Smart Agriculture: Driving Innovation in Rural America

NTIA Webinar Series

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Conference Line: 800-593-7190 Passcode: 984-4951#

September 16, 2020
Participans

Moderators
• Jean Rice, Senior Broadband Specialist, BroadbandUSA, NTIA
• Karen Archer Perry, Senior Policy Analyst, BroadbandUSA, NTIA

Presenters
• Dennis Buckmaster, Dean's Fellow for Digital Agriculture, Professor of Agricultural and Biological Engineering, Purdue University; Co-chair, GCTC Smart Agriculture and Rural SuperCluster
• Megan Nelson, Economic Analyst, American Farm Bureau Federation
• Chad Rupe, Administrator, Rural Utility Service, U.S. Department of Agriculture
Helpful Information

Questions

• Please type questions in the Q&A box on the right hand side of the screen. Questions will be taken after the final presenter.

Presentation

• The presentation along with a transcript and recording will be available on the BroadbandUSA website within 7 days of this webinar under Events/past events.
  • https://broadbandusa.ntia.doc.gov/past-event

Technical Assistance

• Guides, products, publications, and other tools are available to assist you with the planning, funding and implementation of your broadband project.
  • https://broadbandusa.ntia.doc.gov

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Global Cities Team Challenge

• GCTC brings together
  – industry
  – universities
  – nonprofits
  – local and state government
to work on projects to share knowledge and best practices on smart community technologies

• National Institute of Standards and Technology leads GCTC, in partnership with NTIA, Dept. of Homeland Security, National Science Foundation, International Trade Administration, and others
GCTC Ag & Rural Supercluster – Objectives

**Farmers & Ranchers**
Help farmers and ranchers improve water efficiency, produce higher quality crops and raise healthier livestock, while making it easier to meet federal and state reporting requirements.

**Rural Communities**
Focus on projects to bridge the digital divide and close the homework gap, improve healthcare and the ability to age in place, improve economic development and spur innovation.

**Results**
Set of best practices and a replicable blueprint for other communities and partners to use.

Smart Agriculture and Rural SuperCluster blueprint
Ag & Rural Supercluster – Action Clusters

Agriculture
Looking at ways to streamline food sheds (supply chain, i.e., farm to table) and increase smart ag (crops, livestock).

Rural Communities
Potential collaborations to streamline and improve government services, education, workforce development and deploy regional approaches.

HealthCare
Collaborating on telehealth projects (wearables, data analytics, remote monitoring), telemedicine (physical and mental), blockchain, and cybersecurity.
Food Shed and Freight Analysis Zones

Pennsylvania Department of Agriculture

- Eliminate deficit of local food in Pittsburgh food shed
- Increase number of people/farms involved in agriculture by 25%
- Increase amount of output of farm product in food shed by 25%

Impacts
- More locally-produced food at a fair price
  - Higher income for farmers
  - Fresher, healthier food for consumers
  - Increased accessibility to food resources
- New opportunities for younger farmers
- More land in production, increasing tax base of communities
Smart Agriculture: Driving Innovation in Rural America

Welcome Dennis Buckmaster!
SMART, DATA-DRIVEN AGRICULTURE

Dennis Buckmaster
Professor & Dean’s Fellow for Digital Agriculture
Agricultural & Biological Engineering, Purdue University
GCTC SUPERCLUSTER – AG/RURAL

- Smart Agriculture
- Farm Field Mapping
- Improving Rural Outcomes and Broadband Access
- Telehealth

Leadership:
- Mo Shakouri, Community Broadband – Joint Venture Silicon Valley
- Josh Seidemann, NTCA-The Rural Broadband Association
- Dennis Buckmaster, Purdue University
The Data Pipeline

1. **Data needs**
2. **Data acquisition**
3. **Filter, clean, pre-process**
4. **Wrangle formats**
5. **FAIR principles**
6. **Data integration**
7. **Visualization**
8. **Statistical analysis**
9. **Decisions**
Actual Decision Making

Data needs $\rightarrow$ Data acquisition $\rightarrow$ Filter, clean, preprocessed $\rightarrow$ Wrangle formats $\rightarrow$ FAIR principles $\rightarrow$ Data integration $\rightarrow$ Visualization $\rightarrow$ Statistical analysis $\rightarrow$ Data insights $\rightarrow$ Biophysical models $\rightarrow$ Logistical considerations $\rightarrow$ Decisions
ContxT App

Context

1. Background, environment, framework, setting, or situation surrounding an event or occurrence.

The circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood and assessed.

Purpose of the app

The primary purpose of ContxT is to provide metadata about other data layers which might be UAV images, as applied seed or chemical files, yield data files, etc. This context (the full backstory of what happened here this year - maybe even longer term) is critical for record keeping, model building, artificial intelligence, and machine learning. By streamlining the collection of this data, we hope to move quicker and farther toward achieving the promise of data in agriculture.
GROW – your own GDD tool

**Google Sheets** - grower specific data, such as:
- Field name
- Boundary
- Plant date
- Variety

**Applied Climate Information System** - NOAA Regional Climate Centers (RCC) with a web API for free gridded daily weather metrics.

**Progressive Web App**
- Can be installed to your device like a native program
- Offline first - automatically caches satellite imagery, field metadata, and relevant historical weather data, allowing for a complete and full offline experience.
- No backend - fetches, stores, and computes on field data locally (no server backend other than weather database)
Some commercial examples – just a sampling

• Machine data - real-time harvest insights, timeline, playback, agronomic data
• Cropping systems management - stream real-time data, utilize various data layers (imagery, yield, as-applied inputs), create and apply prescriptions
• Sub-acre management with data integration and research-oriented processes to mitigate risk
• Machine connectivity for logistics and operations management, fleet maintenance, and tracking
• AI farm plan modeling, input selection and placement
More commercial examples – just a sampling

- Integration of data from disparate systems to deliver insights - livestock realm
- Robotic, precision soil sampling
- Crop intelligence from frequent high-resolution imagery - collect, classify, analyze, visualize, alert
- Dairy calving predictions, health, heat detection, analytics, herd insights
- Smart and variable rate irrigation control - multiple depth soil moisture tracking
Interoperability – still a challenge

Requires cooperation amidst competition
Many stakeholders
Multiple platforms and systems each with a “piece of the pie”
Can enable efficiency, sustainability, traceability
Thank you, Dennis!

Smart Agriculture: Driving Innovation in Rural America

Thank you, Dennis!
Smart Agriculture: Driving Innovation in Rural America

Welcome Megan Nelson!
BENEFITS OF PRECISION AGRICULTURE AND HOW WE GET THERE

Megan Nelson
Economic Analyst
American Farm Bureau Federation
WHERE ARE WE TODAY?

Nearly 60 million people or 1 in 5 Americans live in rural areas.
Broadband is no longer a luxury, it’s a NECESSITY

Agricultural Needs:
- Infrastructure
- Precision Agriculture
- Connecting with buyers and customers

Quality of Life:
- Health Care
- Education
- Entrepreneurship
- Leisure
Percentage of Americans with Access to Wired Broadband (min. 25 Mbps/3 Mbps)

Source: FCC, 2020 BroadbandDeployment Report
WHY IS THIS SO IMPORTANT?

USDA’s estimates potential benefits that broadband technology and infrastructure could bring to rural areas at $64.5 billion annually.
Figure 1. Annual Potential Gross Economic Benefits of Precision Agriculture Technologies Derived From Broadband

<table>
<thead>
<tr>
<th></th>
<th>Row Crops</th>
<th>Specialty Crops</th>
<th>Livestock</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Value of the U.S. Market Studied*</td>
<td>$110.6 B</td>
<td>$30.1 B</td>
<td>$113 B</td>
<td>$254 B</td>
</tr>
<tr>
<td>Precision Ag in Planning</td>
<td>$4.2 B</td>
<td>$1.3 B</td>
<td>$2.4 B</td>
<td>$7.9 B</td>
</tr>
<tr>
<td>Precision Ag in Production</td>
<td>$6.7 B</td>
<td>$3.5 B</td>
<td>$15.8 B</td>
<td>$25.9 B</td>
</tr>
<tr>
<td>Precision Ag in Market Coordination</td>
<td>$2.2 B</td>
<td>$8.5 B</td>
<td>$2.4</td>
<td>$13.1 B</td>
</tr>
<tr>
<td>Next Generation Precision Ag Potential Gross Economic Benefits Annually, For the Market Studied</td>
<td>$13.1 B</td>
<td>$13.3 B</td>
<td>$20.6</td>
<td>$46.9 B</td>
</tr>
<tr>
<td>Annual Value of Total U.S. Market Production*</td>
<td>$142.6 B</td>
<td>$45.3 B</td>
<td>$151.9 B</td>
<td>$340 B</td>
</tr>
<tr>
<td>Next Generation Precision Ag Potential Gross Economic Benefits Annually, Extrapolated to Total Market</td>
<td>$16.8 B</td>
<td>$19.9 B</td>
<td>$27.7</td>
<td>$64.5 B</td>
</tr>
<tr>
<td>Next Generation Precision Ag Potential Gross Economic Benefits as a Percent of Total U.S. Production</td>
<td>12%</td>
<td>44%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>Average Percent of Next Generation Precision Ag Benefits that Depend on Broadband</td>
<td>35%</td>
<td>43%</td>
<td>38%</td>
<td>36%</td>
</tr>
<tr>
<td>Potential Gross Economic Benefits of Ubiquitous Broadband Infrastructure and Next Generation Precision Agriculture Adoption:</td>
<td>$4.6 to $5.7 B</td>
<td>$5.7 B to $6.8 B</td>
<td>$7.8 B to $8.9 B</td>
<td>$18 B to $23 B</td>
</tr>
</tbody>
</table>
Figure 1. Potential Benefits for Row Crops by Digital Technology Type

- Potential Annual Gross Benefit of Next Generation Precision Ag
- Potential Attributable to Broadband
- % Dependent on Broadband

Source: USDA, Farm Bureau Calculations
Figure 2. Potential Benefits in Specialty Crops from Digital Technology by Business Function

- Potential Annual Gross Benefit of Next Generation Precision Ag
- Potential Attributable to Broadband
- Average Percent Dependent on Broadband

Source: USDA, Farm Bureau Calculations
Figure 3. Potential Benefits for Livestock and Dairy By Digital Technology Type

- **Potential Annual Gross Benefit of Next Generation Precision Ag**
- **Potential Attributable to Broadband**
- **Percent Dependent on Broadband**

Source: USDA, Farm Bureau Calculations
Source: A Framework for Assessing Effects of the Food System.
“I’m driving my combine, and the phone rings. It's my 84-year-old father, who is in our other combine. The conversation goes like this:

  Dad: "I just got a call from John Deere."
  Me: "Uh huh."
  Dad: "They said I was running out of DEF!" (A diesel fuel additive)
  Me: "Uh huh."
  Dad: "They’re watching us!"

**Farming has changed.** We used to think that we just grew corn and soybeans. Now we also generate data. Trillions of bits, all containing information that can make us more efficient, economical and reduce our environmental impact."
Accurate Broadband Maps
- Broadband DATA Act
- Broadband Deployment Accuracy and Technological Act

Precision Agriculture Connectivity

Continued funding assistance for connecting rural areas and bridging the digital divide

AFBF Advocacy
Questions?

Contact Information:
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202-406-3629
MeganRNelson1
Thank you, Megan!

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Welcome Chad Rupe!
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USDA Rural Development
Presented by Chad Rupe, Rural Utilities Service Administrator
USDA Rural Development’s Mission

To assist rural communities in creating prosperity so they are self-sustaining and economically thriving through investments that create ladders of opportunity, build regional resilience and support the growth of emerging markets.
Rural Utilities Service

• Investing in Rural Communities
  • Broadband Programs
  • ReConnect Round 1 Recap
  • Smart Grid and Middle Mile Buildout

• Interagency Coordination
  • FCC Precision Ag Task Force
  • American Broadband Initiative

• Additional Resources
Investing in Rural Communities
2018 USDA Rural Development Performance Highlights

Building Strong Reliable Infrastructure
This is crucial to maintain America's competitive edge and to help raise up all Americans

1 in 6 Americans live in distressed areas
1 in 4 live in distressed rural communities
25% higher mortality rate in distressed communities
58% of people in distressed communities are on a low school score only

America is ranked 14th internationally in infrastructure
Investing to reach 19.2M rural households without reliable high-speed connectivity
45K+ rural homes and businesses receive high-speed connectivity

Our Programs Address Real Challenges

$3.4B invested in distressed communities
$270M increased funding to distressed communities from 2017
$39M invested in rural distance learning & telemedicine

Rural America's Partner to Drive Growth and Innovation

Investing in Community Infrastructure
Helping Millions of Rural Americans Receive Essential Upgrades

- Electric Systems: $7M
- Distance Learning & Telemedicine: $4.6M
- Water & Wastewater: $3M
- Other Community Infrastructures: $1.2M

Together, America Prosper
• The last few months have highlighted the need for connectivity in rural communities
  • Distance learning, teleworking, telemedicine, etc.
• Broadband is of interest to our borrowers across all program areas
  • RUS Telecom Program
    • Ensuring that local service providers have access to affordable capital to deploy high speed networks
  • RUS Electric Program
    • Financing thousands of miles of fiber based smart grid
  • RUS Water and Environmental Program
    • Water utilities are making space on water towers for wireless communications
• Distance Learning and Telemedicine (DLT)
  • Applications for Round 1 and 2 are currently under review.
  • In Round 1 (closed April 10), RUS received 253 applications requesting $143.2 M
  • In Round 2 (closed July 13), RUS received 534 applications requesting $252.1 M
  • Be on the lookout for award announcements in the coming months

• ReConnect
  • Round 2 Application Window Closed on April 15
  • 172 Applications were submitted for $1.57 Billion
  • We have invested over $86.7M in 7 states so far
  • Be on the lookout for more announcements in the coming weeks
Broadband ReConnect Program

In round one of the ReConnect Program, USDA has invested $744 million into bringing high-speed broadband e-Connectivity to:

- 172,000 Rural American Households
- 13,000 Farms
- 5,953 Businesses
- 286 Educational Facilities
- 227 Critical Community Facilities
- 49 Healthcare Centers
In FY 19, the RUS Electric Program invested in over 9,586 middle mile fiber.

RUS will also consider a wide range of fire prevention and security measures for financing:
- Protecting the grid and other critical infrastructure from both cyber and physical threats.
Interagency Coordination

- FCC Precision Ag Task Force
  - USDA provides support and expertise to the leadership team and working groups on the topics of
    - Jobs/Adoption
    - Connectivity
    - Mapping/Data
    - Deployment on Unserved Ag Lands

- American Broadband Initiative
  - Serve on ABI Executive Leadership team with NTIA and White House Office of Science and Technology Policy
  - Co-Chair ABI Federal Funding Workstream
We want to partner with your community by:

- Investing in critical infrastructure for rural areas, spurring innovation in rural, agricultural, and farming communities
- Supporting Broadband deployment to rural and remote areas
- Encourage the growth of emerging markets
Additional Resources

www.rd.usda.gov

Chad Rupe
RUS Administrator
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202-720-9540
USDA is an equal opportunity provider, employer, and lender.
Thank you, Chad!

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Thank you, Chad!
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Questions and Comments

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Thank you for attending.
Tune in for the next Practical Conversations Webinar
The Changing Landscape of Remote Learning
October 21, 2020
2:00 pm EST

Registration is required for each webinar:
https://broadbandusa.ntia.doc.gov/event
BroadbandUSA is available to help communities with their broadband access and digital inclusion efforts

For General Information:
- 202-482-2048
- broadbandusa@ntia.doc.gov
- https://broadbandusa.ntia.doc.gov/resources

To Request Technical Assistance (TA):
- Broadband TA Request Form - https://broadbandusa.ntia.doc.gov/ntia-common-content/how-we-can-help

BBUSA Resources
- Implementing a Broadband Network Vision: A Toolkit for Local and Tribal Governments
- Community Broadband Roadmap Toolkit
- Guide to Federal Funding of Broadband Projects
- Using Partnerships to Power Smart Cities