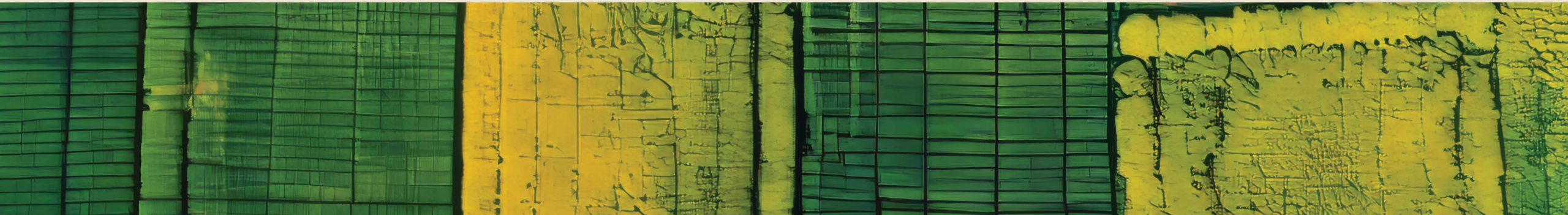
TASK FORCE FOR REVIEWING THE CONNECTIVITY AND TECHNOLOGY NEEDS OF PRECISION AGRICULTURE IN THE UNITED STATES



Initial Findings of the Mapping and Analyzing Connectivity on Agricultural Lands Working Group for Review and Deliberation by the Precision Agriculture Connectivity Task Force

1

MAPPING AND ANALYZING CONNECTIVITY ON AGRICULTURAL LANDS

Mobile Map Data Rates

- Currently, National Broadband Map attempts to display mobile performance levels:
  - LTE (5/1 Mbps)
  - 5G (7/1 and 35/3 Mbps)
- “Examining Current and Future Connectivity Demand” WG anticipates that 100 Mbps will be required in field.
- Autonomy applications require upload capability as much as download.
- Therefore, the Mapping WG **will add a new recommendation** that the National Broadband Map include a mobile layer for 100 Mbps download, 25 Mbps upload on the 5G Map.

Discussion of Voice Service

- Voice service remains the “killer app” for mobile; this is especially true for precision ag.
- As part of BDC, the FCC collects information from MNOs regarding voice service
  - The information is not displayed on the National Broadband Map
  - The information is available for download
  - There is no challenge process
- From a broadband perspective, even the lowest level 5/1 LTE service supports voice as an application (e.g. WhatsApp)
  - A map showing any level of “mobile broadband” service will support voice.
- The Mapping **WG will not be adjusting** its recommendations related to voice service.

Discussion of Sustainability

- Currently, Mapping working group recommendations include several recommendations related to ongoing mapping efforts, surveys and census.
  - These USDA surveys primarily involve farmers.
- Based on feedback from “Accelerating Deployment” WG, we **will be expanding our recommendation** to include that these surveys and census be extended to include requirements & needs analysis from equipment manufacturers and similar entities.

Mapping Available Spectrum

- During the last Task Force meeting, there was some discussion about availability of spectrum, especially to support precision agriculture.
- The Mapping WG has an existing recommendation to map areas where TVWS spectrum is available.
- NTIA has an existing National Spectrum Strategy, which includes spectrum sharing. It is more appropriate for them to consider this.
- The Mapping WG **will not be adjusting** its recommendations to include a spectrum map.
  - However, that would be a reasonable thing for other groups that follow us to consider more carefully.

Initial Findings of the Examining Current and Future Connectivity Demand Working Group for Review and Deliberation by the Precision Agriculture Connectivity Task Force

2

EXAMINING CURRENT AND FUTURE CONNECTIVITY DEMAND

Summary Paragraph:

We strongly recommend implementation of "Last Acre" initiatives, policies, and incentives, highlighting their critical role in ensuring national security, particularly in terms of food and water. The core objective is to extend high-capacity internet service to croplands and livestock operations, enabling broadband requirements of symmetrical 100 Mbps speeds and low latency (ideally under 10 milliseconds).

The key drivers to achieve these connectivity goals include deploying fiber to farm and ranch premises and incentivizing the targeted build-out of high-performance wireless connectivity that provides broad, umbrella-like coverage across the entire farm. The technology is already available; the opportunity lies in securing the necessary funding and prioritizing Precision Agriculture within existing and future policies and programs.

Recommendations:

1. Last Acre: Extending high-capacity internet service to cover croplands and livestock operations, where internet access is crucial for integrating modern technologies like IoT devices, autonomous machines and farm-to-fork traceability systems.

The goal of Last-Acre connectivity is to ensure that every part of the farm is connected to the digital network, enabling real-time data collection, monitoring, and automation of farming processes. This level of connectivity is critical for improving efficiency, sustainability, and productivity in agriculture. It requires a commitment to overcoming high infrastructure costs and low population density - changing the mindset of government policies and programs from population-based criteria to a geography-based approach that prioritizes Precision Agriculture.

Recommendations

2. Connectivity Requirements: Symmetrical bandwidth of 100 Mbps and latency targets below 10 milliseconds. This is the “sweet spot” to maximize the transformative power of Precision Agriculture from wide-area coverage to high-performing networks, supporting advanced technologies.

Farmers can benefit from using the basics of Precision Agriculture—such as GPS-guided equipment, variable rate application technology, and field mapping software—at relatively low uplink speeds while still achieving highly desirable results. However, the potential of higher throughput is game-changing. At its core, Precision Ag thrives on the ability to collect vast amounts of data and convert it into actionable insights through powerful computational tools.

This data-driven approach is poised to revolutionize farming, much like the tractor did in its time. In fact, thought leaders have coined a new adage: "Data is the new tractor." Just as the tractor reshaped agriculture, data-driven decision-making is set to be equally transformative, enabling smarter, more sustainable farming practices, optimizing yields and improving resource efficiency, to meet global demands.

Recommendations

3. Infrastructure: A combination of fiber and wireless (terrestrial, cellular and satellite) connectivity is needed to provide the primary and failover capabilities to support Precision Ag operations as a national food safety and food security concern.

Research at Penn State demonstrates that fiber-to-the-farm-perimeter is achievable. 96.1% of all crops are located within 10 miles of existing fiber infrastructure and 99.9% within 25 miles. This proximity makes it possible to establish a fiber junction box and power source at a suitable location on the farm, serving as a mini IoT hub.

This setup would enable high-capacity wireless connectivity for Precision Agriculture applications and support Cloud/Edge computing for data-intensive processes.

Last Mile fiber would boost the capabilities of 5G coverage and facilitate the transition to 6G. Additionally, fiber-to-the-farm-perimeter provides redundancy for wireless solutions, whether terrestrial or satellite, to cover farm fields or ranches. Greater capacity and a lifespan of 30 years, give fiber the win as more future proof.

4. Spectrum:

- Agriculture be given access to mid-band spectrum through AI-driven spectrum sharing, which can effectively manage and minimize interference. Common wisdom is that mid-band spectrum is best suited for 5G wireless technologies.

- FCC, in coordination with the NTIA, move forward on a Notice of Inquiry (NOI), issued in 2021, on the allocation and use of low-band spectrum (under 1 GHZ) specifically for IoT devices essential to Precision Agriculture.

- That a dedicated percentage of spectrum be explicitly allocated for agricultural use whenever spectrum is auctioned. We also recommend strategies to promote deployment of dedicated spectrum in agricultural/rural areas prior to auction.

- License holders be encouraged to build out currently unused spectrum in agricultural regions with a use it or lose it mandate.

- Consideration of a dedicated agricultural spectrum band. Such a band would provide greenfield opportunities for future technologies without the complications of extensive frequency coordination requirements. We suggest that the FCC, in conjunction with NTIA, issue a Notice of Inquiry (NOI) seeking guidance on what spectrum band be considered including the ramifications to any existing users.

5. Funding: Prioritizing Precision Agriculture within the FCC Rural 5G Program and the Broadband Equity, Access, and Deployment (BEAD) program, utilizing their existing budgeted disbursement mechanisms to fund initial infrastructure deployment. These two opportunities are the most immediately available vehicles.

6. Standards: Encourage and fund the foundational work of creating standards to improve sensor and data interoperability. This foundational work is crucial for ensuring the quality, safety, efficiency, and seamless operation of products, services, and systems.

Enhancing interoperability fosters innovation and scalability, simplifies compliance and reporting, facilitates traceability, and supports global collaboration. Agriculture needs a seat at the table in creating those standards that ensure interoperability, redundancy, and security.

7. Redundancy: Covering unacceptable intermittent or lost signals, which can be caused by any kind of interference. Edge Compute is invaluable for redundancy allowing local processing to continue even if there is a disruption in connectivity to the central Cloud, ensuring that critical applications remain operational.

8. **Near Future:** Agriculture interest must play a crucial role in the development and deployment of 6G by acting as both a driving force and a key beneficiary of the technology.

Sustainability Statements

There are three sides to this core issue:

Sustainable Connectivity — By definition, sustainable connectivity is robust, always-on, ubiquitous, redundant, and future-proof. Another key element of sustainability in this context is fostering a healthy, competitive marketplace with multiple players to ensure resilience, innovation and choice.

Connectivity for Sustainability – We need to provision farmers with the connectivity needed for “smart farming” practices, i.e. Precision Ag technologies/applications that create “sustainable value” like reducing inputs (water/fertilizer/pesticides) and implementing robust farm-to-fork traceability systems to ensure the safety, reliability of the food supply chain.

Sustainability of Agriculture – This means achieving cost savings by reducing inputs, improving water management, especially in states like California where fields are being fallowed due to lack of water, enhancing efficiency, reducing down-time, increasing yields, and addressing labor shortages through automation and hopefully by attracting a younger generation interested in the technology.

Timeline: Goals and Milestones

2024-2026

- Prioritize Last Acre coverage.
- Earmark BEAD funding for Precision Agriculture with build out hopefully to begin in 2025.
- Launch FCC 5G Fund for Rural America, prioritizing Precision Ag.
- Anticipate Congress reauthorizes FCC auction authority to facilitate spectrum availability for next-gen networks.
- Foresee passage of the Farm Bill with provisions for Last Acre connectivity to close gaps post BEAD.
- Continue foundational research on 6G technologies, including AI integration, and satellite networking.
- FDA FSMA rule 204 implementation In January 2026.

2027-2030

- Aspirational goal of mid-band spectrum available to every acre.
- UN sustainability goal to double food production and income of small-scale producers.
- Begin developing pilot infrastructure and small-scale testbeds to assess 6G capabilities on ag lands.
- Quantify sustainability outcomes with availability of current and next generation networks (i.e., 6G & beyond).
- Quantify energy and water impact of AI.

2030+

- Reach widespread adoption of Precision Agriculture
- Launch early commercial infrastructure projects and begin large-scale 6G network deployments, ensuring compatibility with existing 5G infrastructure.
- Implement carbon sequestration tracking systems.
- Aspirational goal by industry to have fully autonomous operations on 40% of U.S. farms.
- Net zero by 2050.

Initial Findings of the Accelerating Broadband Deployment on Unserved Agricultural Lands Working Group for Review and Deliberation by the Precision Agriculture Connectivity Task Force

3

ACCELERATING BROADBAND DEPLOYMENT ON UNSERVED AGRICULTURAL LANDS

Accelerating Deployment

Since September:

- Additional Discussion Items
- Ranked within Categories
- Ranked Overall
- Consolidated some topics under fewer headings
- Still have a few additions

Leading Opportunities for Accelerating Deployment

(AKA Sections of the Working Group Report)

- Funding and Incentivizing Deployment to Unserved and Underserved Rural Areas and Precision Agriculture
- Leveraging Underused Spectrum and Infrastructure
- Accelerating Deployment Through Improvements to Siting

Funding and Incentivizing Deployment to Unserved and Underserved Rural Areas and Precision Agriculture Since 9/4/24

- Updated 5G Fund language

Since early Sept, FCC released guidance that removed their initial intent to dedicate some funds for precision ag. We need to emphasize this is where funds are needed to deliver connectivity to the last acre.

- Funding from Multiple Sources

We continue to have disagreement on the phrasing and intent of this concept.

- Targeted Subsidy Program for Precision Ag

We don't know if this will be a stand alone statement or feed into the 5G fund comments or other areas.

- "All of the Above" Technology

Reflecting NTIA recent guidance – that recognizes the ecosystem approach to deliver broadband. BUT we need to keep standards (data up/down, reliability, affordability) of delivered service front and center.

Changes or Additions to Leveraging Underused Spectrum and Infrastructure
9/4/24

- ## Process for FCC and NTIA to Enact PATF Priorities

We discussed this at the September PATF meeting – to encourage it to become an 'umbrella' priority that the Task Force would encourage for ongoing advancements in this space.

- ## Unlicensed and Licensed by Rule

We would like confirmation from FCC staff that our edited language helps clarify intent.

- ## Allocate Low Band Spectrum for Precision Agriculture

The connectivity needs working group might also highlight this fact that under canopy reach/readings are currently a challenge for deploying precision ag. tech. More low band availability should contribute to solving at least part of that challenge.

- ## Rural Service Rules; Geographic-Based Buildout Requirements

Our team ranked geographic-based buildout requirements as a high priority, however, it is currently found deep in the document. We will discuss how to reconcile this in our final ordering.

Changes or Additions to Acclerating Deployment Through Improvements to Siting Section Since August 14, 2024

- There have been no substantive changes or additions in our Siting recommendations since August or September.

Appendix and References

Could you please provide guidance on the level of detail you would like for referenced material?

Example; only those items shared with entire team vs. those items referenced by a team member in conversation with the team.

Is there a specific citation process or is title, author, date sufficient for the purpose of this appendix?

* Denotes dissenting opinions.

Anticipated Work in October

- Add recommendation on spectrum auction authority

Congress reauthorize FCC ability to auction spectrum

- Add recommendation to pass a Farm Bill

Congress recognize the urgency and necessity of certainty, infrastructure, and innovation

- Finalize language on Universal Service Fund

We anticipate sticking closely to how the fund is applied vs. funding mechanisms. But that could change…stay tuned.

Initial Findings of the Encouraging Adoption and Availability of High Quality Jobs Working Group for Review and Deliberation by the Precision Agriculture Connectivity Task Force

4

ENCOURAGING ADOPTION AND AVAILABILITY OF HIGH QUALITY JOBS

Charge 1: Adoption

- Ag tech should be recognized as a key tool in addressing human labor shortages while increasing demand for skilled workers.
- Federal policy should support industrial and educational efforts to upskill workers with training in both specific equipment and common core technology.
- The FCC and USDA should identify the risk of cyber-security threats in agriculture and coordinate with DHS and other agencies of jurisdiction to identify vulnerabilities and potential remedies.
- The USDA and FCC should coordinate to educate farmers and other stakeholders about cyber threats, including but not limited to FCC IoT labeling rules.

Charges 2 and 3: Education and Outreach

- USDA should expand the ability of farmers to utilize USDA loan and other programs for ag tech deployment.
- USDA should create tiered incentive and other benefit programs that contemplate the size of farm, job development, productivity savings/gains, and other criteria for loans, matching funds, and other benefits.
- USDA should support research into ROI strategies for common and specialty ag tech applications and enable resources to be administered by extension services to develop ag tech curriculum.
- USDA should work with partners to assist with the development of paid ag tech internships and apprenticeship programs, including academic credits in both 2- and 4-year programs.
- The FCC and USDA should convene stakeholder conferences between farmers, extension services, and state employment offices to identify gams and develop solutions.

Charge 4: Partnerships

- The FCC and USDA should assist farmers and coops with the exploration of unlicensed spectrum where licensed or Federally-supported services are not available.
- Federal programming should support partnerships and relationships among farmers and non-ag sectors who share common goals.
- Federal policies should support extension services working with farmers to develop economic evidence to support championship and advocacy for ag tech.
- Federal policies should support development of digital literacy, skills, and adoption.

Charge 5: Obstacles

- Federal policies should address affordability of ag tech for small farmers to spur adoption.
- Federal programs should support land grant university extension research to model ROI strategies, including financial modeling as well as technologies suited to small farms.

Charge 6: Lessons from other sectors

- Federal policies should identify and proactively incentivize the development of ag tech leadership and relationships between the leading adopters and states (or regions) where similar relationships are less robust.

- Federal agencies should create programs and/or incentives for manufacturers to develop deeper product lines that can be applied to smaller farms and non-commodity crops.

- USDA should elevate awareness and understanding of how PA is an essential and expanding tool for farmers and producers for sustainable and even more cost-effective operations.

Charge 7: Metrics

• USDA should establish metrics for progress measured by include market indicators such as sales, revenues and profits alongside review of new technology available in the marketplace.

- USDA should work with state agricultural agencies to survey farmers, dealers, and service providers to identify type and extent to which technology is adopted for plant and animal farming.

- USDA should correlate farm productivity data with ag tech adoption and savings in areas such as water, chemical, and labor costs, coupled with productivity and yield increases.