

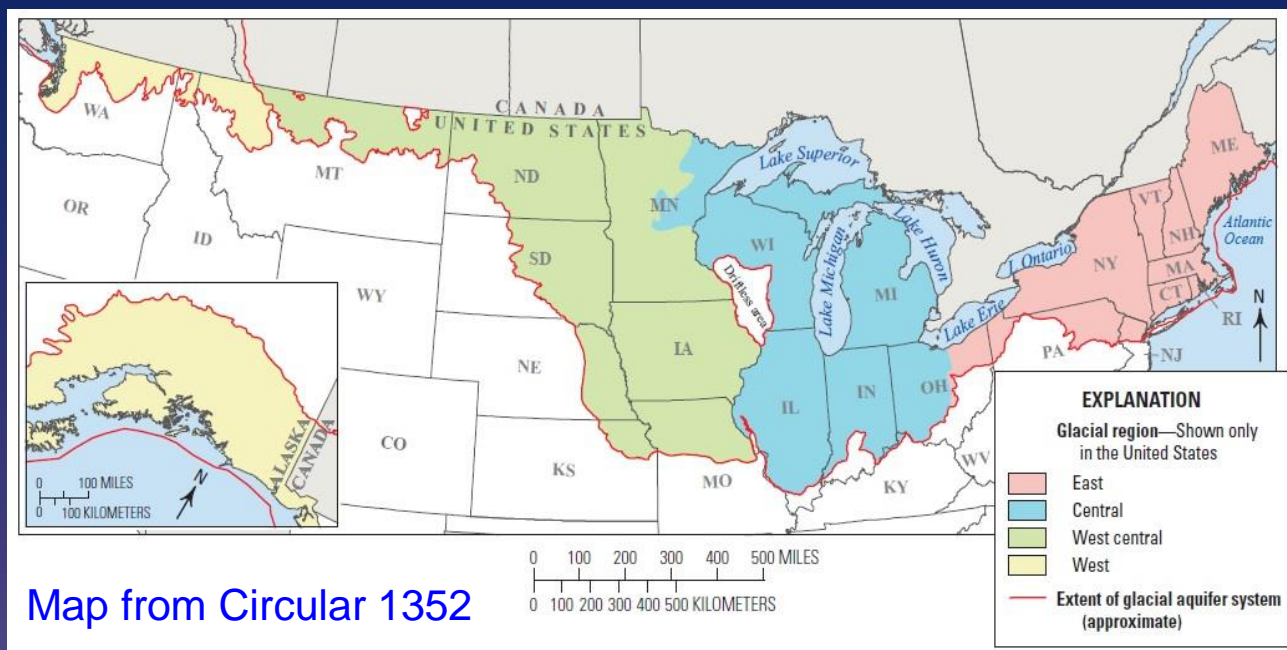
Well dataset quantifying potential human influence at USGS wells in the U.S. glacial aquifer system

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US Geological Survey,
New England Water Science Center

Or..... If you are looking at long-term groundwater data

→ How do you make sure your data can answer your research question?

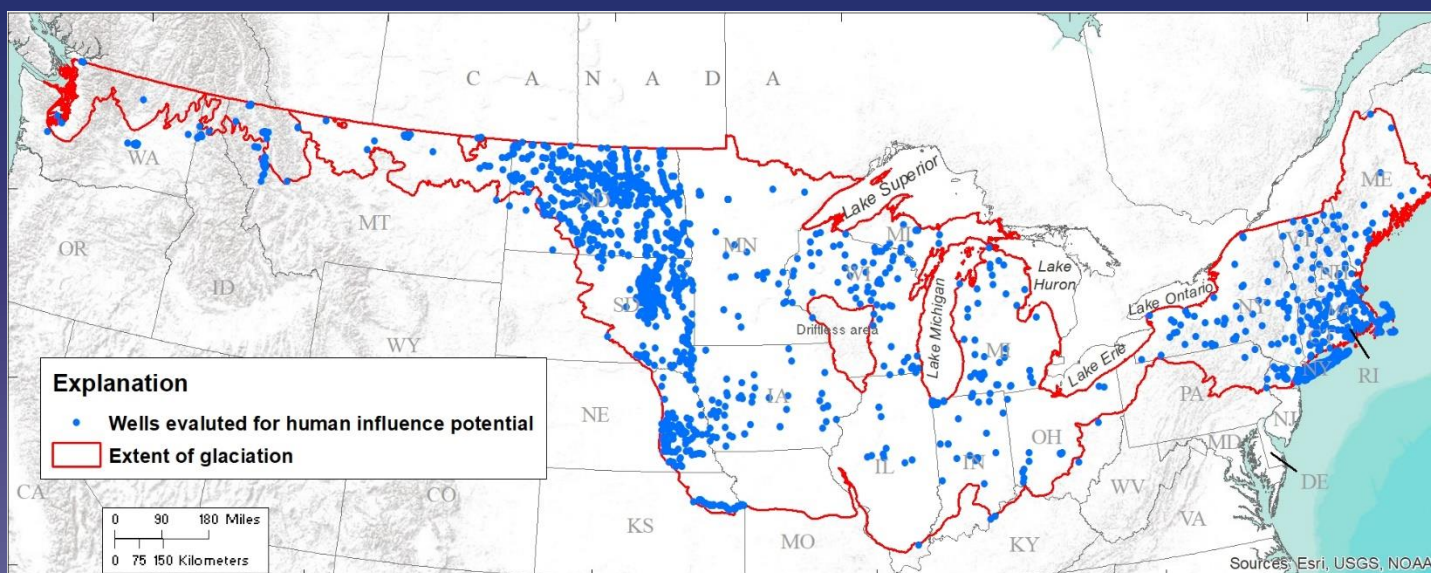
Part of a study on.. Groundwater-level trends in the U.S. glacial aquifer system



USGS Groundwater Availability Study (Glacial Aquifer System)
led by Howard Reeves

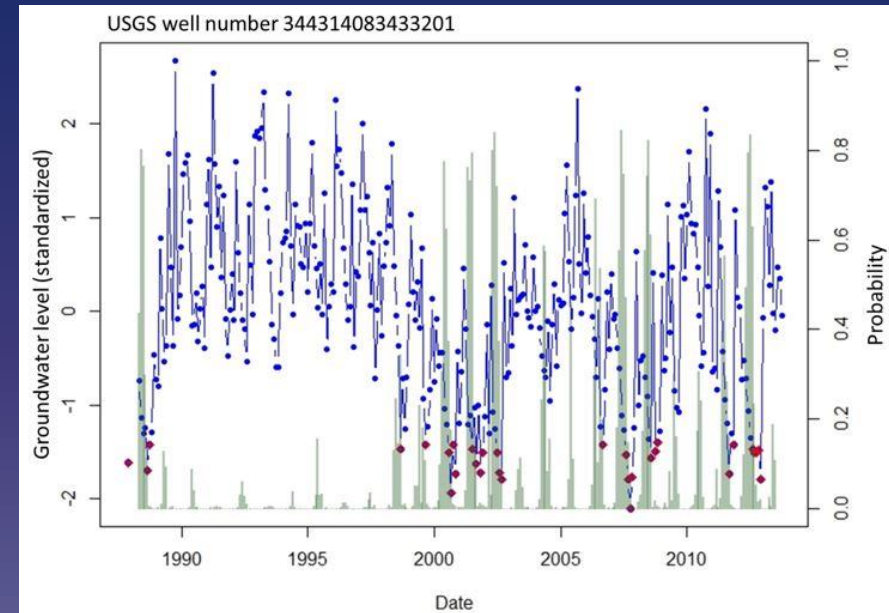
How does the USGS define the “Glacial Aquifer System”?

- Aquifers above bedrock north of the line of continental glaciation (in the US)
- Contains a mix of glacial and post-glacial sediments, ranging from glacial till to coarse-grained sand and gravel



Water-level analysis for the Glacial Aquifer System

- Historical trends at wells
- Relations between groundwater levels and hydrologic and meteorological variables



The USGS National Water Information System (NWIS)

- ◎ <https://nwis.waterdata.usgs.gov/nwis>
 - Primary portal for site information and water levels data
 - Over 1.5 million hydrologic sites, over 880,000 wells with some amount of water-level data (continuous or field measurements)
- ◎ This study initially evaluated over 4,000 Glacial Aquifer wells with monthly data (at least) spanning 10+ years

Water levels can change over time for many reasons

- ⦿ Wanted to know which wells would likely be un-influenced by human activity
- ⦿ Developed an index of potential human influence, applied to a selection of wells in the glacial aquifer system
 - Index based on variables independent of the water level record

Categorization of potential human influence at wells

- ◉ Interested in potential influences from activity near the well
 - Urbanization (pumping, impervious surfaces)
 - Agriculture (irrigation, increased recharge)



Categorization of potential human influence at wells

- Semi-qualitative scale from “Minimal Influence Potential” to “High Potential for Human Influence”
- Scoring based on various factors that could affect natural recharge and groundwater quality (e.g., land use, population density, etc.)



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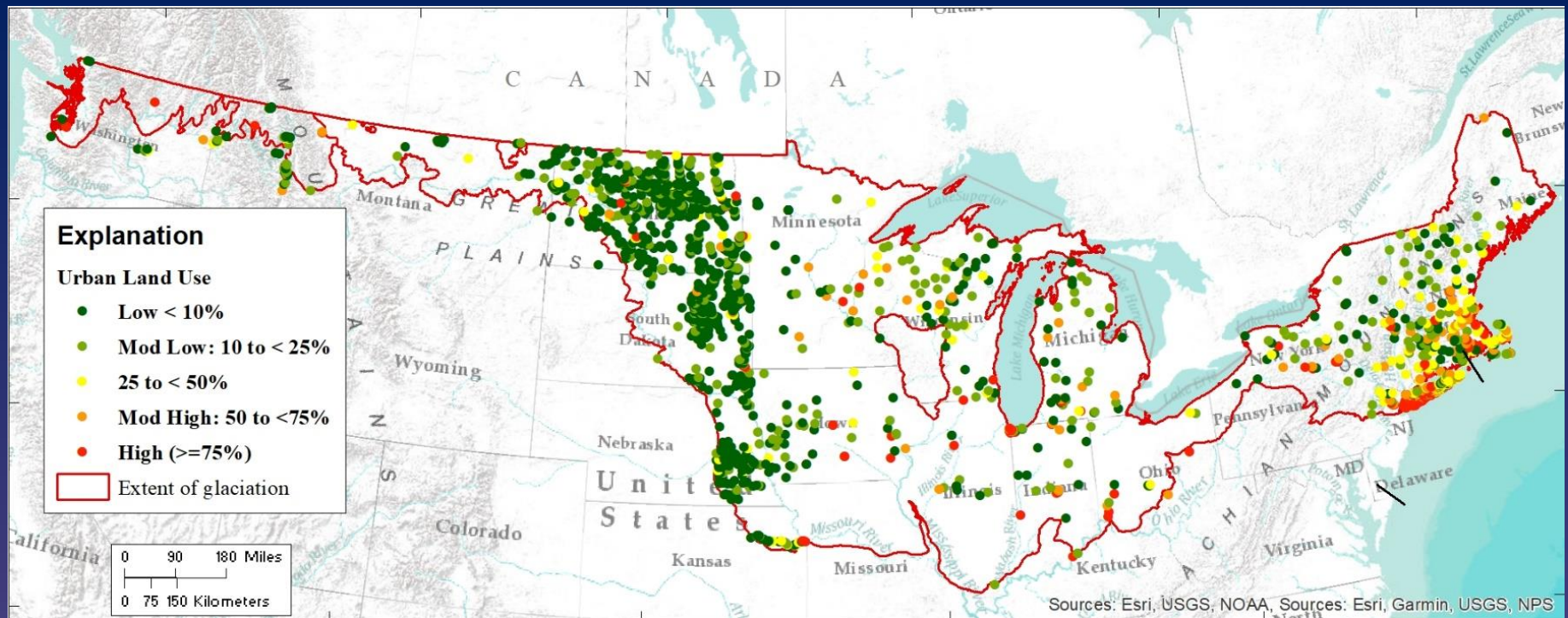
Scoring and weighting by category

Categories	Point scoring
Urban land use	
< 10 %	0
10 to < 25%	2
25 to < 50%	4
50 to < 75%	6
>= 75%	8
Cultivated crops land use	
None	0
> 0 to < 10%	1
10 to < 25%	2
25 to < 50%	3
50 to < 75%	4
>= 75%	5
Total county groundwater withdrawals in Mgal/yr/mi ² (less GW irrigation withdrawals)	
< 2.0	0
2 to 15	1
15 to 50	2
50 to 100	3
> 100	4
Total county irrigation in acres/mi ²	
< 6.9	0
6.9 to 26	1
26 to 105	2
105 to 200	3
>200	4

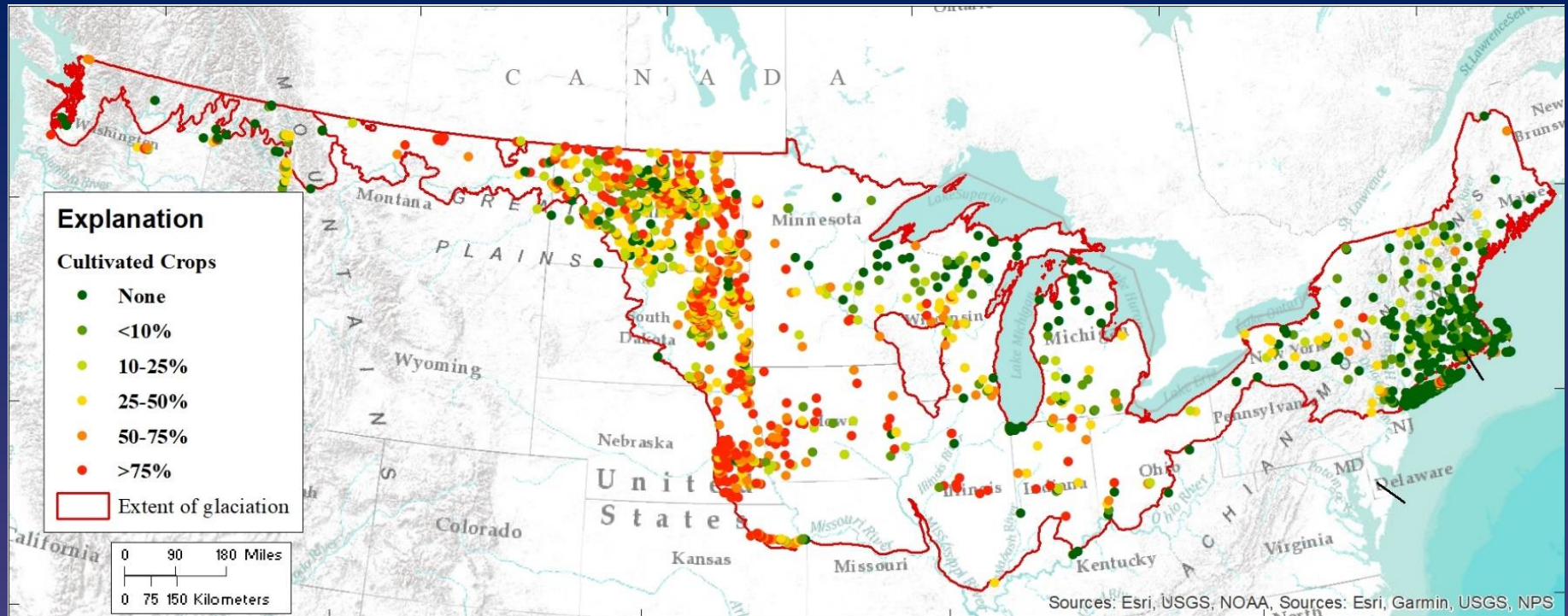
All
categories
start at
zero

Max points are
higher for
land-use
categories
than water-use
categories

Urban Land use in 500m-radius circle

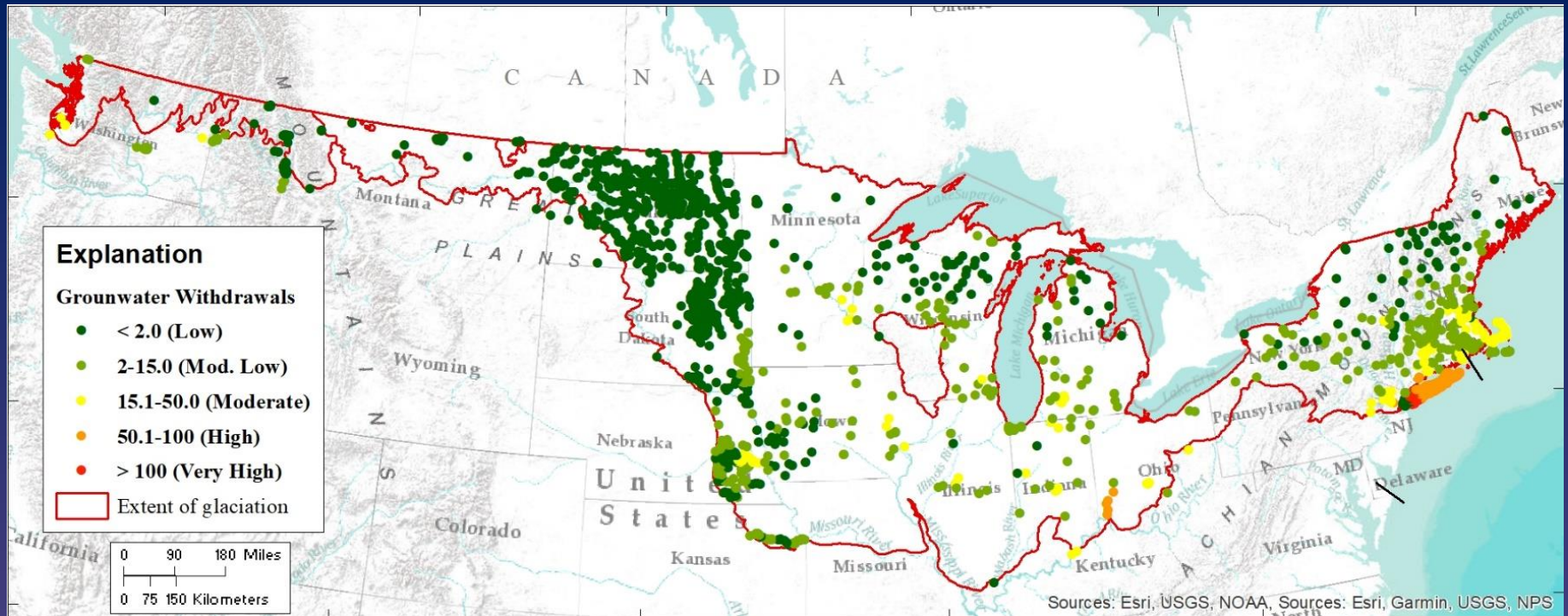


Cultivated crops in 500m-radius circle



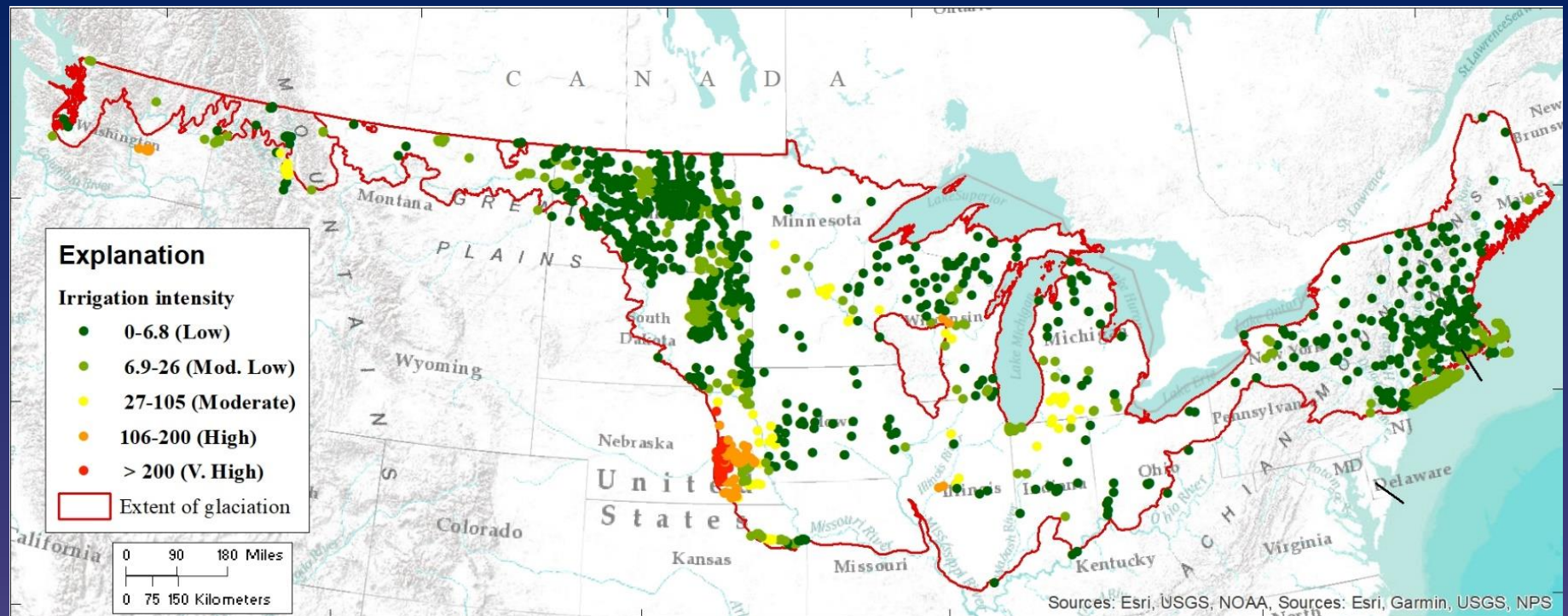
GW withdrawals in county, 2010

Mgal/yr/mi²




Irrigation in county, 2010

Acres/mi²

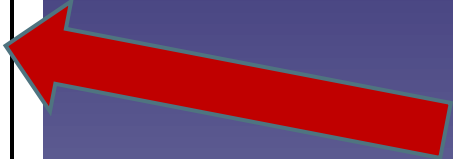


Total scoring categories

Total score (4 factors)	Level of potential human influence	Notes
0 - 3	Minimal Influence Potential	These wells do not fall in the maximum category for any of the factors.
4-5	Transitional-Low	One or more factors present, but not high levels of multiple factors
6 - 8	Transitional-High	Typically several factors present, but not more than one with a maximum score
>= 9	High Influence Potential	Typically high level of land use and water use potential influence



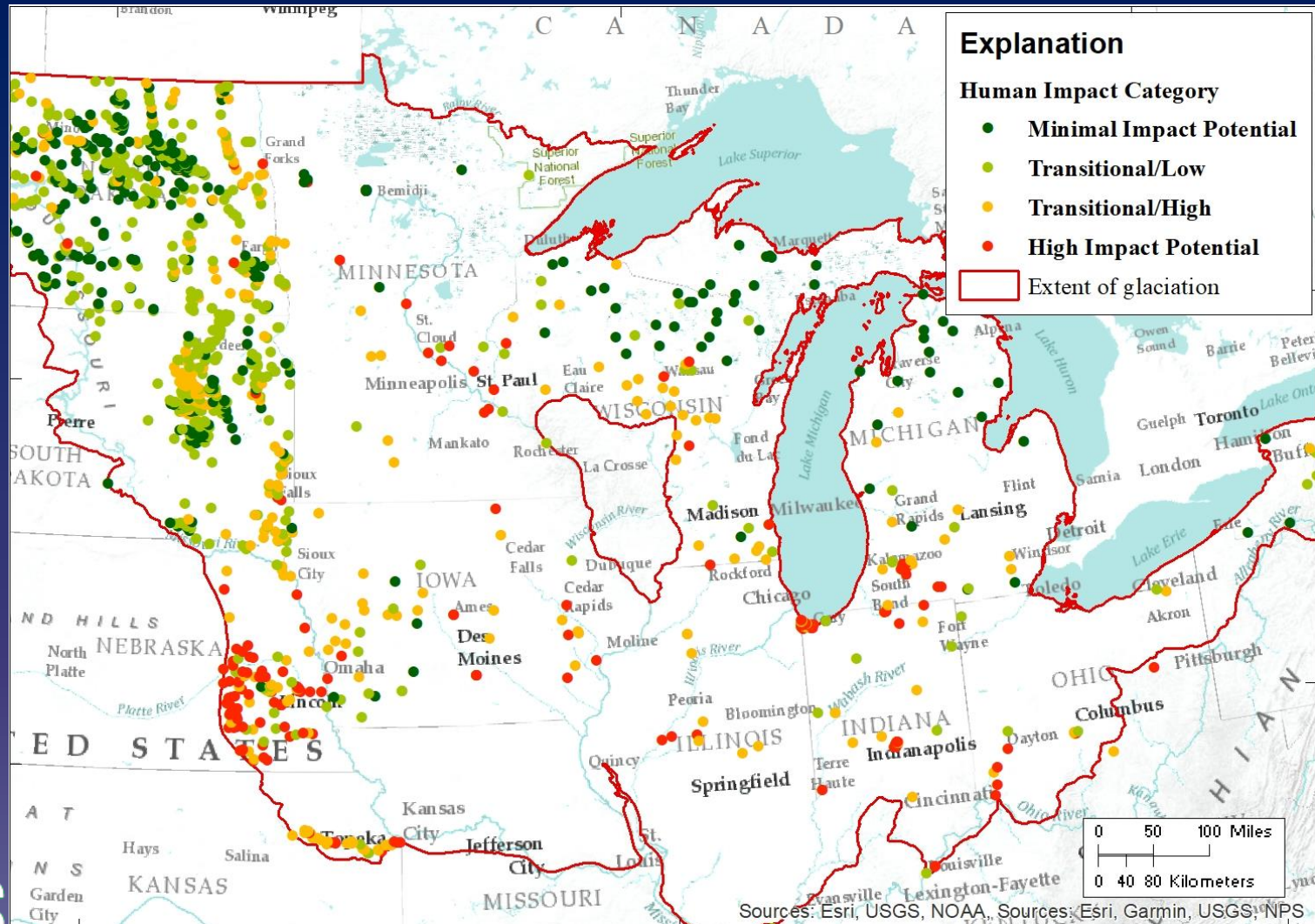
Asked State GW specialists if there were any obvious mischaracterizations



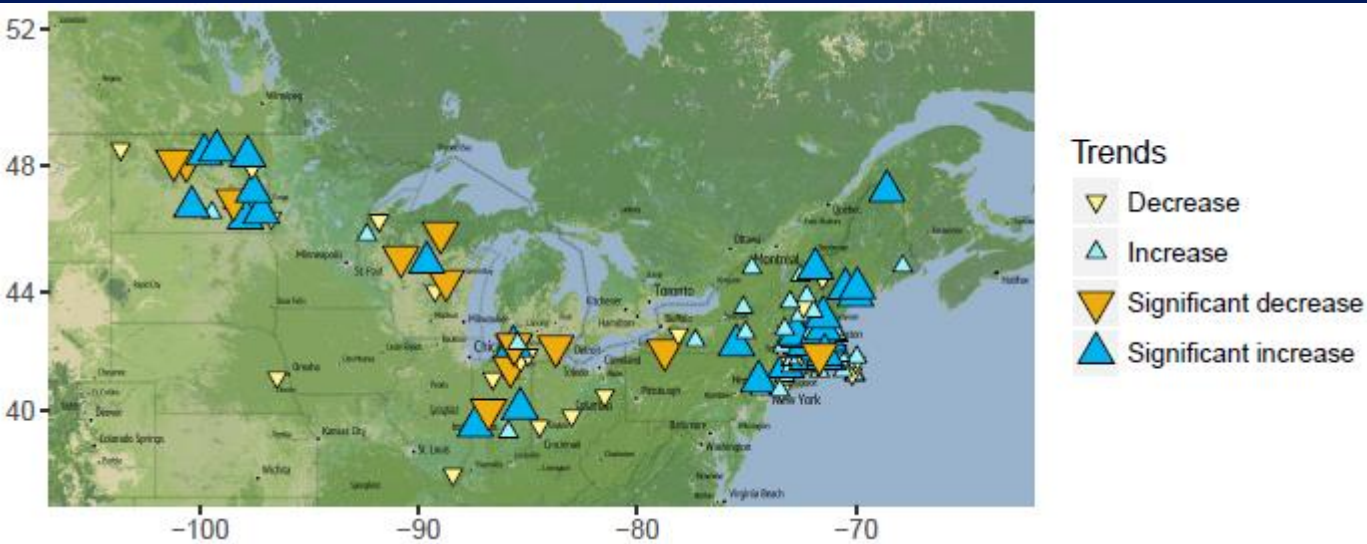
State GW Specialists input

- ⦿ Critical to get local input on the screening
- ⦿ Based on input from all state groundwater specialists,
 - 85% were categorized correctly
 - 15% were adjusted based on local input

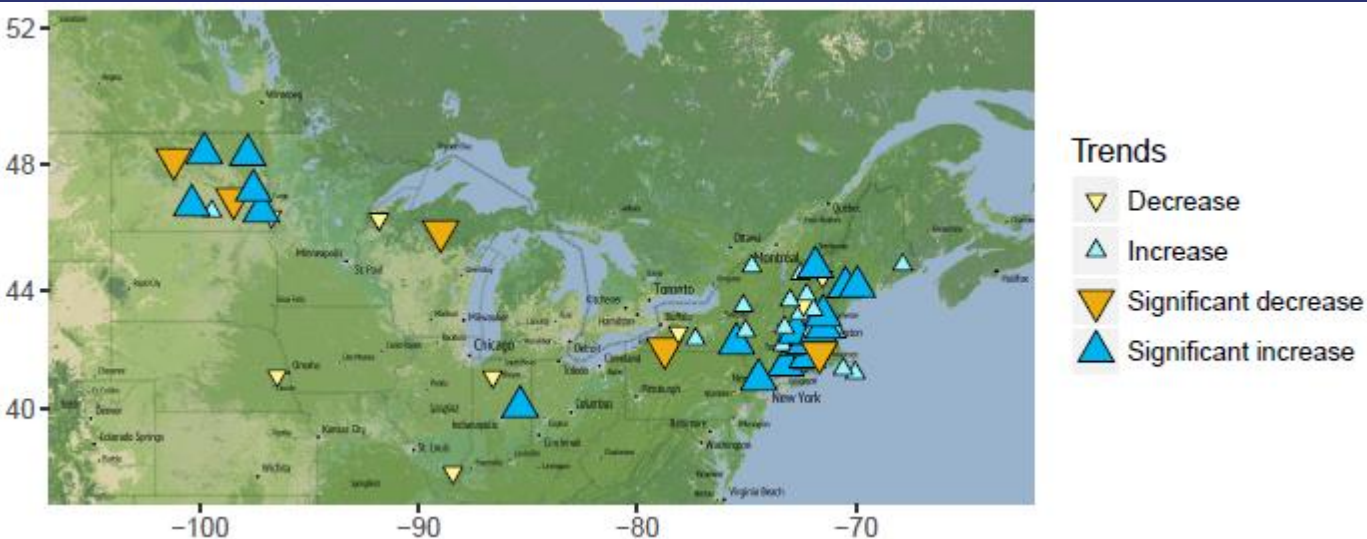
Regional view – Overall 1043 wells in the “Minimal” and “Transitional/Low” categories



Example of trends: Trends in annual mean groundwater levels, 1984-2013 (30 yrs)



Both high and low human impact potential



Low human impact potential only

Availability of well dataset:

- Data release of overall human-influence category, land-use data, and water-use data for 2228 wells in the glacial aquifer system
- Hodgkins, G.A., Nielsen, M.G., Qi, S.L., Dudley, R.W., 2017. Data related to the degree of potential human influence near 2228 groundwater wells in the U.S. glacial aquifer system: U.S. Geological Survey data release,
<https://doi.org/10.5066/F79K48FX>

Questions?