NEBRASKA

Rural Broadband Task Force

Agriculture Subcommittee

Findings and Recommendations

October 1, 2021

Executive Summary

Agriculture is a significant part of Nebraska's economy. The market value of crops and livestock produced in Nebraska in 2017 was $21,983,430,000 with a per farm average of $474,476.

Fully adopting next generation precision agriculture technologies in the United States would result in potential annual gross benefits of up to $13 billion for row crops and $20.6 billion for livestock and dairy with over a third of these benefits dependent on broadband.

Farmers and ranchers need upload speeds of at least 30 Mbps to transfer the immense amount of data generated to the cloud. In the future even greater upload speeds may be required.

Rural areas of most Nebraska counties—including many of Nebraska's top-producing agricultural counties—lack broadband with upload speeds of greater than 25 Mbps or fiber connectivity. The table below shows broadband availability for the rural areas of Nebraska's top-producing agricultural counties.

% Rural Population with Broadband available (ADSL, Fiber, Cable, Fixed Wireless) Dec 2019
Top 10 Nebraska Counties by Agricultural Sales (2017)

County	Agricultural Sales	Population	Land Area (Square Miles)	Pop. per square mile	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
Cuming County	1,131,997,000	9,013	571	15.8	83.83	74.63	74.1	7.06
Custer County	781,155,000	10,545	2,576	4.1	53.02	7.21	0.13	3.25
Lincoln County	755,236,000	34,676	2,564	13.5	81.47	51.37	36.7	35.52
Dawson County	748,426,000	24,111	1,013	23.8	63.95	38.21	33.59	7.11
Platte County	688,562,000	34,296	674	50.9	95.06	72.08	56.61	1.26
Phelps County	578,241,000	8,968	540	16.6	85.9	62.42	60.18	37.16
Antelope County	529,502,000	6,295	857	7.3	80.12	44.25	8.46	17.45
Boone County	473,778,000	5,379	687	7.8	63.08	53.74	0	0
Holt County	453,539,000	10,127	2,412	4.2	75.41	16.31	0	16.31
Chase County	440,113,000	3,893	894	4.4	100	93.83	12.36	12.36

Source: USDA 2017 Census of Agriculture County Profiles data available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/
Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

[1] *USDA NASS. 2017 Census of Agriculture State Profile. Available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/cp99031.pdf*

[2] *USDA. A Case for Rural Broadband: Insights on Rural Broadband Infrastructure and Next Generation Precision Ag Technologies. (April 2019). Available at https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf*

Different methods of connectivity are required for agriculture, including:

- Low-bandwidth connectivity for devices like sensors or monitors often called internet of things (IoT) devices
- High speed, centralized broadband with upload speeds of at least 30 Mbps up for targeted agricultural operational headquarters such as a farm or ranch operations center
- High-speed decentralized coverage over large agricultural areas

The following connectivity profile provides additional details about types of internet connectivity needed.

Connectivity Profiles for Next Generation Precision Agriculture

	Low-Speed, Broad Coverage	High-Speed, Centralized	High-Speed, De-centralized
Geographic Coverage	Large areas (i.e., agricultural fields)	Targeted agricultural operational headquarters such as farm or ranch operations center, typically one site per producer.	Large areas (i.e., agricultural fields)
Network Speed	Slow (< 5 mb/sec)	Broadband and faster (25 mb/sec) +	Broadband and faster
Network Latency	High latency is tolerable	Low latency	Low latency
Upload/Download Speeds	Asymmetrical (faster download, slower upload) Expect small upload and downloads over time from many sensors and field devices	Symmetrical (same download and upload speeds) Expect large upload and downloads to support processing of large data files, and online training and support	Symmetrical Expect large uploads to transmit live video for remote monitoring and real-time decision making
Usage	• Transmit sensor data from fields • System automation and monitoring • Mobile access to systems and data for workers and decision makers	• Farm-level data aggregation and modeling • Raw data uploads for processing (drone and other sensor data) • Remote training and systems support • Online cattle auctions	• Field-level video streaming • Large uploads of HD videos and photos • Live video conferencing for support

Adapted from Examining Current and Future Connectivity Demand for Precision Agriculture Report Oct. 2020 by the Connectivity Working Group of the FCC's Precision Agriculture Committee pages 8-9 https://www.fcc.gov/sites/default/files/precision-ag-connectivity-demand-wg-report-10282020.pdf

Other Issues

Legal and technical issues—including data ownership and portability, right to repair, and technical standards and interoperability—may impede the full adoption of next generation precision agriculture technologies. Industry efforts to address these issues would likely accelerate the adoption of precision agriculture technologies.

Research and outreach efforts on best practices in connected agriculture technologies and the associated return on investment could accelerate adoption. Because farming varies from state to state and within regions of a state, research and outreach efforts should be localized and feature farmers and ranchers who are early adopters of next generation precision agriculture technologies.

As farmers and ranchers are increasing their reliance upon next generation precision farming applications, the risk of cyberattacks is also increasing. Food processors are also at risk as the 2021 ransomware attack on meatpacker JBS demonstrated. Industry-wide efforts to increase the security of next generation precision farming technologies and the industrial control systems used in food production will likely be needed to improve the cybersecurity of agriculture and the food industry.

Recommendations

- Establish a state goal of having broadband access to every farm or ranch headquarters.
- Focus a portion of broadband funding on the highest cost areas.
- Review the initial round of awards from the Broadband Bridge Grant Program to determine if adjustments to program requirements could aid in funding extremely high cost rural areas.
- Survey Nebraska farmers and ranchers on their broadband needs and broadband availability to their farms and ranches, including what percentage of their operations are covered by broadband and where broadband coverage is still needed.

Terms and Definitions

Precision and Connected Agriculture Technologies

Auto-guidance enabled farm equipment and variable rate technologies were among the first generation of precision agriculture technologies.

Auto-Guidance Enabled Farm Equipment has a global navigation satellite system (GNSS) receiver which processes satellite signals to determine position. The use of a differential correction system using satellite, Real Time Kinemetics (RTK) radio or mobile (cellular) networks improves the accuracy of the estimated geographic coordinates in real time. John Deere's RTK network offers horizontal pass-to-pass accuracy of +/-2.5 cm.

Auto guidance systems on farm equipment such as tractors, combines, harvesters, planters, seeders, and sprayers and applicators have many benefits, including reduced skips and overlaps, the ability to work in poor visibility conditions, the ability to skip certain areas and return later, and event logging.

Newer farm equipment and on-board monitors may also be able to connect to the internet via LTE or WiFi. This allows for the delivering of prescriptions for product applications and other uses. The United Soybean Board survey found that 29% of farmers and ranchers access the internet with their machinery.

Photo Credit: United Soybean Board Creative Commons License CC BY 2.0

Variable-rate technology (VRT) enables producers to precisely control the rate of application of crop inputs and tillage operations.

Next generation precision agriculture technologies include internet-connected sensors, monitors, and controllers as well as decision support systems using artificial intelligence tools. The term **connected agriculture technologies** refers to equipment and devices which are connected to the internet and programs or services which are accessed through the internet.

Internet connected devices such as soil moisture sensors, temperature sensors, flow meters on a pivot, and ear tags which monitor animal health are providing farmers and ranchers with real-time information on their crops and livestock so that they can make better decisions. The use of monitors/sensors in agriculture is still in the early adoption phase with only about 10-15% of agricultural producers widely using these technologies.

Decision support systems using artificial intelligence (AI) technologies can help farmers and ranchers make better decisions in managing their crops and livestock.

[4]*Presentation by Roric Paulman on October 15, 2020 as part of a precision ag demo.*

Findings

Agriculture in Nebraska

Agriculture is a significant part of Nebraska's economy. The market value of crops and livestock produced in Nebraska in 2017 was nearly $22 billion ($21,983,430,000) with a $9.3 billion from crops and $12.7 billion from livestock, poultry and products. Cattle and calves brought in $10.6 billion which was 48% of total agricultural sales and 84% of sales of livestock, poultry and products in Nebraska. Of the 22,242,599 acres of cropland in Nebraska, 43% (9,455,031 acres) is planted with corn for grain and 25% (5,664,225 acres is planted with soybeans. The average market value of products sold per farm was $474,476.[4]

Photo Credit: Catchpenny Creative Commons License CC BY 2.0

Economic Impact of Next Generation Precision Agriculture Technologies

Fully adopting next generation precision agriculture technologies would result in potential annual gross benefits of up to $13 billion for row crops and $20.6 billion for livestock and dairy with over a third of these benefits dependent on broadband.[5]

The following tables provide a breakdown of potential annual gross benefits for row crops as well as livestock and dairy by technology.

Photo Credit: United Soybean Board Creative Commons License CC BY 2.0

[4] *USDA NASS. 2017 Census of Agriculture State Profile. Available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/cp99031.pdf*

[5] *USDA. A Case for Rural Broadband: Insights on Rural Broadband Infrastructure and Next Generation Precision Ag Technologies. (April 2019). Available at https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf*

Row Crops			
Technology	**Potential Annual Gross Benefit**	**Potential Attributable to Broadband**	**% Dependent on Broadband**
Microclimate Modeling Technology	1,574,000,000	787,200,000	50%
Yield Monitoring Technology	1,771,000,000	177,100,000	10%
Precision Seeding	810,000,000	162,000,000	20%
Field Scouting	1,423,000,000	711,300,000	50%
Variable Rate Application	1,715,000,000	171,500,000	10%
Connected Equipment	638,000.00	191,300,000	30%
Machine Learning and Visioning	905,000,000	452,500,000	50%
Remote Diagnostics & Predictive Maintenance	1,981,000,000	990,400,000	50%
Storage Monitoring	1,580,000,000	474,700,000	40%
Small Producer Coordination	2,900,000,000	1,457,000,000	40%
Total	**11,759,638,000 - 13,079,638,000**	**4,118,000,000 - 5,100,300,000**	

Source: A Case for Rural Broadband: Insights on Rural Broadband Infrastructure and Next Generation Precision Ag Technologies. (April 2019). Available at https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf

Livestock and Dairy			
Technology	**Potential Annual Gross Benefit**	**Potential Attributable to Broadband**	**% Dependent on Broadband**
Fertility Planning	1,780,000,000	177,800,000	10%
Infanticide Prevention	9,800,000	4,900,000	50%
Livestock Records and Management	623,100,000	186,900,000	30%
Precision Feeding	4,100,000,000	1,200,000,000	29%
Mastitis Detection	143,300,000	14,300,000	10%
Audio/Visual Facility Monitoring	240,700,000	120,300,000	50%
Unmanned Herding	470,000,000	141,000,000	30%
Robotic Milking	2,050,000,000	613,400,000	30%
General Health Monitoring	8,800,000,000	4,400,000,000	50%
Automated Sorting	391,200,000	117,400,000	30%
Online Channels	1,004,400,000	502,200,000	50%
Tracing and Marketing	990,000,000	297,000,000	30%
Total	**20,602,500,000**	**7,775,200,000**	

Source: A Case for Rural Broadband: Insights on Rural Broadband Infrastructure and Next Generation Precision Ag Technologies. (April 2019). Available at https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf

Benefits of Next Generation Precision Agriculture Technologies to Farmers and Ranchers

Photo Credit: United Soybean Board Creative Commons License CC BY 2.0

Next generation precision agriculture technologies provide farmers and ranchers with real-time data for decision-making. Here are examples of how farmers and ranchers in Nebraska are using real-time data for decision making:

- Farmers are using real-time data on precipitation to reduce irrigation, resulting in significant savings.
- Producers also use real-time data on wind speed and direction and documentation in order to safely spray dicambra.
- Livestock producers are using smart internet connected ear tags to monitor animal health and detect illness earlier and more accurately than visual observation.
- Cameras or monitors on water troughs can let ranchers check water supplies without having to travel to each location.
- The watering, cooling, feeding and disease management in confinement hog facilities can be managed offsite, reducing the risk of disease transmission.

Next generation precision agriculture technologies can reduce costs and increase productivity. The following tables show the potential benefits of a number of technologies and applications used by row crop farmers as well as livestock and dairy producers.

Next generation precision agriculture technologies also allow producers to spend more time with their families, improving their quality of life. For example, sensors, monitors and video cameras allow farmers and ranchers to check on their farms and ranches remotely, eliminating drive time.

Row Crop Technology/Application	Estimated Potential Benefits
Yield Monitoring. Monitors on combines gather yield data, reducing input costs.	Saving $25 per acre in input costs for corn farmers
Precision Seeding/Variable Rate Seeding allows producers to optimize seed inputs: Typically for corn, seeding rates are increased in high productivity zones and decreased in low productivity zones.[1]	Saving $6.53 per acre on seed expenses
Connected Equipment Guidance. Vehicles use GPS to determine field boundaries for precise tending.	Saving $15 per acre on corn farms
Remote Diagnostics and Predictive Maintenance. Software can diagnose and anticipate needs for equipment repair.	Saving $5 to $15 per acre
Microclimate Monitoring. Satellites or on-site weather stations can monitor current weather conditions and forecast local weather more accurately. Accurate Information on local wind conditions can help reduce dicambra drift. Accurate information on rainfall can reduce unneeded irrigation.	Reducing crop loss by up to 80%
Field Scouting. Drone imagery or monitors in the field can collect nutritional and growth data used to calculate optimal inputs.	Saving $12 per acre on corn farms
Weed, pest and disease identification. Connected cameras and software can identify weeds, pests, and disease.	Reducing crop loss by 30%
Storage Monitoring. Temperature and moisture sensors can detect storage quality issues for stored grain.	Reducing crop loss and increasing sale price by $1 per hundred weight for grain sorghum
Small Producer Coordination. Small producers use web platforms to connect directly with buyers allowing them to earn premiums for meeting specific quality standards.	Increasing sale prices by $0.35-$0.51 per bushel for corn, soy, wheat and rice

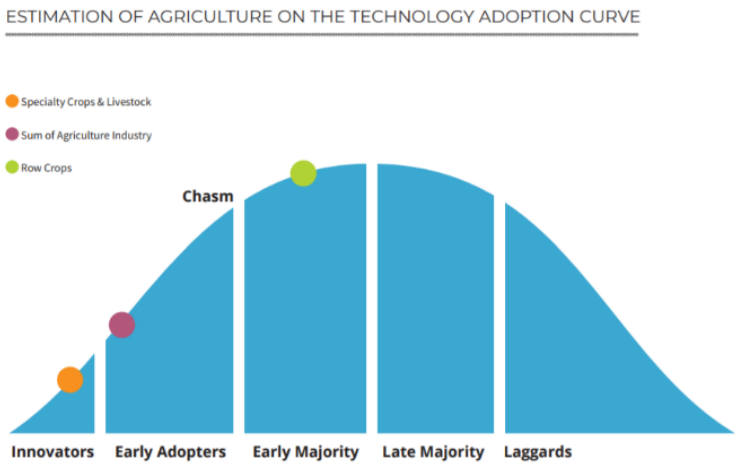
Source (Except as Noted): USDA. (April 2019). Connected Technologies in Row Crops—A Case for Rural Broadband https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf

Livestock and Dairy Technology/Application	Estimated Potential Benefits
Fertility Planning. Biosensors can track ovulation and detect estrus with a 95% to 97% success rate.	Increasing pregnancy rates
Infanticide Prevention. Sensors can listen for sounds of distress and stimulate sows to reposition.	Reducing deaths by 75%
Livestock Records and Management. Producers can make decisions based on real-time herd data using record management software.	Reducing costs by $6 per 20 kg of production
Precision Feeding. Sensors can calibrate and distribute optimal amounts of feed.	Decreasing costs by $0.12 per day per cow
Mastitis Detection. Automated monitoring systems can detect early signs of mastitis.	Avoid $316 in indirect costs per infected cow per year
Audio/Video Facility Monitoring. Cameras and AI can help avoid or track lost animals.	Reducing labor time by 2.27 labor hours per 1000 pounds and 2 hours per broiler house per day.
Unmanned Herding. Unmanned Aerial Vehicles can monitor and herd	Reducing the cost of looking for lost cattle by 20%
Robotic Milking. Robots can sanitize and stimulate teats, self-attach to utters and catch milk.	Increasing production by 8%
Health Monitoring. Bluetooth-enabled animal wearables can monitor activity and detect anomalies.	Reducing medication by 15% per animal and shortening the cattle finishing process by 4 to 6 weeks
Automated Sorting. Visual inspection, weighing and quality sorting can optimize product price	Returning an additional $27 per day or $10,000 per year for a farm
Online Channels. Online cattle auctions	Returning 65% more revenue per unit of beef.
Tracing and Marketing. Technology can communicate key product attributes so consumers make informed purchases.	Providing a 15% premium compared to retail prices of commodity beef

Source (Except as Noted): USDA. (April 2019). Connected Technologies in Row Crops—A Case for Rural Broadband https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf

Adoption of Next Generation Precision Agriculture Technologies

Connected agriculture technologies are in the early stages of adoption with row crop farmers on average being more advanced in their use of these technologies. The USDA estimates that row crop farmers are in the early majority stage of the technology adoption curve while specialty crops and livestock farmers are in the innovators stage.[7]



The use of next generation precision agriculture technologies by livestock producers in Nebraska is increasing. However, limited broadband availability over sparsely populated ranchland is a barrier to the adoption of these technologies by ranchers in Nebraska.

Terms and Definitions

Next Generation Precision Agriculture Technologies on the Ranch

A rancher may use broadband connectivity in several ways, including:

Marketing/Online Auctions. Hosting a cattle sale on the ranch requires reliable connectivity. A fiber connection with good upload speeds at the sale barn is preferable, although some livestock auction companies can run an online auction with a phone line in and a phone line out.

Advertising. Before the auction, still photos, videos and uploading to a catalog company in NW South Dakota; Facebook or webpage. A good upload connection at the home or ranch headquarters makes this easier.

Weighing. New scales have data capture capability and must have consistent broadband connections. A ranch may have several scales needing connectivity.

Watering. Cameras, drones or monitors can be used monitor troughs for water levels, ice and the availability of salt and minerals. Cameras require a high bandwidth connection. Monitors may require a low bandwidth connection such as LoRaWAN. A drone is an option to monitor areas without broadband.

As connectivity improves, ranchers may be more likely to use smart ear tags which monitors the overall health of animals and other technologies.

[7] *USDA. (April 2019). Connected Technologies in Row Crops—A Case for Rural. Broadband. Available at https://www.usda.gov/sites/default/files/documents/case-for-rural-broadband.pdf*

Farm and Ranch Connectivity

A majority of farmers and ranchers in Nebraska (84%) and the U.S. (75%) have internet access and recognize the importance of connectivity to their operations. A survey of over 2,000 U.S. farmers and ranchers by the United Soybean Board in 2018[9] found:

- 67% of farmers believe it is at least moderately important to be able to transfer data wirelessly from the field.
- Over 50% of farmers want to incorporate more data in their operations, but lack the connectivity to do it.

Photo Credit: Smith Farm, Arnold, by Anne Byers

However, most farmers and ranchers do not believe that their internet service is adequate for their farm or ranch operations:[10]

- 60% of U.S. farmers and ranchers do not believe they have adequate internet connectivity to run their businesses.
- More than 60%of respondents consider internet connections to be inadequate, poor value, slow and/or unreliable.

Most farmers and ranchers use a smart phone, laptop, tablet or desktop computer:[11]

- 92% of farmers use smart phones and 59% use tablets.
- 66% use a laptop and 58% use a desktop computer in their offices.

Having a smart phone makes it easy for farmers to use apps for checking weather or getting market information on a daily basis. Many sensors, monitors and other devices connected to the Internet of Things (IoT) devices also have apps for smart phones.

Only 38% of rural Nebraskans have broadband available to them with broadband of 250 Mbps down and 25 Mbps up or greater. Less than one-fifth (18%) of rural Nebraskans have broadband available via fiber which offers the most reliable connectivity. Nebraska lags the U.S on the percent rural population with access to broadband at higher speeds (100/10 Mbps and 250/25 Mbps) and with fiber connectivity.[12] See the following table.

Area	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
United States	82.75	66.85	55.54	20.23
Nebraska	86.95	62.33	38.41	18.14

Source: Dec. 2019 Form 477 data, FCC Broadband Map at https://broadbandmap.fcc.gov

[8] *United States Department of Agriculture National Agricultural Statistics Service. (August 2019) Farm Computer Usage and Ownership. Available at https://downloads.usda.library.cornell.edu/usda-esmis/files/h128nd689/8910k592p/qz20t442b/fmpc0819.pdf*

[9] *United States Department of Agriculture National Agricultural Statistics Service. (August 2019) Farm Computer Usage and Ownership. Available at https://downloads.usda.library.cornell.edu/usda-esmis/files/h128nd689/8910k592p/qz20t442b/fmpc0819.pdf*

[10] *United Soybean Board. (2019). Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Impact and Sustainability. Available at https://api.unitedsoybean.org/uploads/documents/58546-1-ruralbroadband-whitepages-final.pdf*

[11] *United Soybean Board. (2019). Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Impact and Sustainability. Available at https://api.unitedsoybean.org/uploads/documents/58546-1-ruralbroadband-whitepages-final.pdf*

[12] *Dec. 2019 Form 477 Data from the FCC Broadband Map at https://broadbandmap.fcc.gov*

Rural areas of most Nebraska counties—including many of Nebraska's top-producing agricultural counties—lack broadband with upload speeds of greater than 25 Mbps or fiber connectivity. The table below shows broadband availability for the rural areas of Nebraska's top-producing agricultural counties.

% Rural Population with Broadband available (ADSL, Fiber, Cable, Fixed Wireless) Dec 2019 Top 10 Nebraska Counties by Agricultural Sales (2017)					
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Holt County	453,539	75.41	16.31	0	16.31
Chase County	440,113	100	93.83	12.36	12.36

Source: FCC Broadband Map at https://broadbandmap.fcc.gov and USDA 2017 Census of Agriculture County Profiles at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/

Connectivity Needs of Next Generation Precision Agriculture

Different methods of connectivity will likely be required for agriculture, including:

- Differential correction systems using satellite, Real Time Kinemetics (RTK) radio or mobile (cellular) for agricultural equipment with auto-guidance—This specialized system is widely available and widely used in Nebraska.
- Low-bandwidth connectivity for devices like sensors or monitors often called internet of things (IoT) devices
- High speed, centralized broadband for targeted agricultural operational headquarters such as a farm or ranch operations center
- High-speed decentralized coverage over large agricultural areas

Photo Credit: Smith Farm, Arnold, by Anne Byers

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Network Speed	Slow (< 5 mb/sec)	Broadband and faster (25 mb/sec) +	Broadband and faster
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[13] *USDA 2018 Farm and Ranch Irrigation Survey Table 2 Irrigated Farms by Acres Irrigated: 2018 and 2013* https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris_1_0002_0002.pdf

[14] *USDA 2018 Farm and Ranch Irrigation Survey Table 23 Methods Used in Deciding When to Irrigate :2018* https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris_1_0023_0023.pdf

[15] *USDA 2018 Farm and Ranch Irrigation Survey Table 25 Barriers to Making Improvements to Reduce Energy Use or Conserve Water: 2018* https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris_1_0025_0025.pdf

Adoption of Irrigation Technologies Increasing

Irrigation plays an important role in Nebraska agriculture. Approximately one-third of Nebraska's farmland was irrigated in 2018. With 7.7 million irrigated acres, Nebraska ranks second in the number of irrigated acres in the United States, behind only California.[13]

Photo Credit: John Kelley, USDA, Creative Commons License CC BY 2.0

Connected agriculture technologies can support irrigation scheduling through data from soil moisture sensors, plant moisture sensors, evapotranspiration measurement, and weather stations. Decision support software can use this data to help farmers make better irrigation systems. Farmers can more efficiently deliver irrigation using remote pivot controls and variable rate irrigation.

The percent of irrigated farms in Nebraska using soil moisture sensing devices increased from 22.9% in 2013 to 30.5% in 2018. Other technologies used included reports on crop-water evapotranspiration (21.2%), plant moisture sensing devices (2.1%), and computer simulation models (1.0%).[14] See the table below:

Technologies Used in Deciding When to Irrigate		
Technologies	**2013 % of Irrigated Farms**	**2018 % of Irrigated Farms**
Using Soil Moisture Sensing Device	22.9%	30.5%
Using Plant Moisture Sensing Device	0.3%	2.1%
Using Reports on Crop-water Evapotranspiration	24.1%	21.2%
Using Computer Simulation Models	0.7%	1.0%

Barriers to implementing irrigation water management technologies include lack of return on investment or lack of financing.[15] See the table below:

Barriers to Making Improvements to Reduce Energy Use or Conserve Water: 2018		
Barriers	**# of Farms Responding**	**% of Farms Responding**
Improvements will not reduce costs enough to cover installation costs	2,346	35.1%
Cannot finance improvements	2,037	30.4%
Investigating Improvements Not a Priority	1,879	28.1%
Landlord will not share in cost	1,305	19.5%
Risk of Reduced Yield or Poorer Crop Quality	800	12.0%
Physical field/crop condition limit system improvements	934	14.0%
Total Nebraska Farms Reporting Barriers to Making Improvements	**6,691**	

The cost of computers, control panels, and computer-controlled valves and hardware for irrigation water management per acre decreased from $19.56 per acre in 2013 to $10.20 per acre in 2018. Further reductions in costs should lead to greater adoption of irrigation control technologies.[16]

[16] *USDA 2018 Farm and Ranch Irrigation Survey Table 16 Expenditures for Irrigation Equipment, Facilities, Computer Technology and Land Improvement: 2018*

https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris_1_0016_0016.pdf

USDA 2013 Farm and Ranch Irrigation Survey Table 15 Expenditures for Irrigation Equipment, Facilities, Computer Technology and Land Improvement: 2018
https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris13_1_015_015.pdf

Big Data

Photo Credit: United Soybean Board Creative Commons License CC BY 2.0

Next generation precision agriculture technologies generate huge amounts of data. "Agriculture will produce more data than all industries combined," said Steve Tippery from RealmFive.[17] Researchers from The Ohio State University found that 100 acres of data generated 6 petabytes of data or 0.5 KB/plant in 2014.[18] Data generation by application[19] was:

- Spraying 0.3 MB/acre
- Planting 5.5 MB/acre
- Yield data 4.2 MB/acre
- Soil/Fertility Data 0.6 MB/acre
- Prescription Files 0.01 MB/acre

The amount of data generated per acre in 2021 and in the future may be even greater.

Farm and ranch data is generally stored and accessed in a cloud platform. Cloud computing can be used to aggregate data from tools like soil sensors, drones, and weather stations. Analytic capabilities and decision support in the cloud can also help farmers understand their production environment and make better decisions about managing their crops or livestock.

Farmers and ranchers need upload speeds of at least 30 Mbps to upload the immense amount of data generated to the cloud. In the future even greater upload speeds may be required. Symmetrical broadband would better meet the future needs of agriculture.

Much of the data generated is not currently usable or valuable to farmers. Data is often stored in file formats that require specialized software to read and access the data. Farmers also often do not have solutions that make it easy to analyze and act on the data. Because of these limitations, only 25% of the data generated is readily available to farmers, and only 11% of the data is valuable to farmers.[20] As solutions which make this data usable are developed and more widely used, the value proposition of next generation precision agriculture technologies will likely increase.

USDA 2013 Farm and Ranch Irrigation Survey Table 15 Expenditures for Irrigation Equipment, Facilities, Computer Technology and Land Improvement: 2018 https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/fris13_1_015_015.pdf

Other Issues

Legal and technical issues—including data ownership and portability, right to repair, and technical standards and interoperability—may impede the full adoption of next generation precision agriculture technologies. Industry efforts to address these issues would likely accelerate the adoption of precision agriculture technologies.

Research and outreach efforts on best practices in connected agriculture technologies and the associated return on investment could accelerate adoption. Because farming varies from state to state and within regions of a state, research and outreach efforts should be localized and feature farmers and ranchers who are early adopters of next generation precision agriculture technologies.

As farmers and ranchers are increasing their reliance upon next generation precision farming applications, the risk of cyberattacks is also increasing. Food processors are also at risk as the 2021 ransomware attack on meatpacker JBS demonstrated. Industry-wide efforts to increase the security of next generation precision farming technologies and the industrial control systems used in food production will likely be needed to improve the cybersecurity of agriculture and the food industry.

Recommendations

- Establish a state goal of having broadband access to every farm or ranch headquarters.
- Focus a portion of broadband funding on the highest cost areas.
- Review the initial round of awards from the Broadband Bridge Grant Program to determine if adjustments to program requirements could aid in funding extremely high cost rural areas.
- Survey Nebraska farmers and ranchers on their broadband needs and broadband availability to their farms and ranches, including what percentage of their operations are covered by broadband and where broadband coverage is still needed.

[17] *Presentation to Rural Broadband Task Force Agriculture Subcommittee on Jan. 22, 2021.*

[18] *FarmBits Podcast. Feb.11, 2021. Episode 20: The Case for Connectivity (Interview with Dr. John Fulton, The Ohio State University). Available at https://www.youtube.com/watch?v=Gs79lMvo5ic&t=39s*

[19] *Shearer, S.A. 2014. Big Data: The Future of Precision Agriculture. Presented at The InfoAg Conference. St. Louis, MO, June. http://past.infoag.org/abstract_papers/papers/paper_233.pdf*

[20] *FarmBits Podcast. Feb.11, 2021. Episode 20: The Case for Connectivity (Interview with Dr. John Fulton, The Ohio State University). Available at https://www.youtube.com/watch?v=Gs79lMvo5ic&t=39s*

Appendix

Broadband Availability and Agricultural Production in Nebraska Counties

Only 38% of rural Nebraskans have broadband available to them with upload speeds of 25 Mbps or greater. Only 18% of rural Nebraskans have broadband available via fiber which offers the most reliable connectivity.

Area	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
United States	82.75	66.85	55.54	20.23
Nebraska	86.95	62.33	38.41	18.14

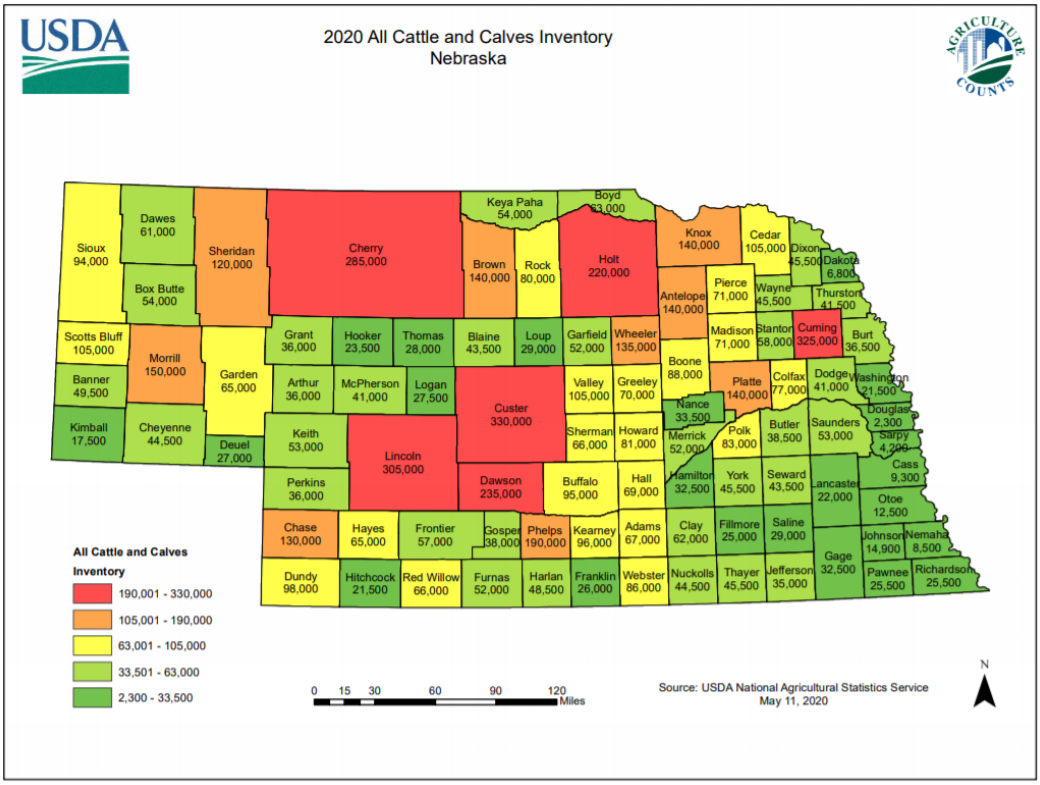
Source: FCC Broadband Map https://broadbandmap.fcc.gov

Rural areas of most Nebraska counties—including many of Nebraska's top-producing agricultural counties—lack broadband with upload speeds of greater than 25% or fiber connectivity.

% Rural Population with Broadband available (ADSL, Fiber, Cable, Fixed Wireless) Dec 2019 Top 10 Nebraska Counties By Agricultural Sales (2017)					
County	**Agricultural Sales**	**% Rural Pop with 25/3**	**% Rural Pop with 100/10**	**% Rural Pop with 250/25**	**% Rural Pop with 100/10 Fiber**
Cuming County	1,131,997,000	83.83	74.63	74.1	7.06
Custer County	781,155,000	53.02	7.21	0.13	3.25
Lincoln County	755,236,000	81.47	51.37	36.7	35.52
Dawson County	748,426,000	63.95	38.21	33.59	7.11
Platte County	688,562,000	95.06	72.08	56.61	1.26
Phelps County	578,241,000	85.9	62.42	60.18	37.16
Antelope County	529,502,000	80.12	44.25	8.46	17.45
Boone County	473,778,000	63.08	53.74	0	0
Holt County	453,539,000	75.41	16.31	0	16.31
Chase County	440,113,000	100	93.83	12.36	12.36

Source: USDA 2017 Census of Agriculture County Profiles data available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/
and Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

Broadband Availability and Top Nebraska Counties for Agriculture—Cattle and Calves Inventory

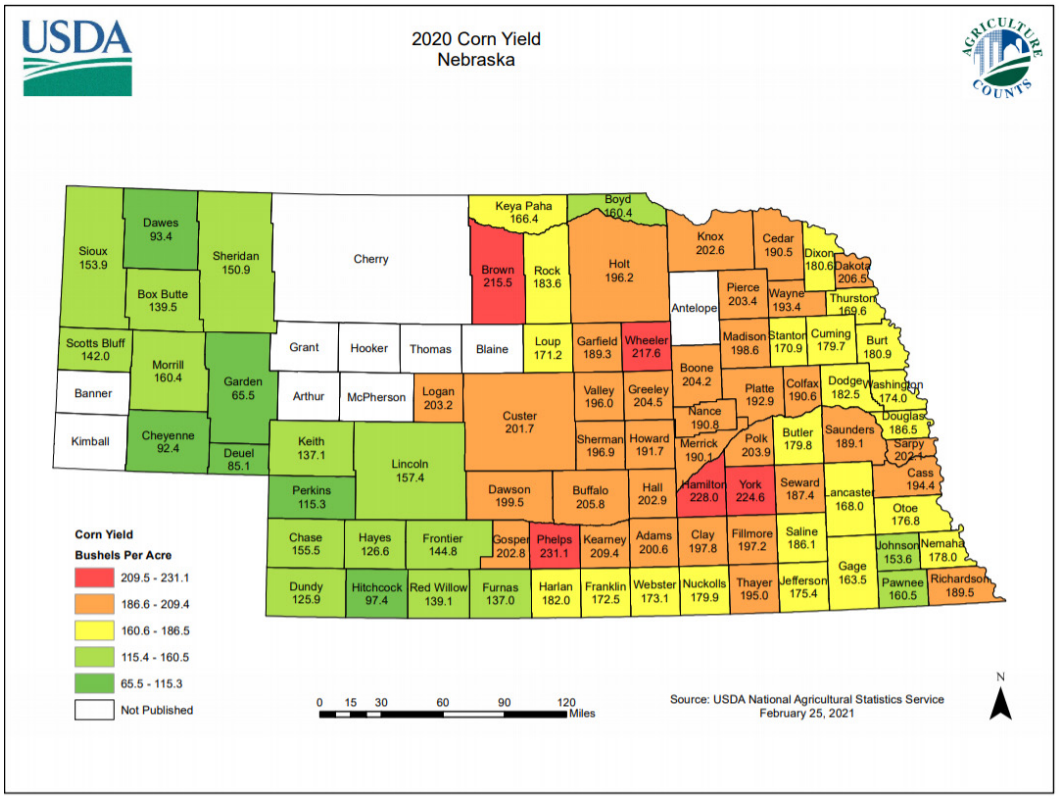


Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcattle.pdfand Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

County	Cattle and Calves Inventory 2020	% rural pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec. 2019
Custer	330,000	53.02	7.21	0.13	3.25
Cuming	325,000	83.83	74.63	74.1	7.06
Lincoln	305,000	81.47	51.37	36.7	35.52
Cherry	285,000	41.88	12.33	0	11.54
Dawson	235,000	63.95	38.21	33.59	7.11
Holt	220,000	75.41	16.31	0	16.31
Phelps	190,000	85.9	62.42	60.18	37.16
Morrill	150,000	98.19	97.78	54.67	28.18
Antelope	140,000	80.12	44.25	8.46	17.45
Brown	140,000	26.8	16.82	0	16.82
Knox	140,000	51.93	0.18	0.18	0.18
Platte	140,000	95.06	72.08	56.61	1.26

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEsoy.pdf and Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

Broadband Availability and Top Nebraska Counties for Agriculture—Corn Yield

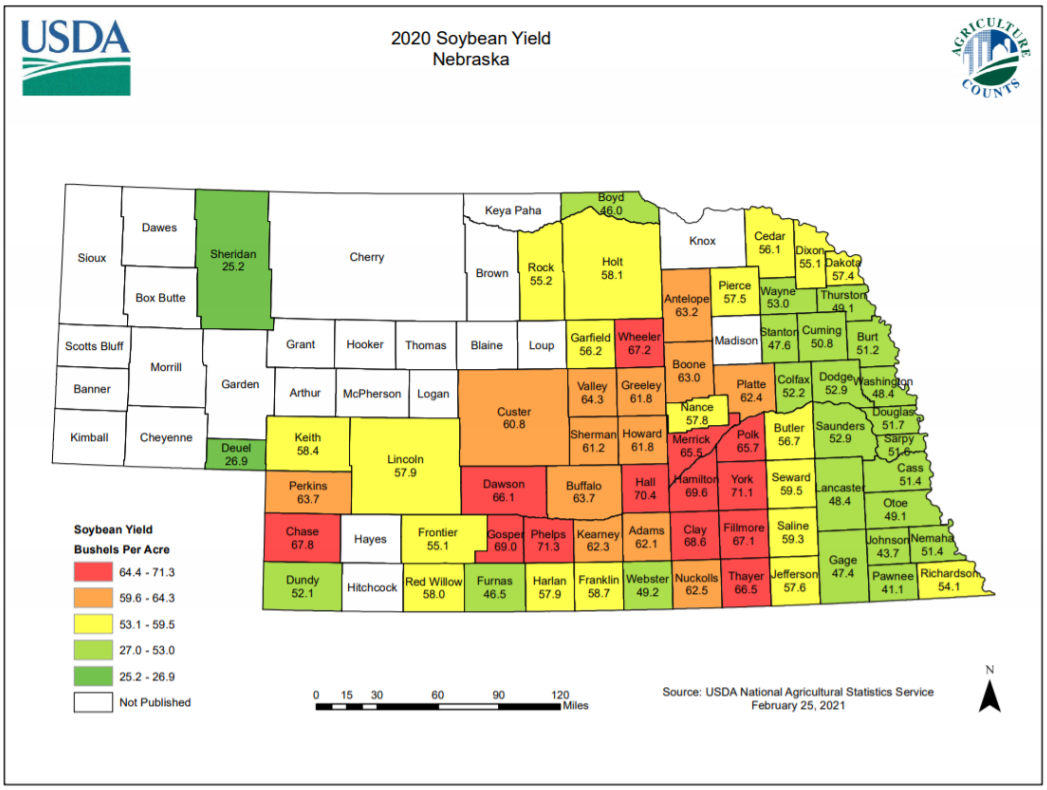


Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcorn.pdf

County	2020 Corn Yield Bushels Per Acre	% pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec. 2019
Phelps	231.1	85.9	62.42	60.18	37.16
Hamilton	228.0	98.94	75.94	70.55	31.07
York	224.6	98.16	75.94	58.46	24.45
Wheeler	217.6	77.91	51.09	0	51.09
Brown	215.5	26.8	16.82	0	16.82
Kearney	209.4	81.8	57.41	57.41	18.06
Dakota	206.5	79.3	79.3	46.17	39.81
Buffalo	205.8	90.43	63.85	61.89	6.95
Greeley	204.5	35.65	21.05	0	2.08
Boone	204.2	63.08	53.74	0	0

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEsoy.pdf

Broadband Availability and Top Nebraska Counties for Agriculture—Soybean Yield

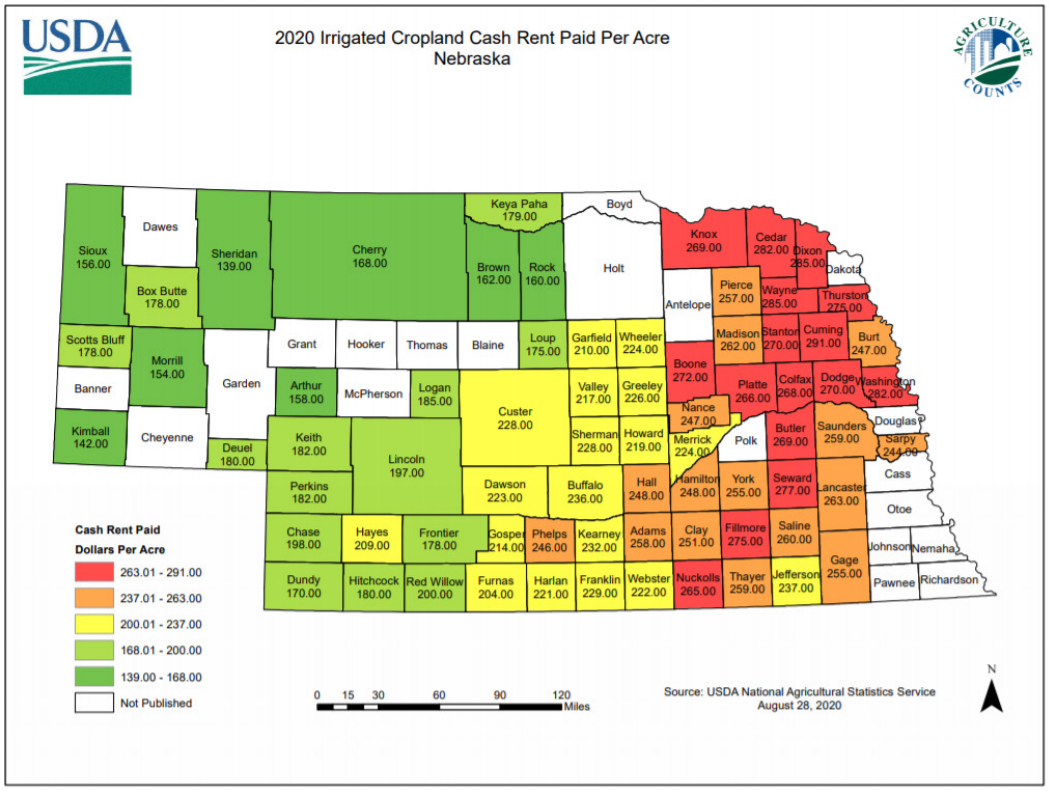


Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEsoy.pdf

County	2020 Soybean Yield Bushels Per Acre	% pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec/ 2019
Phelps	71.3	85.9	62.42	60.18	37.16
York	71.1	98.16	75.94	58.46	24.45
Hall	70.4	98.92	70.79	65.99	2.81
Hamilton	69.6	98.94	75.94	70.55	31.07
Gosper	69.0	52.51	12.51	12.46	0.05
Clay	68.6	74.29	44.29	13.03	5.71
Chase	67.8	100	93.83	12.36	12.36
Wheeler	67.2	77.91	51.09	0	51.09
Fillmore	67.1	84.11	61.52	44.43	5.03
Thayer	66.5	65.02	39.98	35.22	17.25

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEsoy.pdf

Broadband Availability and Top Nebraska Counties for Agriculture—Cash Rent Irrigated Cropland

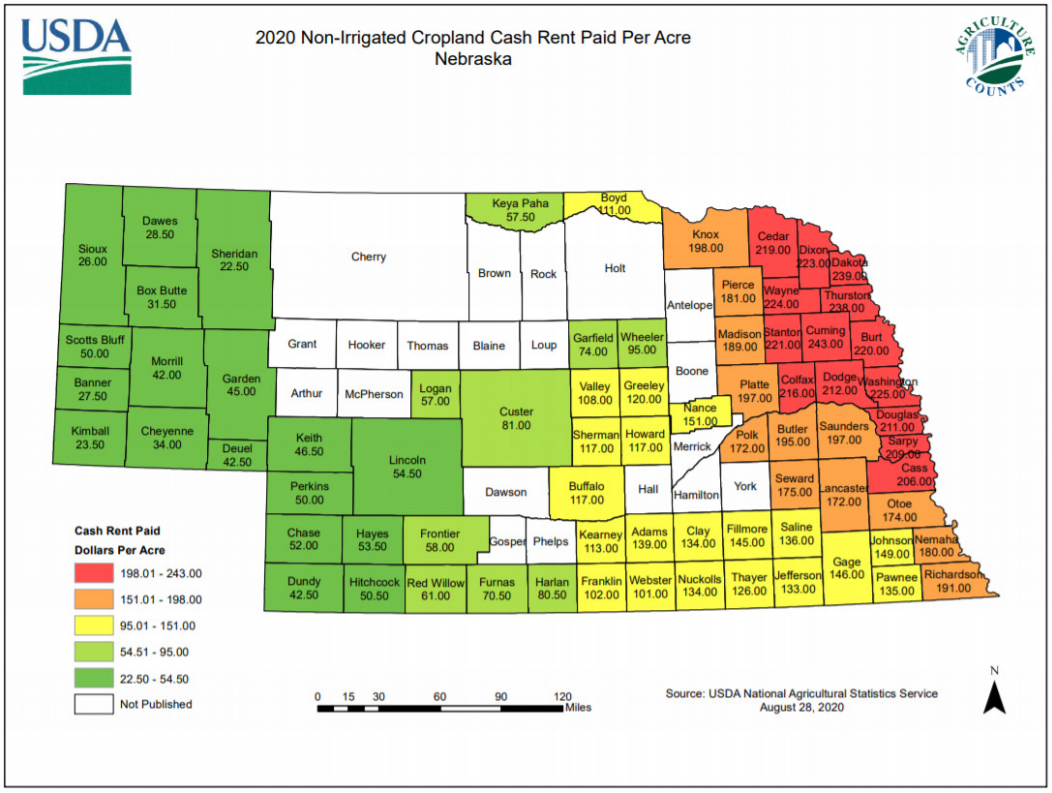


Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcashrents.pdf

County	2020 Irrigated Cropland Cash Rent Paid Per Acre	% pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec/ 2019
Cuming	291.00	83.83	74.63	74.1	7.06
Dixon	285.00	92.37	88.61	29.9	44.23
Wayne	285.00	46.94	43.61	23.7	21.22
Cedar	282.00	65.53	64.78	22.01	42.79
Washington	282.00	100	30.25	4.25	5.92
Seward	277.00	100	88.25	70.57	11.64
Fillmore	275.00	84.11	61.52	44.43	5.03
Thurston	275.00	58.68	34.51	29.11	3.06
Boone	272.00	63.08	53.74	0	0
Dodge	270.00	100	74.63	51.37	23.56

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcashrents.pdf

Broadband Availability and Top Nebraska Counties for Agriculture—Cash Rent Non-Irrigated Cropland

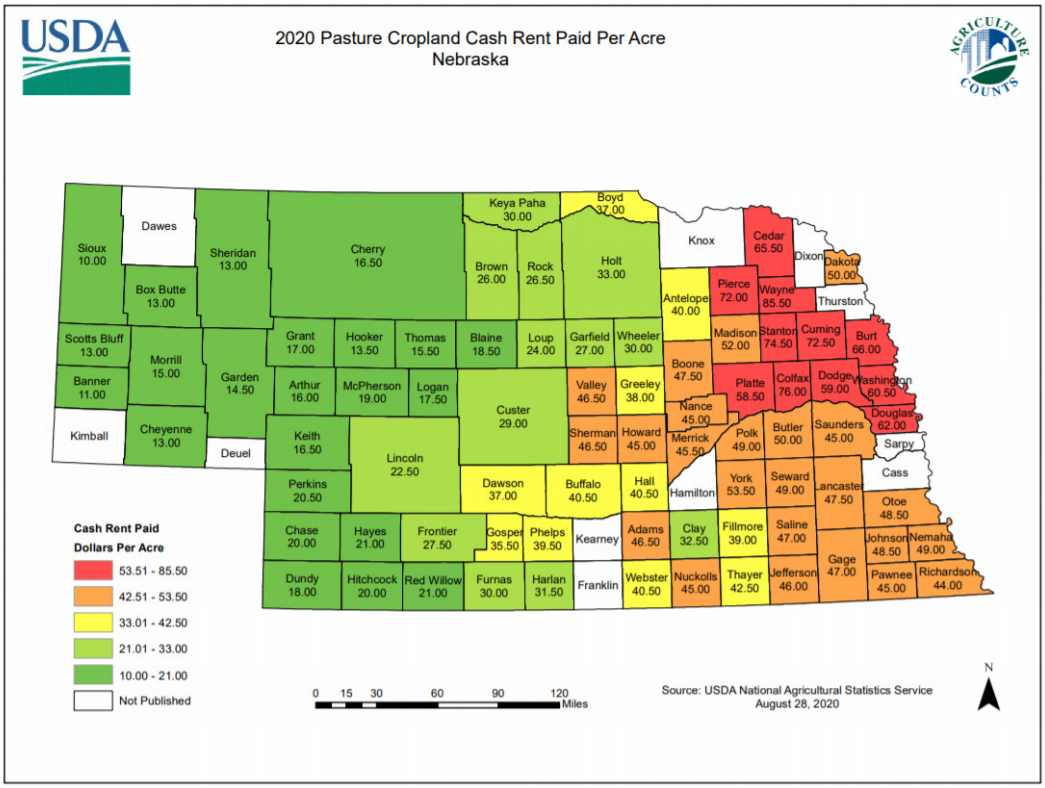


Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcashrents.pdf

County	2020 Non-Irrigated Cropland Cash Rent Paid Per Acre	% pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec/ 2019
Cuming	243.00	83.83	74.63	74.1	7.06
Dakota	239.00	79.3	79.3	46.17	39.81
Thurston	238.00	58.68	34.51	29.11	3.06
Washington	225.00	100	30.25	4.25	5.92
Wayne	224.00	46.94	43.61	23.7	21.22
Dixon	223.00	92.37	88.61	29.9	44.23
Stanton	221.00	90.12	72.12	15.98	56.8
Burt	220.00	98.1	85.26	67.56	20.54
Cedar	219.00	65.53	64.78	22.01	42.79
Colfax	216.00	100	38.49	20.56	0.93

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEsoy.pdf

Broadband Availability and Top Nebraska Counties for Agriculture—Cash Rent Pasture Cropland



Map available at https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcashrents.pdf

County	2020 Pasture Cropland Cash Rent Paid Per Acre	% pop w/25/3 Dec. 2019	% rural pop w/100/10 Dec. 2019	% rural pop w/250/25 Dec. 2019	% rural pop w/fiber 100/10 Dec/ 2019
Wayne	85.50	46.94	43.61	23.7	21.22
Colfax	76.00	100	38.49	20.56	0.93
Stanton	74.50	90.12	72.12	15.98	56.8
Cuming	72.50	83.83	74.63	74.1	7.06
Pierce	72.00	81.27	68.93	68.4	31.25
Burt	66.00	98.1	85.26	67.56	20.54
Cedar	65.50	65.53	64.78	22.01	42.79
Douglas	62.00	100	86.03	71.11	36.15
Washington	60.50	100	30.25	4.25	5.92
Dodge	59.00	100	74.63	51.37	23.56

Source: FCC Broadband Map https://broadbandmap.fcc.gov and USDA National Agricultural Statistics Service https://www.nass.usda.gov/Statistics_by_State/Nebraska/Publications/County_Estimates/20NEcashrents.pdf

% Rural Population with Broadband Available (ADSL, Fiber, Cable, Fixed Wireless) Dec 2019 And Agricultural Sales (2017)					
County	**Agricultural Sales ($1,000)**	**% Rural Pop with 25/3**	**% Rural Pop with 100/10**	**% Rural Pop with 250/25**	**% Rural Pop with 100/10 Fiber**
Adams County	392,512	74.28	69.08	68.39	44.58
Antelope County	529,502	80.12	44.25	8.46	17.45
Arthur County	27,515	75.59	75.59	22.25	75.59
Banner County	100,509	98.79	98.79	0	0
Blaine County	32,055	48.39	36.56	0	36.56
Boone County	473,778	63.08	53.74	0	0
Box Butte County	176,933	94.14	94.14	76.03	75.96
Boyd County	104,269	99.43	68.84	0	68.84
Brown County	290,746	26.8	16.82	0	16.82
Buffalo County	332,712	90.43	63.85	61.89	6.95
Burt County	263,744	98.1	85.26	67.56	20.54
Butler County	259,765	100	79.69	58.62	13.84
Cass County	164,234	100	86.02	47.85	18.1
Cedar County	423,060	65.53	64.78	22.01	42.79
Chase County	440,113	100	93.83	12.36	12.36
Cherry County	230,927	41.88	12.33	0	11.54
Cheyenne County	163,932	88.39	85.99	8.86	0
Clay County	356,051	74.29	44.29	13.03	5.71
Colfax County	364,450	100	38.49	20.56	0.93
Cuming County	1,131,997	83.83	74.63	74.1	7.06
Custer County	781,155	53.02	7.21	0.13	3.25
Dakota County	84,954	79.3	79.3	46.17	39.81
Dawes County	60,933	67.33	51.4	41.77	42.27
Dawson County	748,426	63.95	38.21	33.59	7.11
Deuel County	71,317	94.09	69.29	0	0
Dixon County	271,575	92.37	88.61	29.9	44.23
Dodge County	270,502	100	74.63	51.37	23.56
Douglas County	55,535	100	86.03	71.11	36.15
Dundy County	161,137	96.1	0	0	0
Fillmore County	240,945	84.11	61.52	44.43	5.03
Franklin County	106,857	72	43.67	43.67	33.4
Frontier County	121,440	76.78	13.06	3.81	13.06
Furnas County	240,389	78.68	57.59	24.74	39.09

County	Agricultural Sales ($1,000)	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
Gage County	280,173	90.12	48.24	10.9	15.69
Garden County	81,199	92.49	92.49	0	2.45
Garfield County	54,720	90.25	0.66	0.66	0
Gosper County	105,730	52.51	12.51	12.46	0.05
Grant County	24,129	69.34	23.6	0	23.6
Greeley County	193,340	35.65	21.05	0	2.08
Hall County	302,402	98.92	70.79	65.99	2.81
Hamilton County	275,749	98.94	75.94	70.55	31.07
Harlan County	160,274	75.59	5.77	0.74	5.77
Hayes County	167,234	87.66	2.4	0	0
Hitchcock County	59,623	97.43	0.29	0	0
Holt County	453,539	75.41	16.31	0	16.31
Hooker County	14,035	94.13	22.43	0	22.43
Howard County	235,183	81.16	47.59	41.37	0
Jefferson County	219,574	51.8	25.49	7.11	15.08
Johnson County	83,132	100	51.59	38.18	3.65
Kearney County	369,734	81.8	57.41	57.41	18.06
Keith County	161,853	88.49	74.49	44.01	45.04
Keya Paha County	52,332	96.53	7.2	0	6.7
Kimball County	39,975	97.05	95.57	68.45	0
Knox County	288,490	51.93	0.18	0.18	0.18
Lancaster County	188,834	100	84.32	48.54	28.04
Lincoln County	755,236	81.47	51.37	36.7	35.52
Logan County	28,614	23.66	0.27	0	0.27
Loup County	30,804	84.62	3.02	0	3.02
Madison County	276,087	90.96	61.62	51.72	4.2
McPherson County	28,399	51.82	10.32	7.49	10.32
Merrick County	240,328	90.61	63.85	28.52	17.01
Morrill County	319,692	98.19	97.78	54.67	28.18
Nance County	155,302	80.68	67.29	14.01	0.63
Nemaha County	114,427	100	46.88	5.72	14.4
Nuckolls County	147,522	74.06	67.24	62.15	61.45
Otoe County	170,523	100	66.3	28.77	5.11
Pawnee County	78,869	88.98	47.61	44.62	5.82
Perkins County	196,792	95.88	92.11	0	2.53
Phelps County	578,241	85.9	62.42	60.18	37.16

County	Agricultural Sales ($1,000)	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
Pierce County	255,468	81.27	68.93	68.4	31.25
Platte County	688,562	95.06	72.08	56.61	1.26
Polk County	330,698	99.44	81.09	46.19	2.23
Red Willow County	188,195	96.55	25.72	14.31	14.31
Richardson County	149,348	99.21	80.79	23.99	61.65
Rock County	108,100	73.77	11.79	0	11.79
Saline County	206,909	98.95	79.87	52.25	1.84
Sarpy County	54,922	100	92.66	60.52	19.8
Saunders County	360,464	100	80.15	38.94	27.87
Scotts Bluff County	322,727	100	99.97	50.23	8.32
Seward County	250,954	100	88.25	70.57	11.64
Sheridan County	150,603	51.98	3.16	0.06	3.16
Sherman County	139,348	74.34	46.05	42.92	0
Sioux County	133,325	100	80.79	6	9.09
Stanton County	208,390	90.12	72.12	15.98	56.8
Thayer County	227,717	65.02	39.98	35.22	17.25
Thomas County	24,397	80.19	31.16	0	31.16
Thurston County	207,256	58.68	34.51	29.11	3.06
Valley County	223,891	78.14	51.42	51.42	0
Washington County	150,390	100	30.25	4.25	5.92
Wayne County	223,811	46.94	43.61	23.7	21.22
Webster County	347,852	56.12	53.63	49.56	50.42
Wheeler County	283,148	77.91	51.09	0	51.09
York County	340,896	98.16	75.94	58.46	24.45

Source: USDA 2017 Census of Agriculture County Profiles data available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/ and Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

% Rural Population with Broadband available (ADSL, Fiber, Cable, Fixed Wireless) Dec 2019 By Agricultural Sales (2017)					
County	**Agricultural Sales ($1,000)**	**% Rural Pop with 25/3**	**% Rural Pop with 100/10**	**% Rural Pop with 250/25**	**% Rural Pop with 100/10 Fiber**
Cuming County	1,131,997	83.83	74.63	74.1	7.06
Custer County	781,155	53.02	7.21	0.13	3.25
Lincoln County	755,236	81.47	51.37	36.7	35.52
Dawson County	748,426	63.95	38.21	33.59	7.11
Platte County	688,562	95.06	72.08	56.61	1.26
Phelps County	578,241	85.9	62.42	60.18	37.16
Antelope County	529,502	80.12	44.25	8.46	17.45
Boone County	473,778	63.08	53.74	0	0
Holt County	453,539	75.41	16.31	0	16.31
Chase County	440,113	100	93.83	12.36	12.36
Cedar County	423,060	65.53	64.78	22.01	42.79
Adams County	392,512	74.28	69.08	68.39	44.58
Kearney County	369,734	81.8	57.41	57.41	18.06
Colfax County	364,450	100	38.49	20.56	0.93
Saunders County	360,464	100	80.15	38.94	27.87
Clay County	356,051	74.29	44.29	13.03	5.71
Webster County	347,852	56.12	53.63	49.56	50.42
York County	340,896	98.16	75.94	58.46	24.45
Buffalo County	332,712	90.43	63.85	61.89	6.95
Polk County	330,698	99.44	81.09	46.19	2.23
Scotts Bluff County	322,727	100	99.97	50.23	8.32
Morrill County	319,692	98.19	97.78	54.67	28.18
Hall County	302,402	98.92	70.79	65.99	2.81
Brown County	290,746	26.8	16.82	0	16.82
Knox County	288,490	51.93	0.18	0.18	0.18
Wheeler County	283,148	77.91	51.09	0	51.09
Gage County	280,173	90.12	48.24	10.9	15.69
Madison County	276,087	90.96	61.62	51.72	4.2
Hamilton County	275,749	98.94	75.94	70.55	31.07
Dixon County	271,575	92.37	88.61	29.9	44.23
Dodge County	270,502	100	74.63	51.37	23.56
Burt County	263,744	98.1	85.26	67.56	20.54
Butler County	259,765	100	79.69	58.62	13.84
Pierce County	255,468	81.27	68.93	68.4	31.25
Seward County	250,954	100	88.25	70.57	11.64
Fillmore County	240,945	84.11	61.52	44.43	5.03
Furnas County	240,389	78.68	57.59	24.74	39.09

County	Agricultural Sales ($1,000)	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
Merrick County	240,328	90.61	63.85	28.52	17.01
Howard County	235,183	81.16	47.59	41.37	0
Cherry County	230,927	41.88	12.33	0	11.54
Thayer County	227,717	65.02	39.98	35.22	17.25
Valley County	223,891	78.14	51.42	51.42	0
Wayne County	223,811	46.94	43.61	23.7	21.22
Jefferson County	219,574	51.8	25.49	7.11	15.08
Stanton County	208,390	90.12	72.12	15.98	56.8
Thurston County	207,256	58.68	34.51	29.11	3.06
Saline County	206,909	98.95	79.87	52.25	1.84
Perkins County	196,792	95.88	92.11	0	2.53
Greeley County	193,340	35.65	21.05	0	2.08
Lancaster County	188,834	100	84.32	48.54	28.04
Red Willow County	188,195	96.55	25.72	14.31	14.31
Box Butte County	176,933	94.14	94.14	76.03	75.96
Otoe County	170,523	100	66.3	28.77	5.11
Hayes County	167,234	87.66	2.4	0	0
Cass County	164,234	100	86.02	47.85	18.1
Cheyenne County	163,932	88.39	85.99	8.86	0
Keith County	161,853	88.49	74.49	44.01	45.04
Dundy County	161,137	96.1	0	0	0
Harlan County	160,274	75.59	5.77	0.74	5.77
Nance County	155,302	80.68	67.29	14.01	0.63
Sheridan County	150,603	51.98	3.16	0.06	3.16
Washington County	150,390	100	30.25	4.25	5.92
Richardson County	149,348	99.21	80.79	23.99	61.65
Nuckolls County	147,522	74.06	67.24	62.15	61.45
Sherman County	139,348	74.34	46.05	42.92	0
Sioux County	133,325	100	80.79	6	9.09
Frontier County	121,440	76.78	13.06	3.81	13.06
Nemaha County	114,427	100	46.88	5.72	14.4
Rock County	108,100	73.77	11.79	0	11.79
Franklin County	106,857	72	43.67	43.67	33.4
Gosper County	105,730	52.51	12.51	12.46	0.05
Boyd County	104,269	99.43	68.84	0	68.84
Banner County	100,509	98.79	98.79	0	0
Dakota County	84,954	79.3	79.3	46.17	39.81
Johnson County	83,132	100	51.59	38.18	3.65
Garden County	81,199	92.49	92.49	0	2.45

County	Agricultural Sales ($1,000)	% Rural Pop with 25/3	% Rural Pop with 100/10	% Rural Pop with 250/25	% Rural Pop with 100/10 Fiber
Pawnee County	78,869	88.98	47.61	44.62	5.82
Deuel County	71,317	94.09	69.29	0	0
Dawes County	60,933	67.33	51.4	41.77	42.27
Hitchcock County	59,623	97.43	0.29	0	0
Douglas County	55,535	100	86.03	71.11	36.15
Sarpy County	54,922	100	92.66	60.52	19.8
Garfield County	54,720	90.25	0.66	0.66	0
Keya Paha County	52,332	96.53	7.2	0	6.7
Kimball County	39,975	97.05	95.57	68.45	0
Blaine County	32,055	48.39	36.56	0	36.56
Loup County	30,804	84.62	3.02	0	3.02
Logan County	28,614	23.66	0.27	0	0.27
McPherson County	28,399	51.82	10.32	7.49	10.32
Arthur County	27,515	75.59	75.59	22.25	75.59
Thomas County	24,397	80.19	31.16	0	31.16
Grant County	24,129	69.34	23.6	0	23.6
Hooker County	14,035	94.13	22.43	0	22.43

Source: USDA 2017 Census of Agriculture County Profiles data available at https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Nebraska/ and Dec 2019 FCC Form 477 data from the FCC Broadband Map at https://broadbandmap.fcc.gov

Rural Broadband Task Force Agriculture Subcommittee

Members

Dan Spray	My Precision IT
Zachary Hunnicutt	Hunnicutt Farms
Isaiah Graham	Homestead Bank
Steve Wellman	Nebraska Department of Agriculture
Commissioner Mary Ridder	Nebraska Public Service Commission
Senator Curt Friesen	Nebraska Legislature

Events, Meetings and Speakers

Precision Ag Demo in Arnold and Sutherland hosted by Paige Wireless

October 15, 2020

Professor Terry Griffin	Kansas State University
Professor Gus Hurwitz	University of Nebraska
Steve Tippery	RealmFive

Precision Ag Subcommittee Meeting

January 22, 2021

Bruce Rieker	Nebraska Farm Bureau
Ashley Kohls	Nebraska Cattlemen
Micah Graff	Landmark Implement

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Aerial view of irrigated fields by John Kelley, USDA
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Copies of the executive summary, full report, and appendices are available at:
https://ruralbroadband.nebraska.gov