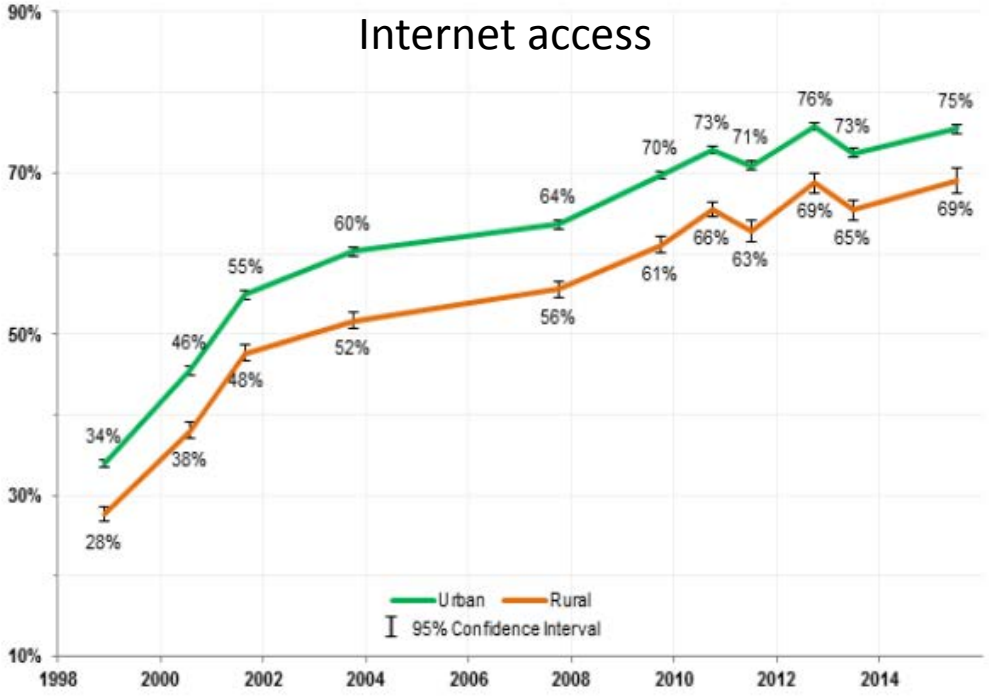
- Precision Ag Technologies
  - Wireless Data Transfer (WDT): 20KBPS
    - Prescriptions to equipment, from remote source
  - Remote Display Access (RDA): 1 MBPS
    - Remote diagnostics, cab display check-in

Served reasonably well by 4G Mobile Networks

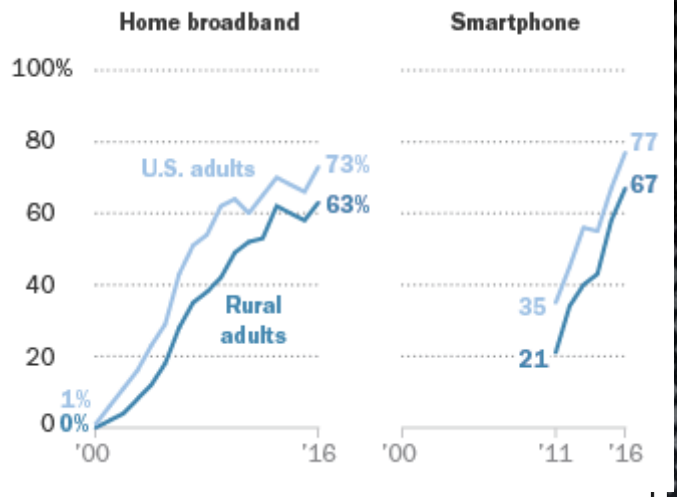
- "Mainstream" Technologies
  - Netflix: 3 MBPS
  - YouTube: 500KBPS
  - Videoconferencing: 4 MBPS
  - Telemedicine: 25 -100 MBPS

The Rural – Urban Digital Divide

- There is also a rural – urban adoption gap

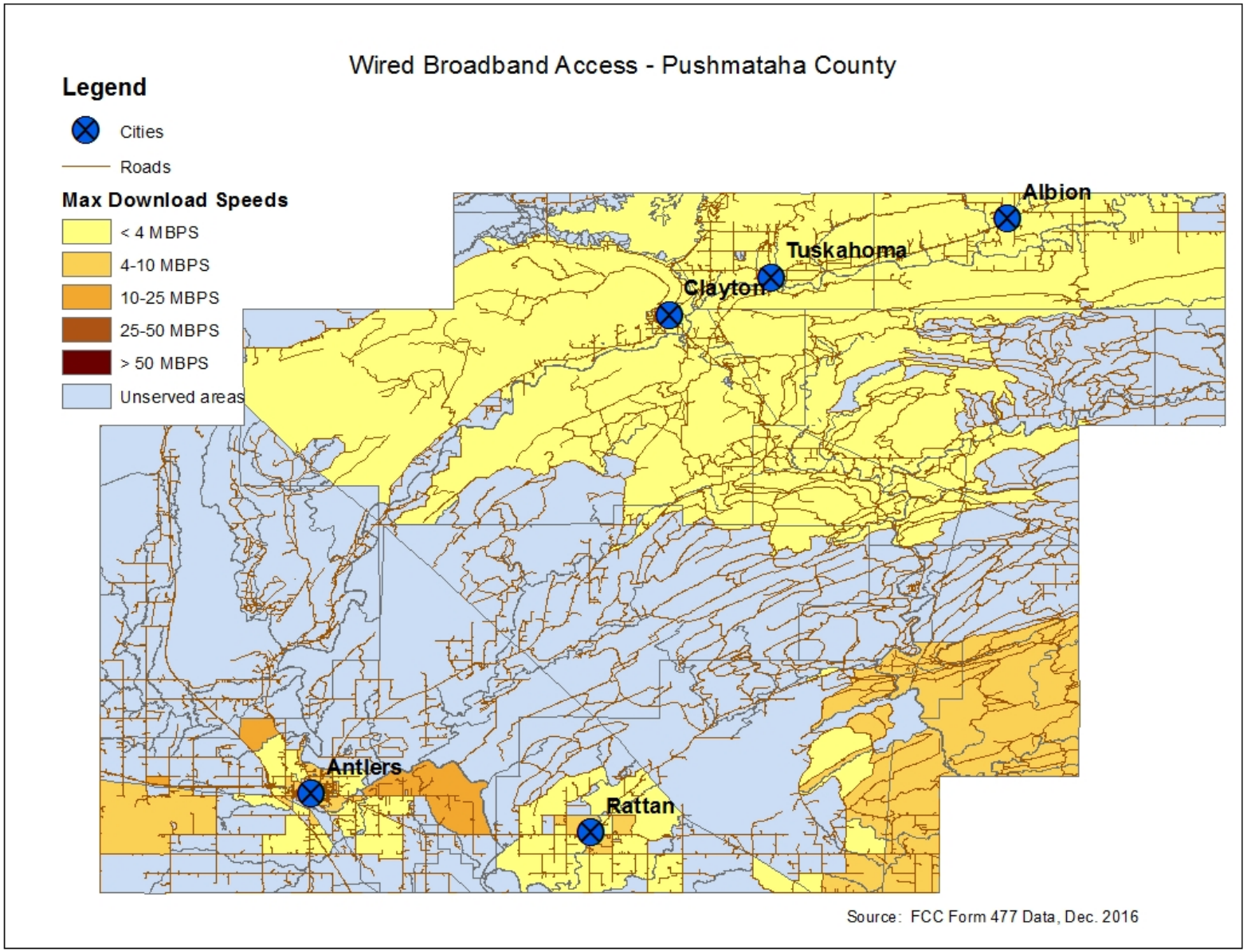


Source: NTIA Current Population Survey Computer and Internet Use Supplements, 1999-2015.



Source: Pew Internet Surveys, 2000-2016

Detailed Maps are Available



Federal Broadband Programs

ARRA (2009): $7.2B in Broadband Funding

- 2 Primary Federal Programs:
  1. FCC Universal Service Funds (FY16 caps)
     - E-rate (libraries, schools) ($2,400M)
     - HealthCare Connect Fund ($400M)
     - Lifeline ($9.25 monthly subsidy) ($1,500M)
     - Connect America Fund ($4,500M)
  2. USDA's Rural Utility Service Grant / Loan Programs (FY16 caps)
     - "Community Connect" grants ($10M)
     - Broadband Loans ($4.5M)
     - Distance Learning / Telemedicine ($25M)

$500M requested by Task Force on Ag / Rural Prosperity focuses here

See also: Kruger and Gilroy, 2016 (https://fas.org/sgp/crs/misc/RL30719.pdf)

NTIA's Broadband USA Guide (2017)

- Details on each program listed
- Program purposes / eligible recipients

The following agencies have programs that may fund projects involving broadband infrastructure, adoption, access, planning, or research.

	Infrastructure Deployment	Adoption and Digital Literacy	Public Computer Access	Planning	Research	Other
Appalachian Regional Commission						
Telecommunications and Technology Program	X	X	X	X		
Federal Communications Commission						
Connect America Fund (High Cost Program)	X					
E-Rate (Schools and Libraries) Program	X					
Rural Health Care Program	X					
U.S. Department of Agriculture, Rural Utilities Service						
Telecommunications Infrastructure Loan Program	X					
Farm Bill Broadband Loan Program	X					
Substantially Underserved Trust Areas (SUTA) Provisions	X					
Community Connect Grant Program	X					
Distance Learning and Telemedicine Grant Program						X*
U.S. Department of Commerce, Economic Development Administration						
Public Works	X					
Economic Adjustment Assistance	X			X		
Partnership Planning				X		
Local Technical Assistance				X		
U.S. Department of Housing and Urban Development						
Community Development Block Grants (including Section 108 Loan Guarantee Program)	X	X	X	X**		
Public Housing Capital Fund			X			
Public Housing Operating Fund		X	X			
Multifamily Housing		X	X			
Indian Community Development Block Grants	X					
Indian Housing Block Grants	X					

https://www2.ntia.doc.gov/files/ntia_guidetofedfunding_062317.pdf

Rural Broadband Research

growth and change
A JOURNAL OF URBAN AND REGIONAL POLICY

Full Access

Infrastructure Investment and Rural Economic Development: An Evaluation of USDA's Broadband Loan Program

IVAN T. KANDILOV, MITCH RENKOW

First published: 25 May 2010 | https://doi.org/10.1111/j.1468-2257.2010.00524.x | Cited by:30

We empirically evaluate whether participation in the U.S. Department of Agriculture's Broadband Loan Program, which began making loans in 2002, has had measurable positive impacts on zip code-level economic outcomes. Using difference in differences and propensity score matching program evaluation techniques, we find that loans made in 2002 and 2003 under the Pilot Broadband Loan Program have had a substantial positive impact on employment, annual payroll, and the number of business establishments in recipient communities. However, a more spatially disaggregated analysis reveals that the positive economic impacts of the pilot program are driven primarily by the outcomes in communities located closest to urban areas. Finally, we find no evidence that loans received as part of the current Broadband Loan P had a measurable positive impact on recipient communities, possibly be enough time has elapsed for the impacts of the current Broadband Loar have emerged.

- Kandilov and Renkow, 2010
- Zip-code level
- Positive impacts on employment, payroll, # of business establishments (ONLY for Pilot loan program)

Variable	*log*(Employment)	*log*(Annual payroll)	*log*(Number of establishments)
Panel A			
$BBLP_{zt}$	0.00[illegible] (0.011)	0.017 (0.012)	0.010 (0.009)
$Pilot\_BBLP_{zt}$	0.050*** (0.020)	0.045** (0.018)	0.068*** (0.014)
R^2	0.90	0.92	0.91
n	340,082	285,099	340,128

Rural Broadband Research

The Impact of Broadband on U.S. Agriculture: An Evaluation of the USDA Broadband Loan Program

Amy M.G. Kandilov ✉, Ivan T. Kandilov, Xiangping Liu, Mitch Renkow

Applied Economic Perspectives and Policy, Volume 39, Issue 4, 1 December 2017, Pages 635–661, https://doi.org/10.1093/aepp/ppx022
Published: 19 March 2017 **Article history** ▾

Abstract

We evaluate the impact that the USDA's low-cost broadband loan programs have on the U.S. agricultural sector. The broadband loan programs increase access to high-speed Internet in recipient communities, which can raise farm sales by increasing both farm output and prices received by producers. Further, high-speed Internet may drive down costs by providing information on cheaper inputs and better management practices, leading to an overall improvement in farm profits. Using U.S. county-level data on farm sales and expenditures in 2000 and 2007, we employ an inverse probability weighting technique to control for endogenous selection in an econometric model that also accounts for spatial dependence. We find that the two USDA broadband loan programs have had positive causal impacts on farm sales, expenditures, and profits in a subset of rural counties—those adjacent to metropolitan counties—but not in other types of counties.

- Kandilov et al., 2017
- County-level analysis, using farm sales / expenditure data from BEA
- Positive impacts on farm sales, expenditures, profits (for loan program)
- Also find positive impact on proportion of farms with Internet access

Rural Broadband Research

- Other work has found that adoption, not infrastructure, is more important for economic growth

Broadband's contribution to economic growth in rural areas: Moving towards a causal relationship ☆

Brian Whitacre [a,*], Roberto Gallardo [b], Sharon Strover [c]

Outcome Variables: Income, Employment Rates

- 2001-2010 data: "High-adoption" non-metro counties grew faster than mirrored counterparts. "High-availability" counties did not.

Does rural broadband impact jobs and income? Evidence from spatial and first-differenced regressions

Brian Whitacre · Roberto Gallardo · Sharon Strover

Outcome Variables: # jobs, median household income

- 2008-2011 data: Increases in BB adoption is associated with growth in income and jobs for non-metro counties. Increases in availability is not.

How Connected Are Our Farms?

CHOICES
The magazine of food, farm, and resource issues
3rd Quarter 2014 • 29(3)
A publication of the Agricultural & Applied Economics Association

How Connected are Our Farms?

Brian E. Whitacre, Tyler B. Mark, and Terry W. Griffin

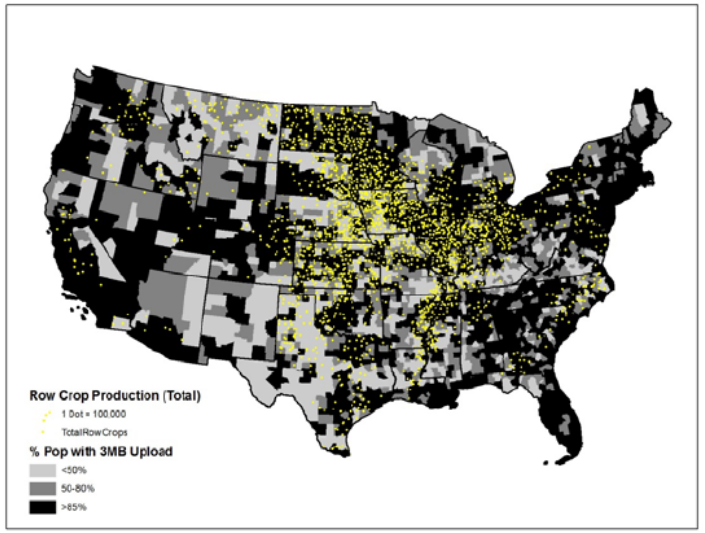
JEL Classifications: Q12, R20
Keywords: Broadband, Connectivity, Precision Agriculture

We take an introductory look at the connectivity available on U.S. farms by examining the broadband availability for counties with high levels of crop production. These are also the areas where precision agriculture adoption rates would be the highest; they could be the most likely to employ telematics and participate in the usage of big data in decision making initially.

The statistics displayed in Table 1 demonstrate that, on aggregate, the counties with harvested acres seem to be better connected than the average non-metropolitan county

- Whitacre et al., 2014
- Some states with significant harvested acres have limited access to 3 MBPS upload speeds

Figure 4: Availability of 3MB Upload speeds and Total Harvested Acres (Row Crops), 2012



Current Federal Legislative Efforts

- Precision Agriculture Connectivity Act of 2018 (H.R. 4881)
  - Establishes Task Force for meeting connectivity / technology needs of precision agriculture
    - Identify gaps in service coverage of cropland
    - Assemble comprehensive guide of relevant Federal programs / resources
    - Develop policy recommendations
- Rural Broadband Deployment Streamlining Act (S. 1363)
  - Streamlines process for considering applications to locate certain types of broadband facilities
- Community Broadband Act (H.R. 4814)
  - Preserves ability of local governments to provide broadband capability
    - Note: 21 states currently limit municipal ownership

Examples of State-level Efforts

- Iowa: Broadband Targeted Service Area
  - 100% property tax exemption for installation of infrastructure that meets 25 / 3 threshold
- New York: Broadband Program Office
  - $500M in funding to bring 100MBPS to most areas, and 25 / 3 to all areas (part of CAF program)
- Other States with Broadband Grant Programs:
  - Colorado ($20M – 1-time basis in 2017)
  - Minnesota ($34M)
  - Massachusetts
  - Ohio (pending - $50M)
  - Most programs require 50/50 matching from private firms
- Elements of Good Broadband Policy
  - Dedicated state-level office
  - Telecom modernization bills
  - Broadband data collection and mapping
  - Direct funding of broadband development

Siefer, 2015