

Improving the Data Customer's Ability to Visualize Historical Data at the National Agricultural Statistics Service

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Acknowledgments

Special thanks to Carol Crawford, Lee Ebinger, Bob Seffrin, and Eric Wilson for their expertise and encouragement in helping develop and implement the changes discussed and presented here.

- **What's the problem?**
- **Is it solvable?**
- **If yes, how?**

The visualizations discussed and presented include:

- 1) “**sparklines**”, and map galleries, employed in small multiples
- 2) **animations** which depict changes over time,
- 3) **interactive charts** and graphics to enable data customers to drill down and focus on more detailed views of the data.

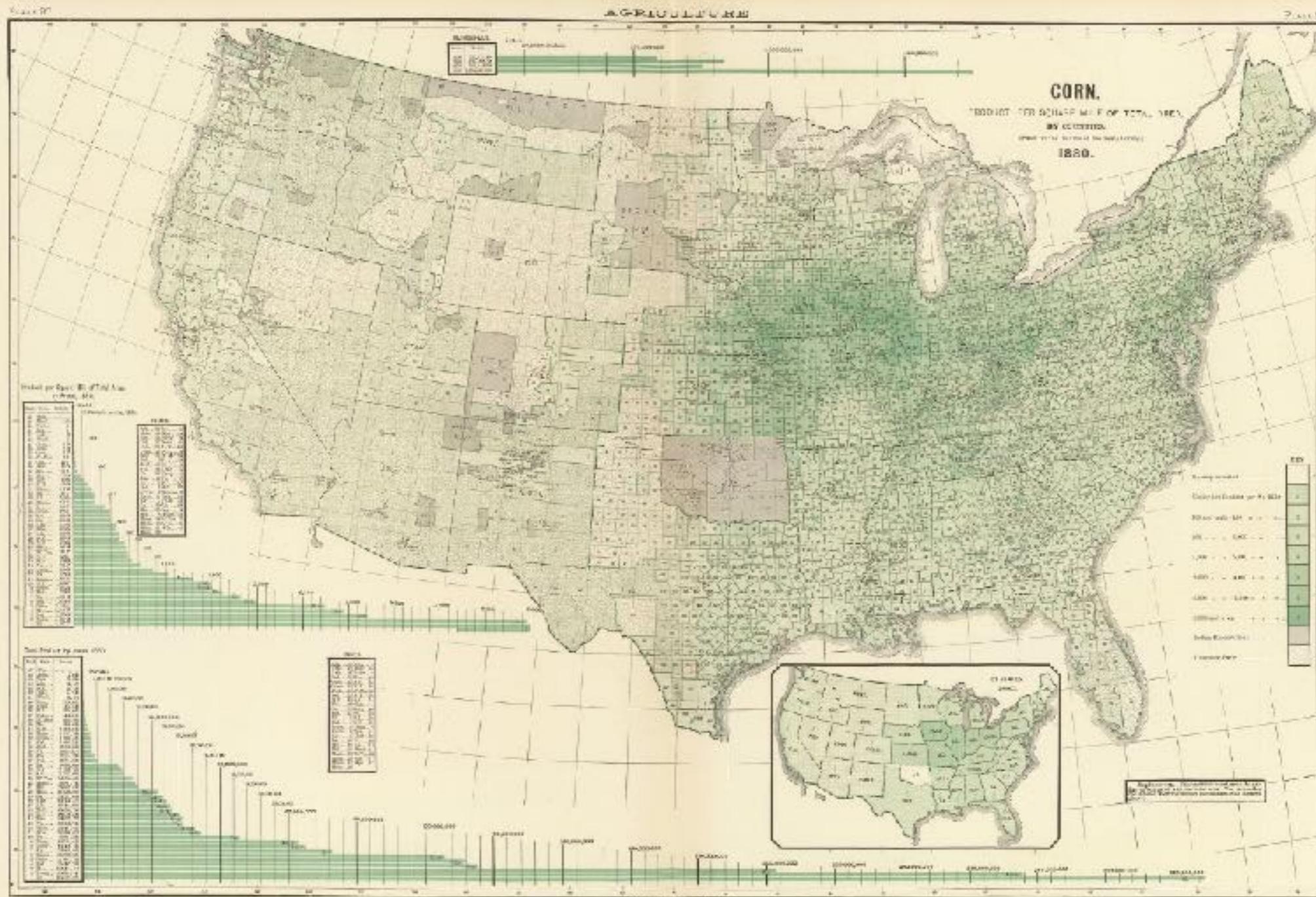
“Graphical elegance is often found in simplicity of design and complexity of data.”

- Edward Tufte

Some recommendations:

- Use words, numbers, and drawings together
- Reflect balance, proportion, a sense of relevant scale
- When possible, have a story to tell about the data
- Create charts in a professional manner, with care
- Avoid using “chartjunk”

- Maps can be enhanced by integrating charts and graphs
- Common when people had to draw maps and charts by hand



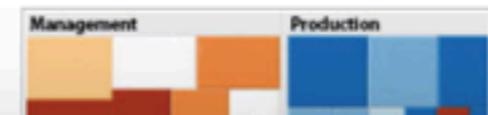
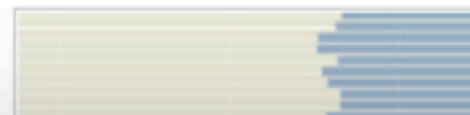
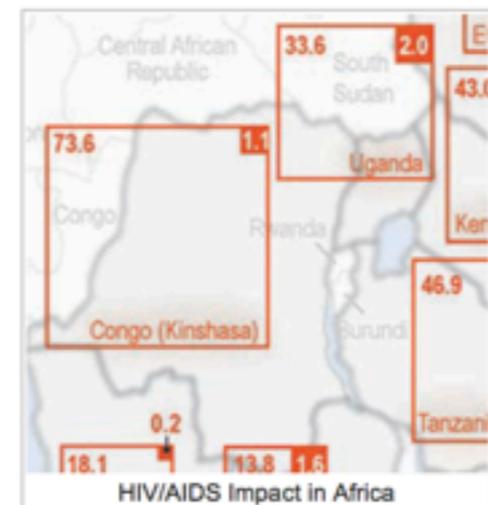
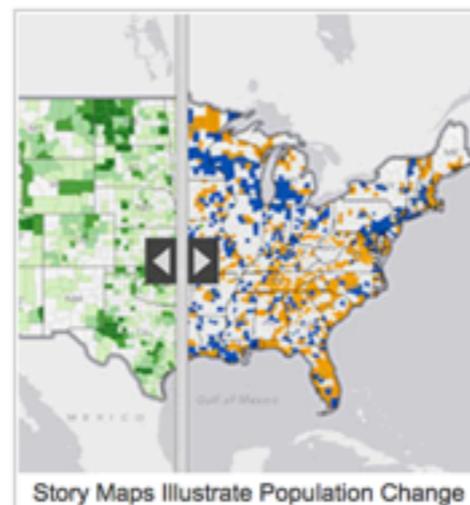
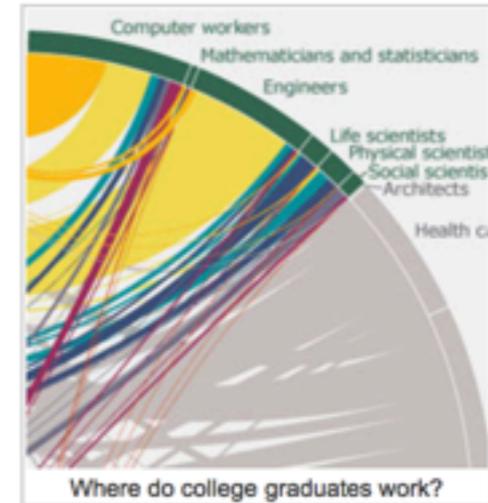
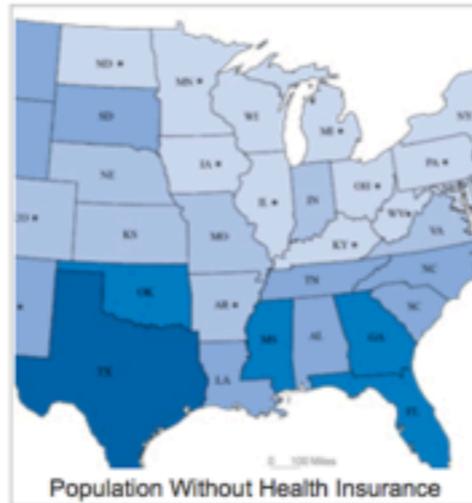
Data

Census Tools
APIs

Data Visualization Gallery

A weekly exploration of Census data.

The Census Bureau is working to increase our use of visualization in making data available to the public, and this gallery is an early part of that effort. The first posted visualizations will pertain largely to historical population data, building on prior work done to portray historical changes in the growth and redistribution of the U.S. population. For later visualizations, the topics will expand beyond decennial census data to include the full breadth of Census Bureau data sets and subject areas, from household and family dynamics, to migration and geographic mobility, to economic indicators.





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Home / Data Products / Data Visualizations / Data Visualizations

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Food Safety

International Markets & U.S. Trade

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Rural Economy & Population

Data Visualizations

Click on any of the images below to explore an interactive data visualization:

		2016/17 estimate	2017/18 projections Low end High end	2018/19 projections Low end High end	2019/20 projections Low end High end	Change from 2016/17		
Cattle	Cattle	676	68	83	88	67	71	2
	Hay	676	4.96	4.1	4.8	4.15	4.85	1
Feed grains & oilseed	Corn	676	3.36	2.85	3.55	2.95	3.55	1
	Soybeans	676	2.98	2.5	2.7	2.35	2.65	1
	Wheat	676	2.75	2.15	2.45	2.35	2.45	1
Pigs	Long	676	0.44	0.8	0.8	0.3	0.3	1
	Medium and short	676	12.9	14.2	15.2	14.5	15.5	1
Sheep	Wool	676	218.88	286	308	286	308	1
	Other	676	0.3248	0.325	0.365	0.32	0.35	1
Horses	Other	676	0.47	0.6	0.6	0.6	0.6	1

676: cents per pound
676: dollars per bushel
676: dollars per short ton

676: dollars per pound
676: dollars per hundredweight
676: dollars per short ton

2/9/2018
World Agricultural Supply and Demand Estimates at a Glance

Get to know farms in Georgia

Farm facts

Number of farms	41,000
Acres of farmland	9,500,000
Net farm income	\$1,814,872,000
Government payments	\$444,367,000
Federal insurance premiums	\$5,671,000
Federal insurance indemnities	\$135,530,000

Ranked by: Net farm income 2008-2016

2/7/2018
Charts and Maps About Your State

2/7/2018
Charts and Maps of U.S. Farm Income Statement Data

Nominal/dollar dollars
Select asset/debt measures (Multiple values)

U.S. farm assets, debt, and equity, 1980 to 2017

2/7/2018
Charts and Maps of U.S. Farm Balance Sheet Data

2000

2/5/2018
SNAP Policy Index

216 commodity exports to California (million dollars)

Wool	1,331
Other farm products	2,005
Wool, fresh	2,043
Wool, processed	2,498

State rank by 2016 export value of soybean meal

1/26/2018
Annual State Agricultural Exports Interactive Chart

Examples of traditional historical data presentations NASS

- Tables typically part of published reports (PDF/Hardcopy)
- Static graphs showing trends (typically last 20 years)

Corn Area Planted and Harvested, Yield, Production, Utilization, Price, and Value – United States: 1866-2016 (continued)

[Blank data cells indicate a program change or that the estimation period has not yet begun]

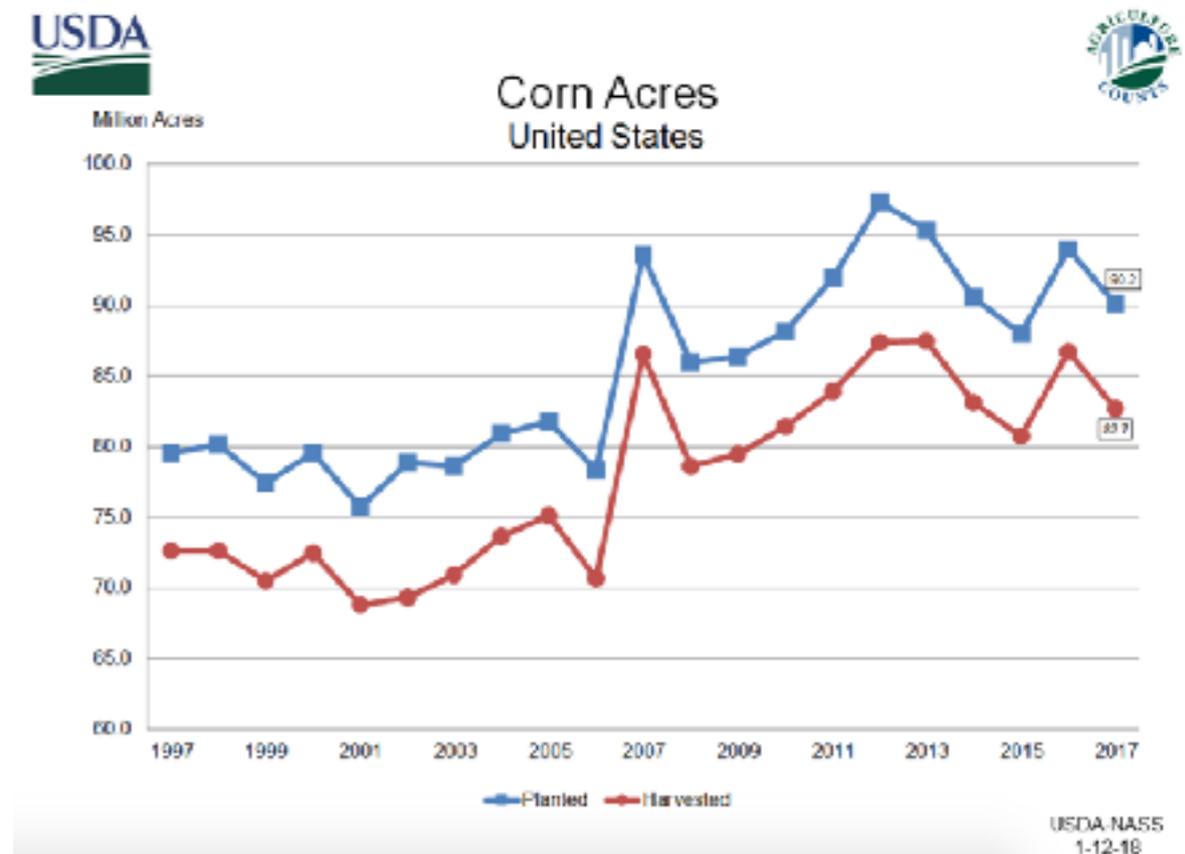
Year	Acreage for all purposes		Harvested for grain ¹					Harvested for silage			Forage grazed/hogged
	Planted	Hv	Acres	Yield per acre	Production	Price per bushel ²	Value of production	Acres	Yield per acre	Production	
	(1,000 ac)	(1,000 ac)	(1,000 ac)	(bu)	(1,000 bu)	(dollars)	(1,000 dollars)	(1,000 ac)	(tons)	(1,000 tons)	(1,000 ac)
1990 ...	74,166	73,075	66,952	118.5	7,934,028	2.28	18,191,643	6,125	14.20	85,820	
1991 ...	75,957	74,862	68,822	108.6	7,474,766	2.37	17,860,947	6,140	13.20	81,216	
1992 ...	78,311	78,146	72,077	131.5	9,476,698	2.07	19,723,258	6,069	14.40	87,863	
1993 ...	73,239	69,796	62,963	100.7	6,337,730	2.50	16,038,515	6,823	11.90	81,131	
1994 ...	78,921	76,231	72,514	138.6	10,050,520	2.28	22,874,154	5,717	15.00	90,170	
1995 ...	71,479	70,531	65,210	113.5	7,400,051	3.24	24,202,234	5,321	14.70	78,181	
1996 ...	79,229	78,251	72,844	127.1	9,232,557	2.71	25,148,013	5,807	15.40	89,561	
1997 ...	79,537	78,726	72,871	128.7	9,206,832	2.43	22,351,507	6,091	18.10	97,182	
1998 ...	80,165	78,502	72,589	134.4	9,758,686	1.94	18,922,084	5,818	18.10	95,479	
1999 ...	77,386	76,634	70,487	133.8	9,430,612	1.82	17,103,991	6,037	15.80	95,633	
2000 ...	79,551	78,522	72,440	136.9	9,915,051	1.85	18,499,002	6,082	15.80	102,156	
2001 ...	75,702	74,910	68,768	138.2	9,502,500	1.97	18,878,819	6,142	16.60	101,952	
2002 ...	78,894	76,452	68,390	128.3	8,966,787	2.32	20,882,448	7,122	14.40	102,293	
2003 ...	78,803	77,527	70,944	142.2	10,087,292	2.42	24,472,254	6,688	16.30	107,378	
2004 ...	80,929	79,732	73,831	160.3	11,805,581	2.08	24,377,913	6,101	17.60	107,293	
2005 ...	81,779	81,047	75,117	147.9	11,112,187	2.00	22,194,287	5,930	18.00	105,486	
2006 ...	78,327	77,125	70,838	149.1	10,531,123	3.04	32,083,011	6,487	18.20	105,264	
2007 ...	93,527	92,590	86,520	150.7	13,037,875	4.20	54,666,959	6,060	17.50	106,229	
2008 ...	85,982	84,541	78,570	153.3	12,043,203	4.06	49,104,148	5,971	18.70	111,752	
2009 ...	88,382	85,085	79,190	161.1	13,087,156	3.55	46,610,938	5,605	19.30	108,221	
2010 ...	88,192	87,013	81,448	162.6	12,426,330	6.18	84,629,828	5,667	19.30	107,314	
2011 ...	91,936	89,614	83,879	146.8	12,313,936	6.22	76,651,242	5,935	18.40	103,091	
2012 ...	97,291	94,784	87,365	123.1	10,755,111	6.89	74,155,299	7,419	15.70	115,148	
2013 ...	95,365	93,732	87,451	158.1	13,820,934	4.18	61,827,518	6,201	18.00	110,296	
2014 ...	90,587	89,507	83,138	171.0	14,215,532	3.70	52,851,760	6,371	20.10	128,048	
2015 ...	88,019	86,990	80,753	168.4	13,601,954	3.61	49,338,261	6,237	20.40	127,311	
2016 ...	94,004	92,934	88,748	174.6	15,146,038	3.40	51,700,898	6,186	20.30	125,870	

¹ Includes other uses converted to "Grain Equivalent" prior to 1913.

² December 1 price prior to 1909; season average price 1909 through 1995; marketing year price beginning 1996.

Charts and Maps

Corn: Acreage by Year, US



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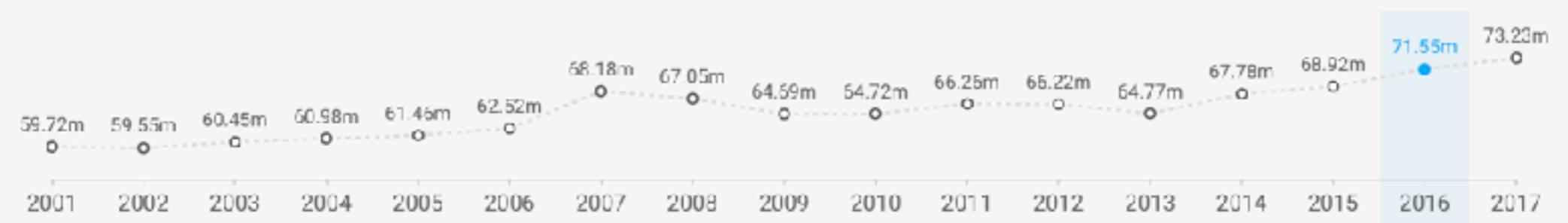
You are here: [Home](#) / Data Visualization

Statistics by State

NASS Data Visualization

COMMODITY: **Hogs** STATISTIC: **Inventory**
Measured in Head (On Dec 1)

Print CSV Share



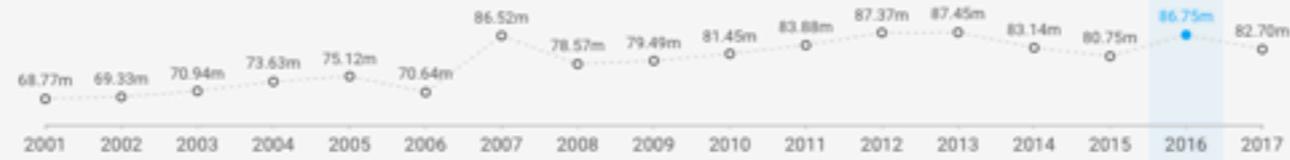
Inventory - Measured in Head (On Dec 1) - United States

US States - 2016

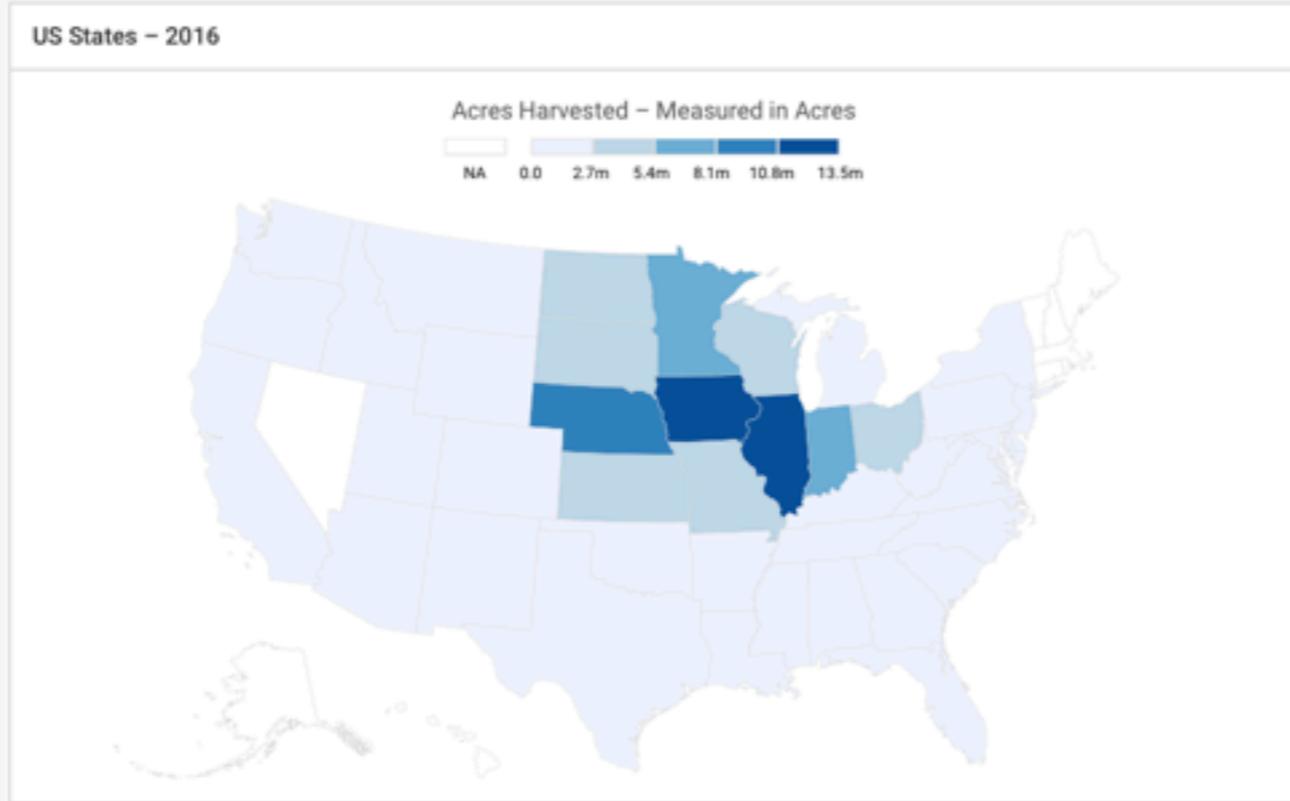


NASS Data Visualization

COMMODITY
Corn, Grain
STATISTIC
Acres Harvested
Measured in Acres
Print
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Acres Harvested - Measured in Acres - United States



US State Rankings - 2016 Acres Harvested - Measured in...			BY RANK	ALPHABETICAL	
Iowa	13.50m	Tennessee	830.00k	Montana	55.00k
Illinois	11.45m	Arkansas	745.00k	Arizona	50.00k
Nebraska	9.55m	Mississippi	720.00k	New Mexico	41.00k
Minnesota	8.00m	New York	570.00k	Florida	40.00k
Indiana	5.47m	Louisiana	550.00k	Oregon	39.00k
South Dakota	5.13m	Maryland	400.00k	West Virginia	35.00k
Kansas	4.92m	South Carolina	350.00k	Utah	29.00k
Missouri	3.50m	Oklahoma	350.00k	Vermont	0.00
Ohio	3.30m	Virginia	340.00k	Rhode Island	0.00

Sparklines

As defined by Ed Tufte:

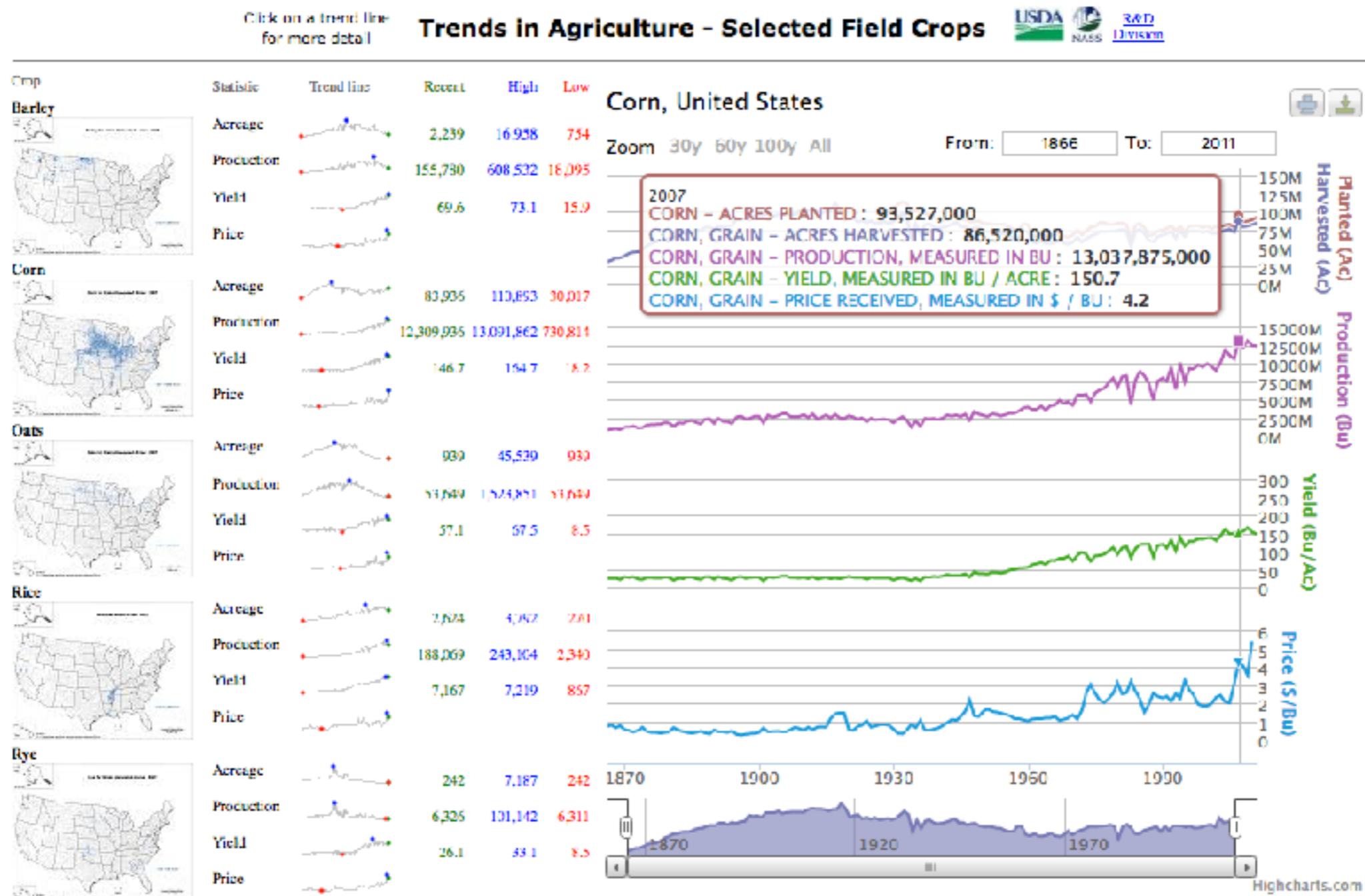
- “a small intense, simple, word-sized graphic with typographic resolution.”
- “Sparklines ... can be everywhere a word or number can be: embedded in a sentence, table, headline, map, spreadsheet, graphic.”



\$64,368	Vanguard 500 Index	-2.0%	+12.2%	-11.7%	-0.8%
62,510	Fidelity Magellan	-2.1	+11.3	-12.9	-0.2
50,329	Amer A Invest Co Am	-1.2	+09.4	-03.9	+4.0
47,355	Amer A WA Mutual Inv	-1.5	+09.9	+00.8	+3.0
40,500	PIMCO Instl Tot Return	-2.3	+02.4	+09.4	+7.6
37,641	Amer A Grow Fd Amer	-2.9	+14.1	-11.0	+7.4
31,161	Fidelity Contrafund	-1.0	+10.7	-06.5	+3.0
28,296	Fidelity Growth & Inc	-1.8	+08.2	-08.7	-0.1
25,314	Amer A Inc Fund Amer	-0.5	+09.9	+05.5	+5.4
24,155	Vanguard Instl Index	-2.0	+12.3	-11.6	-0.7

Sparklines can

- Tracking changes over time, and facilitate comparisons
- Show overall trend as well as local detail
- Be depicted as part of a data table
- Color code min, max, and most recent values



Click on a trend line for more detail

Trends in Agriculture - Selected Field Crops

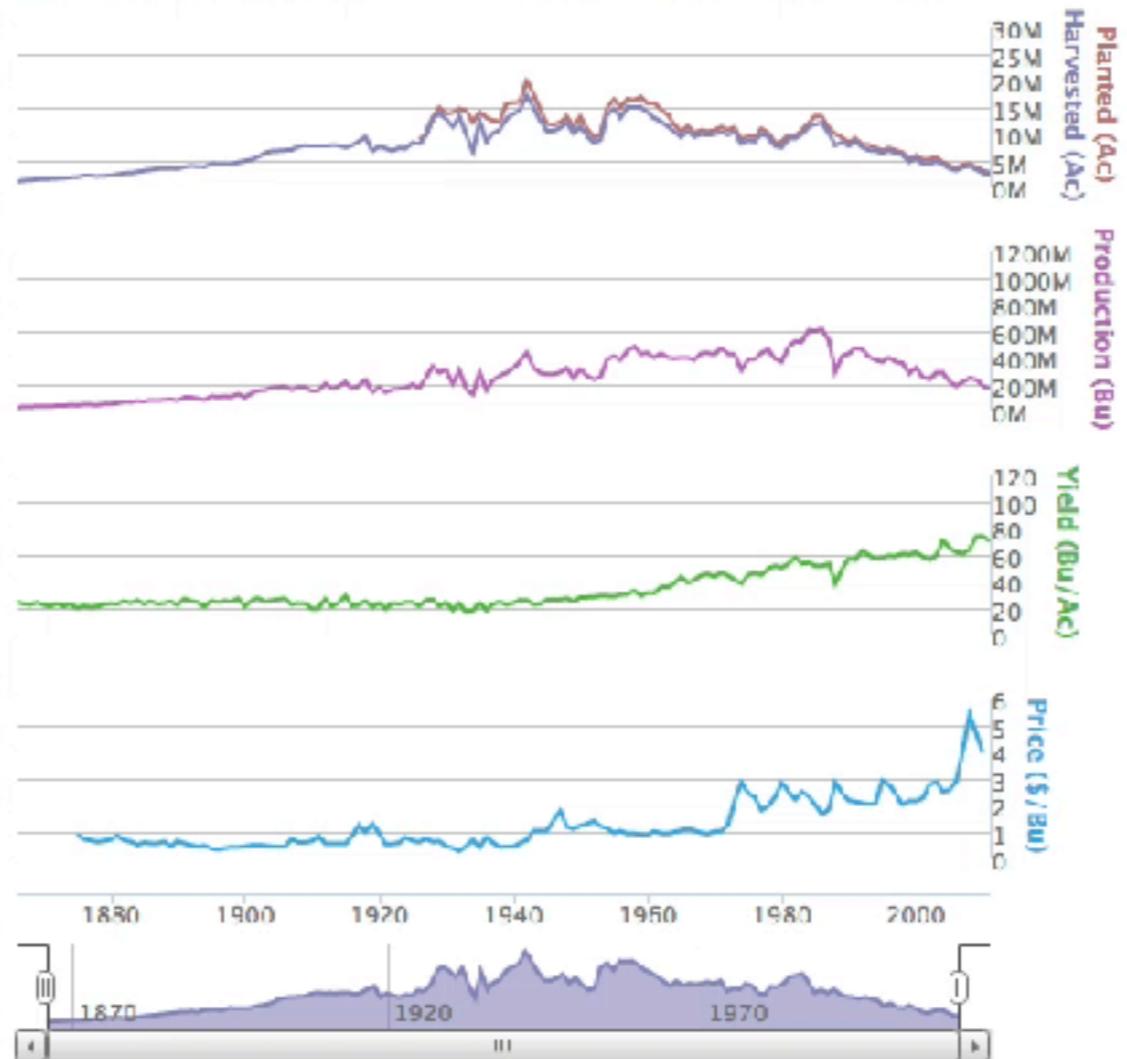


Crop	Statistic	Trend line	Recent	High	Low
Barley	Acreage		2,239	16,558	754
	Production		155,780	608,252	13,095
	Yield		69.6	73.1	15.9
	Price				
Corn	Acreage		83,936	113,893	30,017
	Production		12,300,936	19,001,862	780,814
	Yield		145.7	154.7	18.2
	Price				
Oats	Acreage		939	45,539	939
	Production		53,649	1,523,851	53,649
	Yield		57.1	57.5	8.5
	Price				
Rice	Acreage		2,624	3,792	270
	Production		188,069	243,104	2,340
	Yield		7,167	7,219	867
	Price				
Rye	Acreage		242	7,187	242
	Production		5,326	131,142	6,311
	Yield		25.1	33.1	8.3
	Price				
Sorghum	Acreage		4,432	13,682	2,396
	Production		245,909	1,123,271	19,209

Barley, United States

Zoom 30y 60y 100y All

From: 1866 To: 2011



Highcharts.com

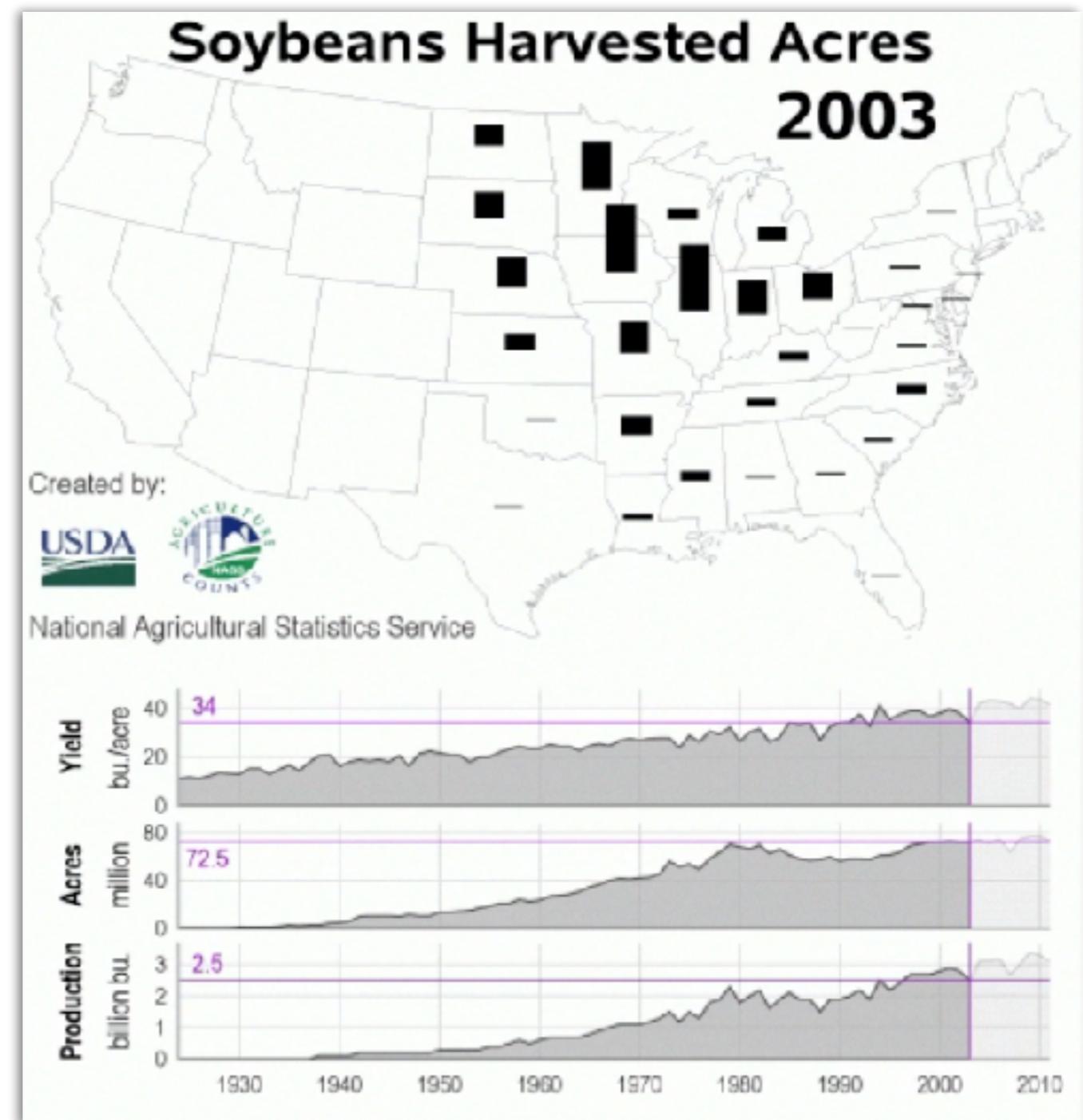
Animations

- Help data customers visualize changes over time
- Can incorporate maps and charts together
- Provides interactivity with familiar pause-play-scroll

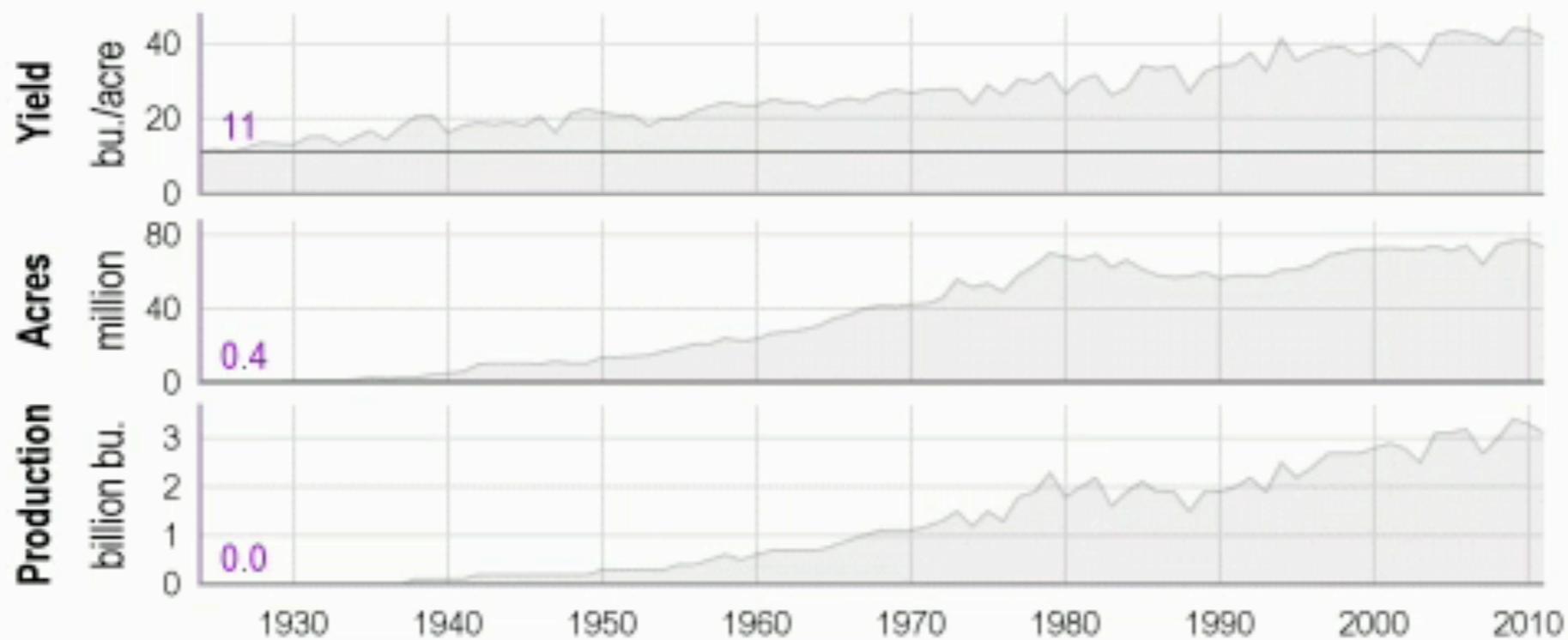
The crop acreage animations for major crops integrate time series charts that animate along with the map.

As the animation progresses, the relevant values for production, acreage and yield appear on the plots.

The harvested acreage for a given crop, as represented by the bars over each state, changes year by year.

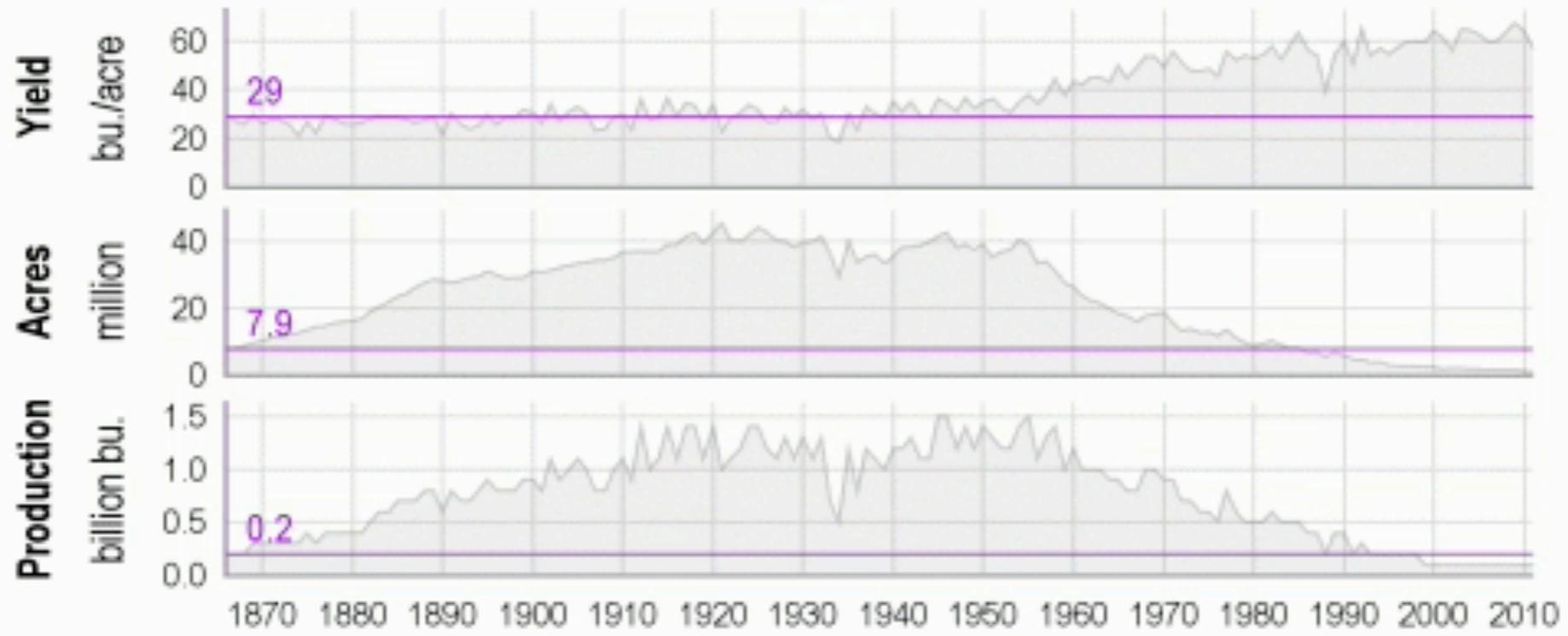


Soybeans Harvested Acres 1924



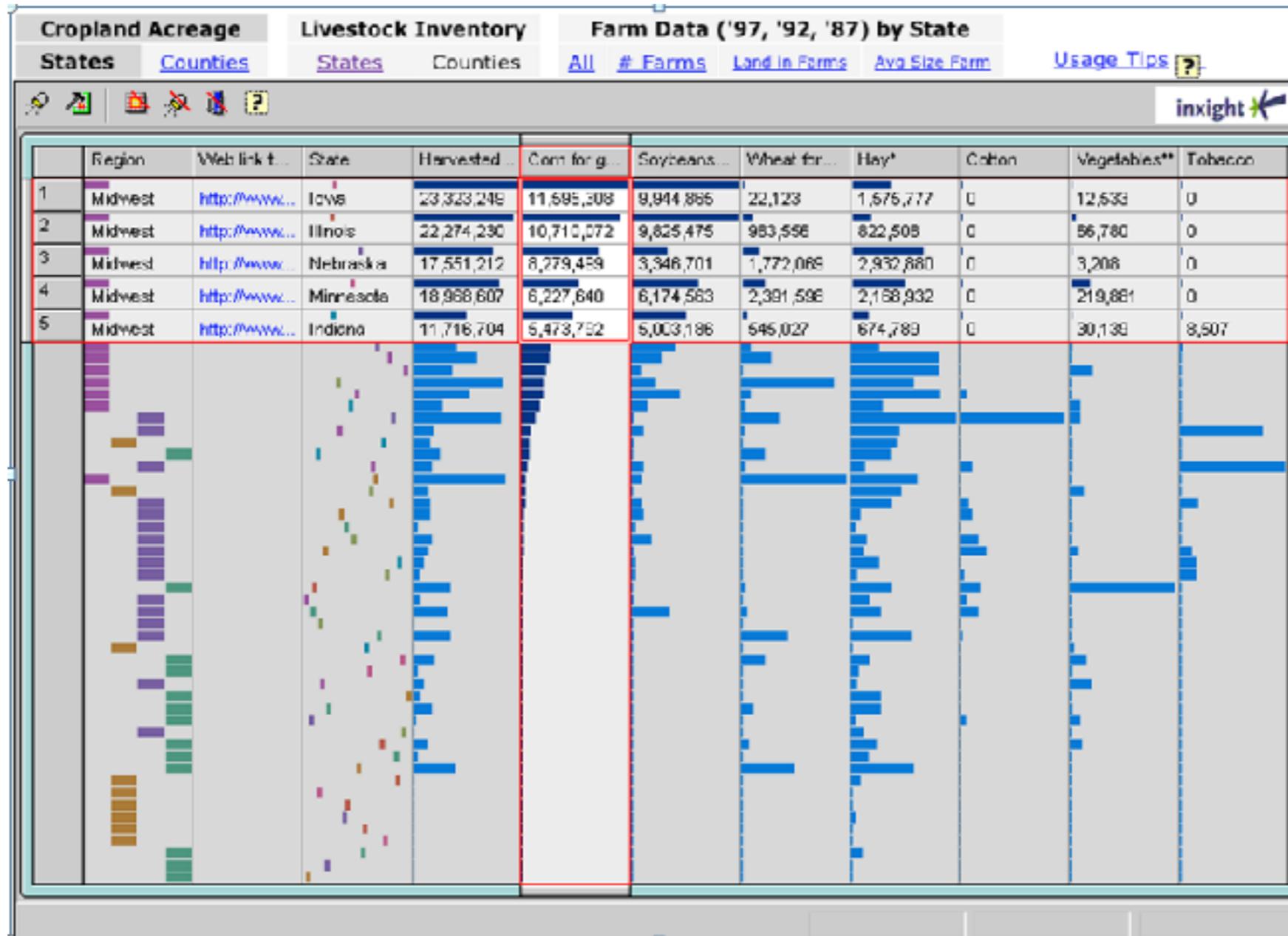
Oats Harvested Acres

1866

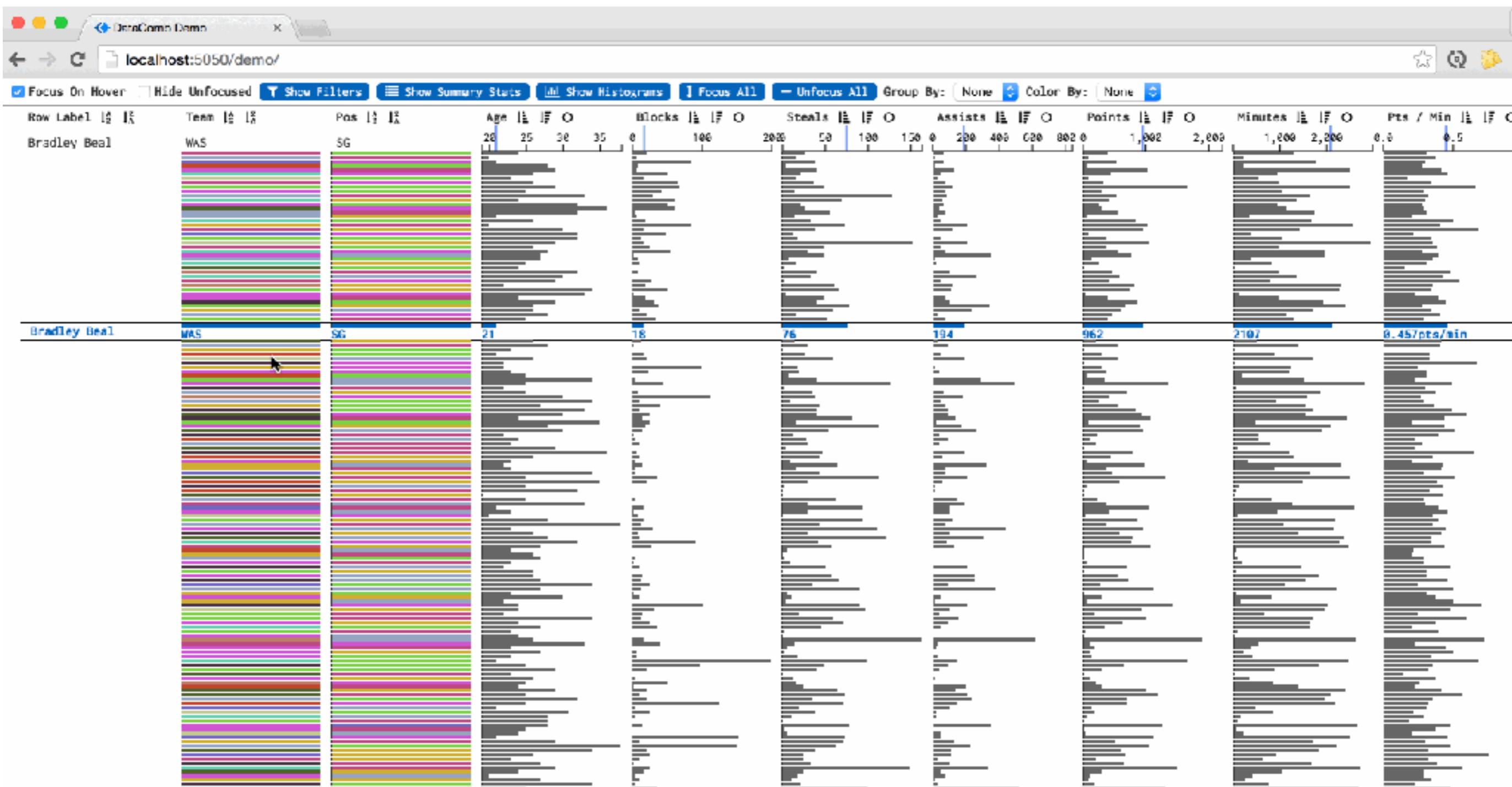


“Table Lens”

- Dynamically explores large amounts of tabular data.
- Using spreadsheet model, displays data in columns and rows
- No scrollbars, no data obscured
- Cells filled with scaled horizontal small bars.
- Rows can represent regions (e.g. state or county)
- Columns can represent specific variables.



Plans at USDA-NASS include use of an open source tool known as "datacomb" recently developed by Chris Polis which adds functionality and compatibility with modern browsers and devices.



Summary

Regardless of the technology, programming languages, and software products used, the data visualizations produced are most useful when creators and designers of these visualizations **think critically about how best to display the data of interest using best practices.**

When looking at historical data, researching and applying best principles and appropriate technologies to create well-designed graphics can **help data customers find the information they want, and learn more about the big picture, and the story behind the data.**

References

Chris Polis, Github - cmpolis/datacomb: <https://github.com/cmpolis/datacomb>

David Rumsey Map Collection website: <http://www.davidrumsey.com>

MacEachren, Alan M. (1998). Cartography, GIS and the World Wide Web. *Progress in Human Geography* 22(4): 575–585.

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