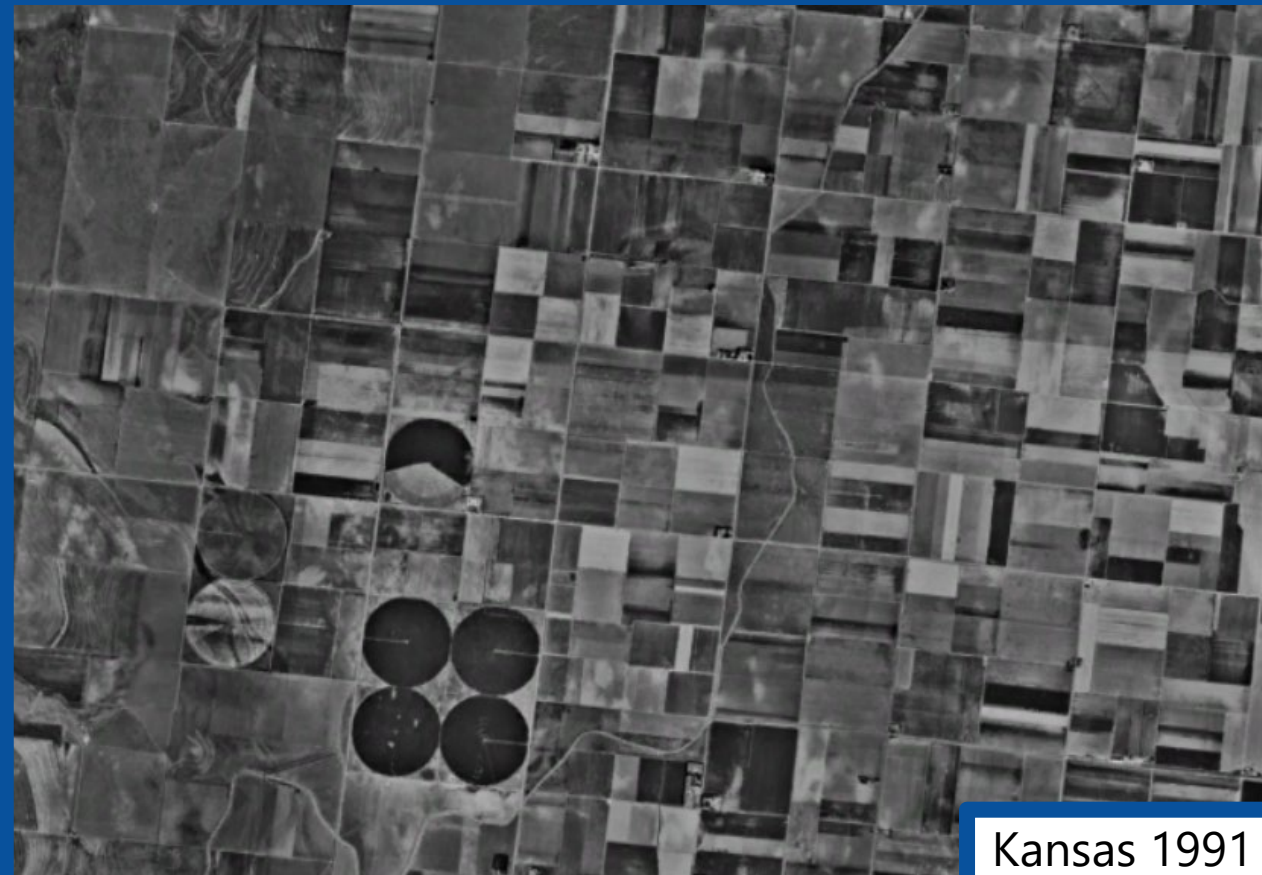


Estimating Historical Irrigated Production of Major US Row Crops

Sam Smidt

Assistant Professor

Soil and Water Sciences Department



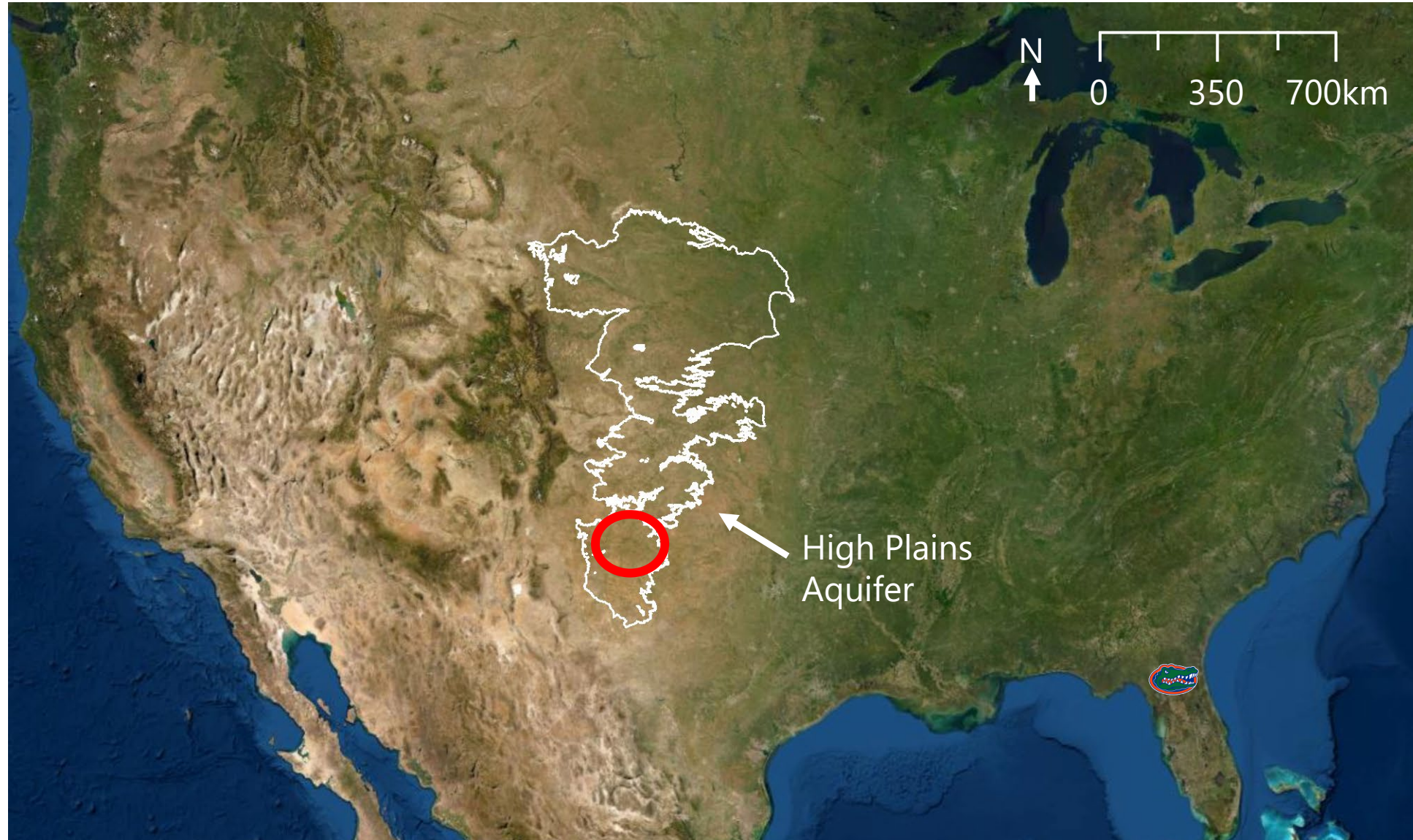
Kansas 1991



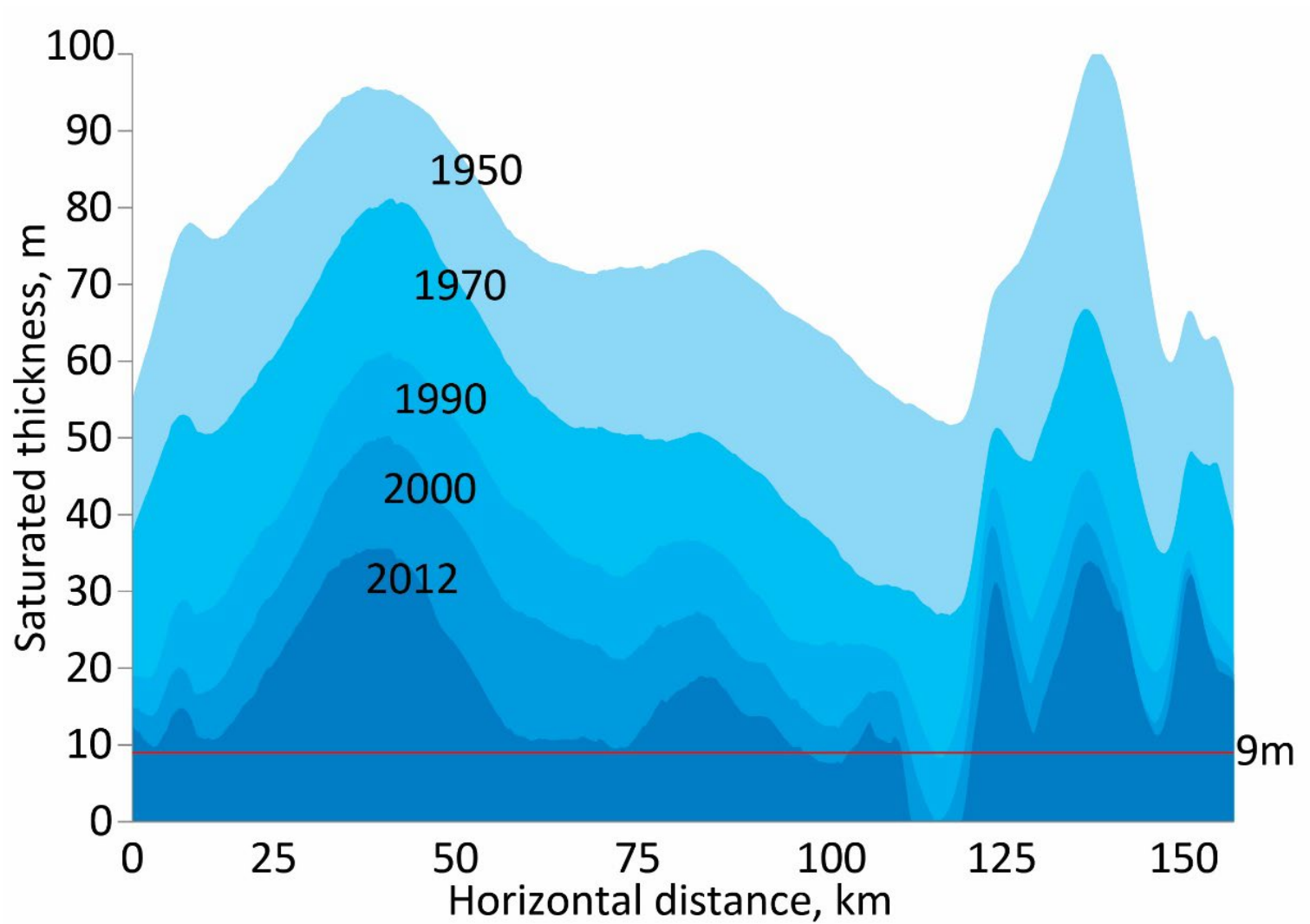
Kansas 2017

Issue #1:

Site-specific technologies do not remain site-specific.



Depleted resources prompt innovations in efficiency.



(Haacker et al., 2016)

High efficiency irrigation was created to overcome HPA water loss.

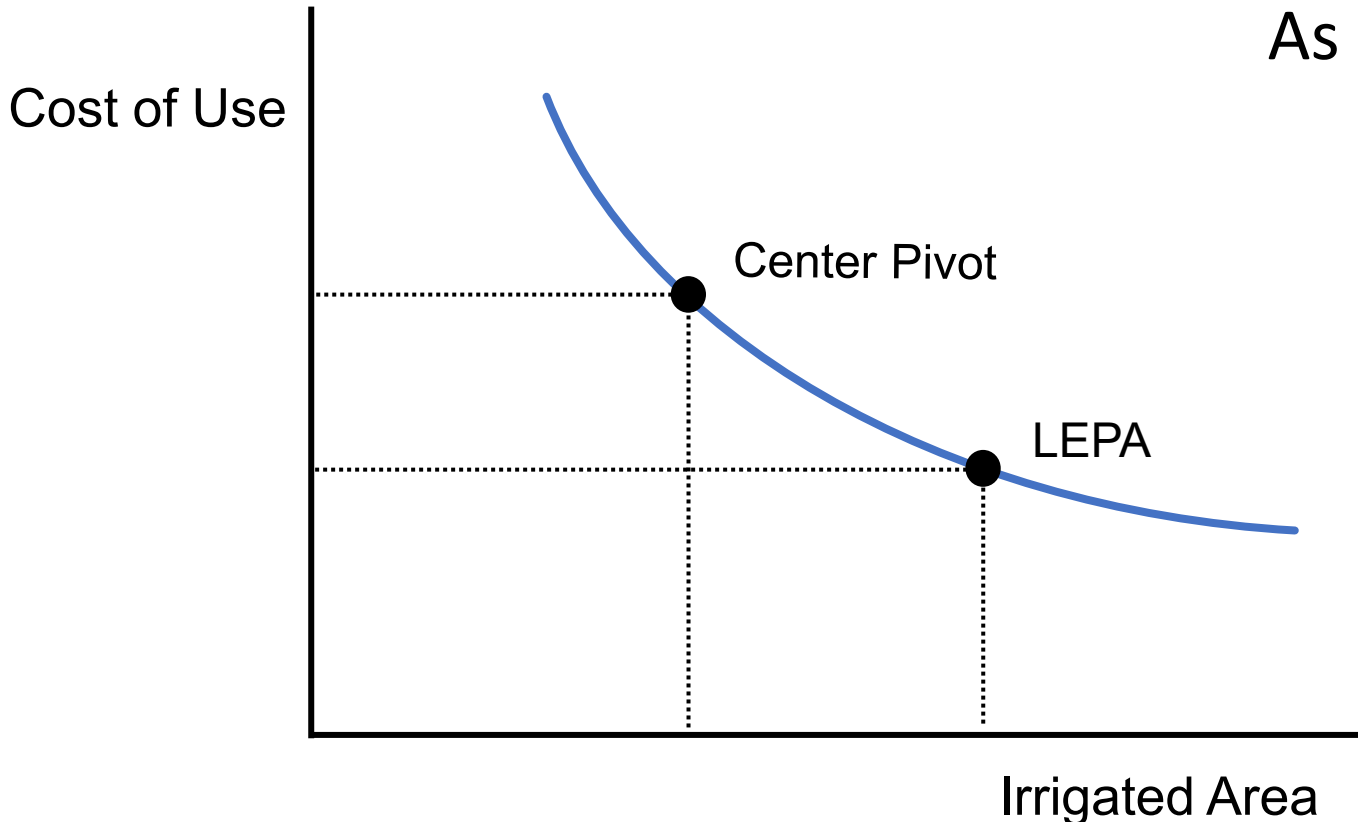
Center Pivot (~1950)



LEPA (~1980)



Efficient technologies can lead to increased use.

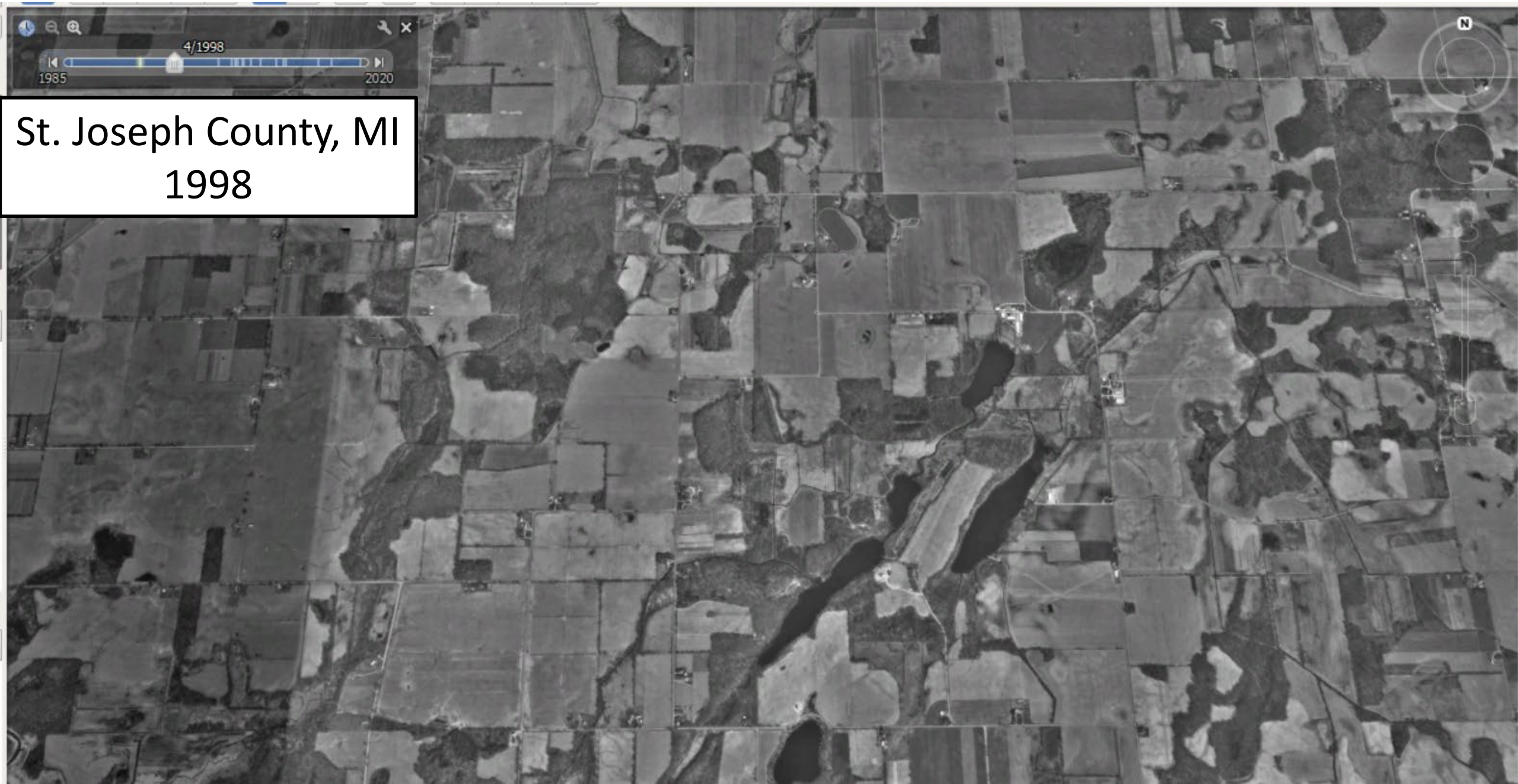


As irrigation efficiency increases, so does total water use.

Irrigated acreage increased ~9% from 2002-2007

(Brown and Pervez, 2014)

Lower operation costs make irrigation use more practical elsewhere.



St. Joseph County, MI
1998

Lower operation costs make irrigation use more practical elsewhere.



St. Joseph County, MI
2017

Issue #2:

Historical agricultural production data are incomplete.

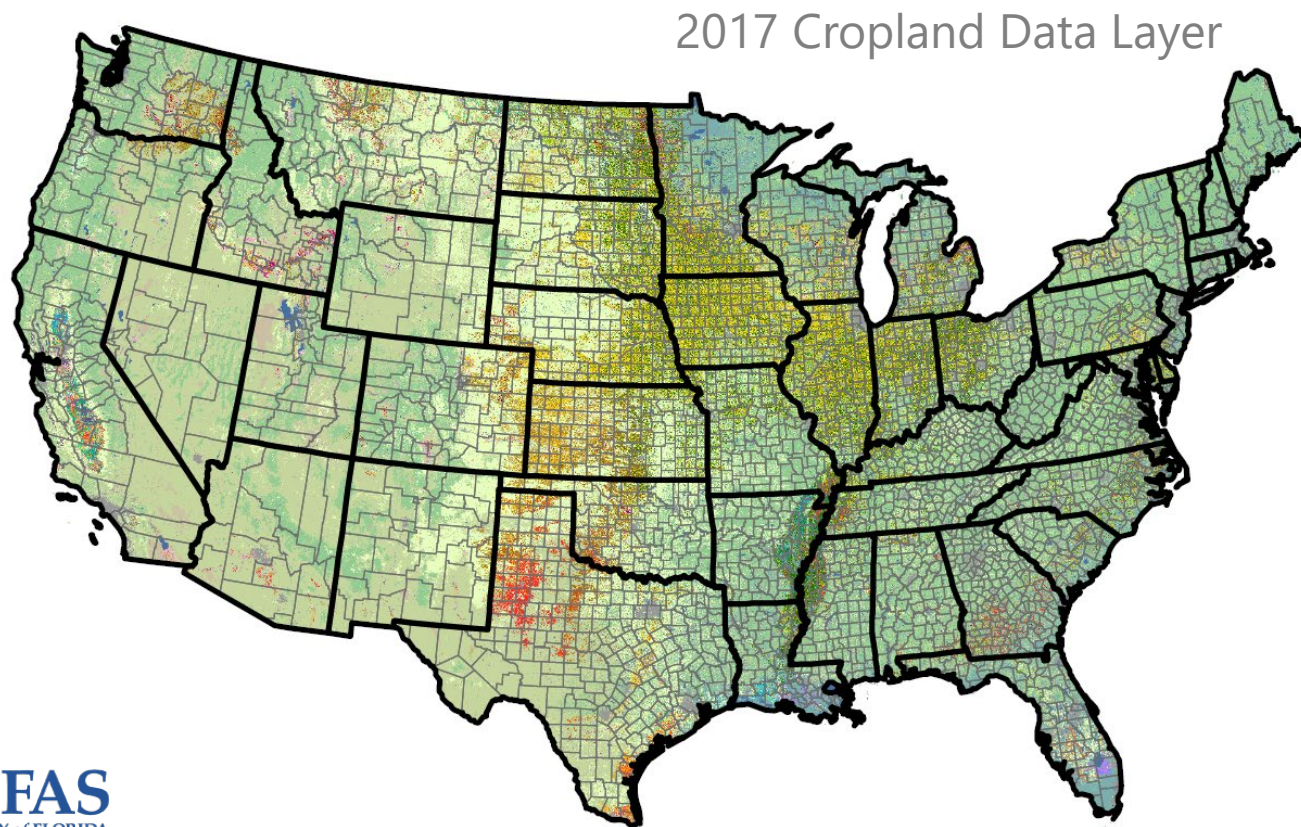
St. Joseph County (MI) Corn		
Year	Ave. Yield [bu/acre]	Total Area [acres]
2017	122	75,000
2016	124	79,000
2015	143	75,000
2014	153	91,000
2013	157	93,000
2012	140	97,000
2011	91	1,470,000
2010	144	2,080,000



Historical observations and modern methods can help us fill data gaps.

Parsed Agricultural Data Model

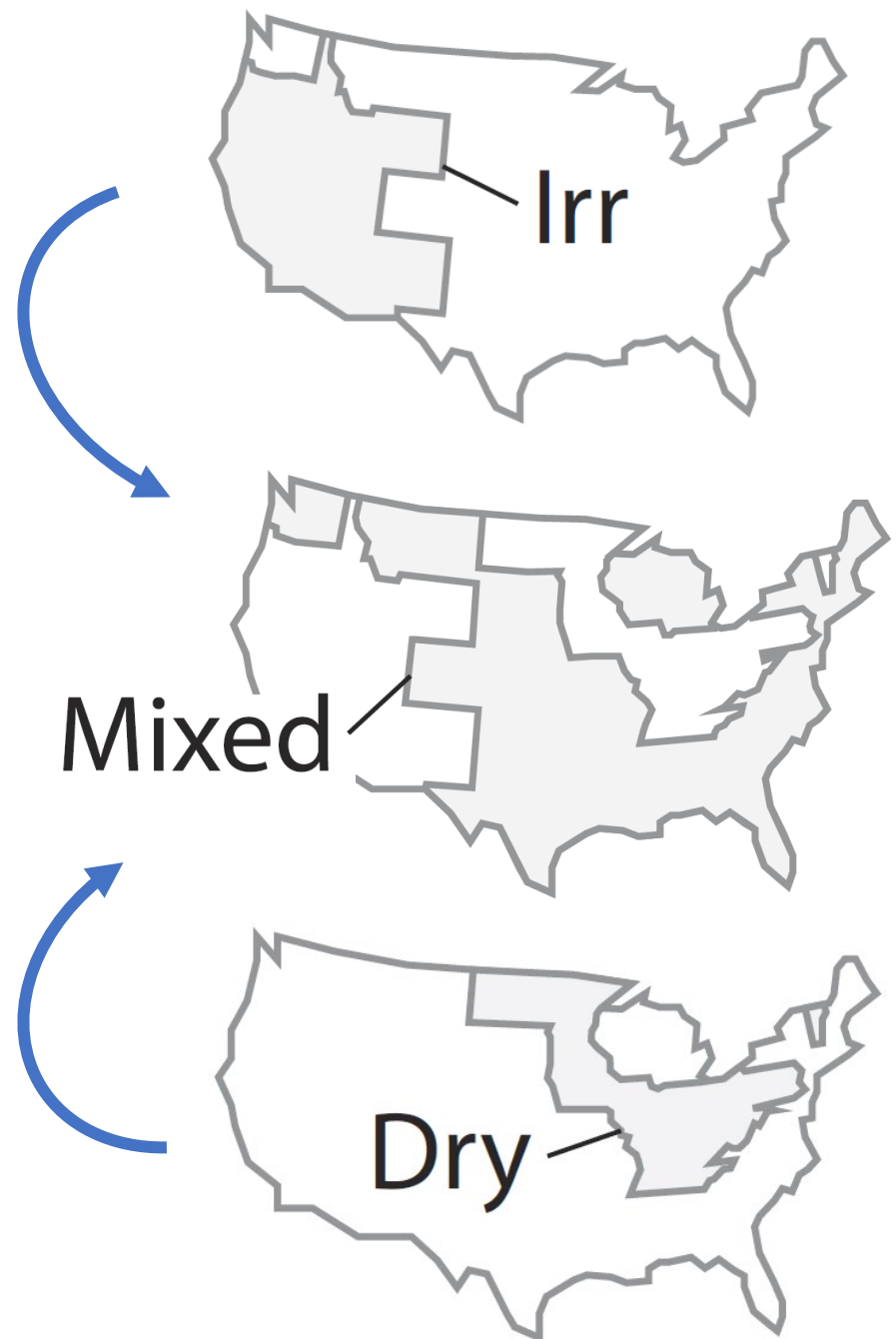
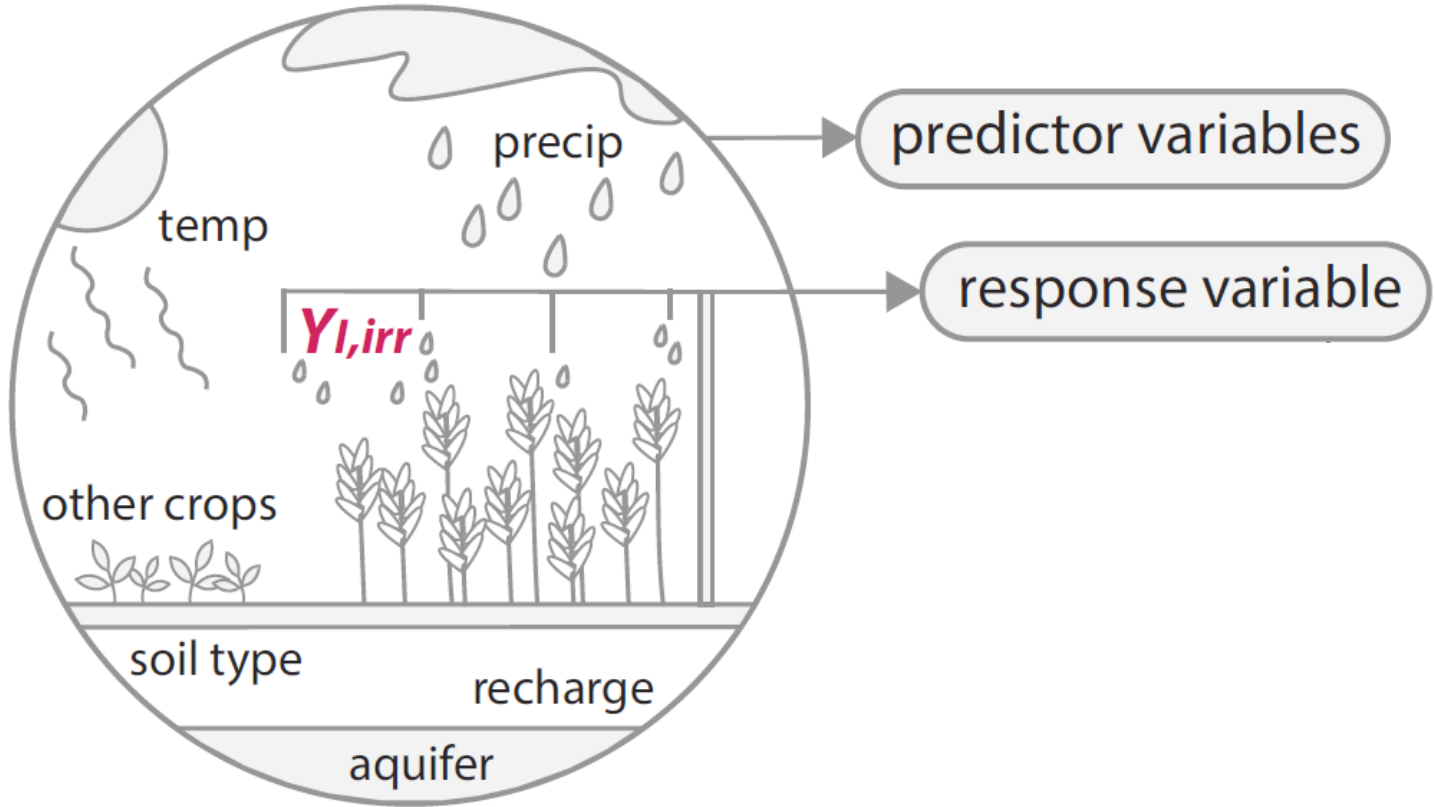
- County-level
- 1945-current (*1866-current*)
- Corn, hay, soybeans, wheat (*then others*)
- Other Ag Census data



1,200 scripts
850,000 lines of code
3 programming Languages
(Matlab, Python, R)
3.5 days runtime

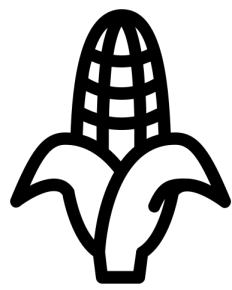
(Smidt et al., In Prep)

Environment-Yield responses are regional.

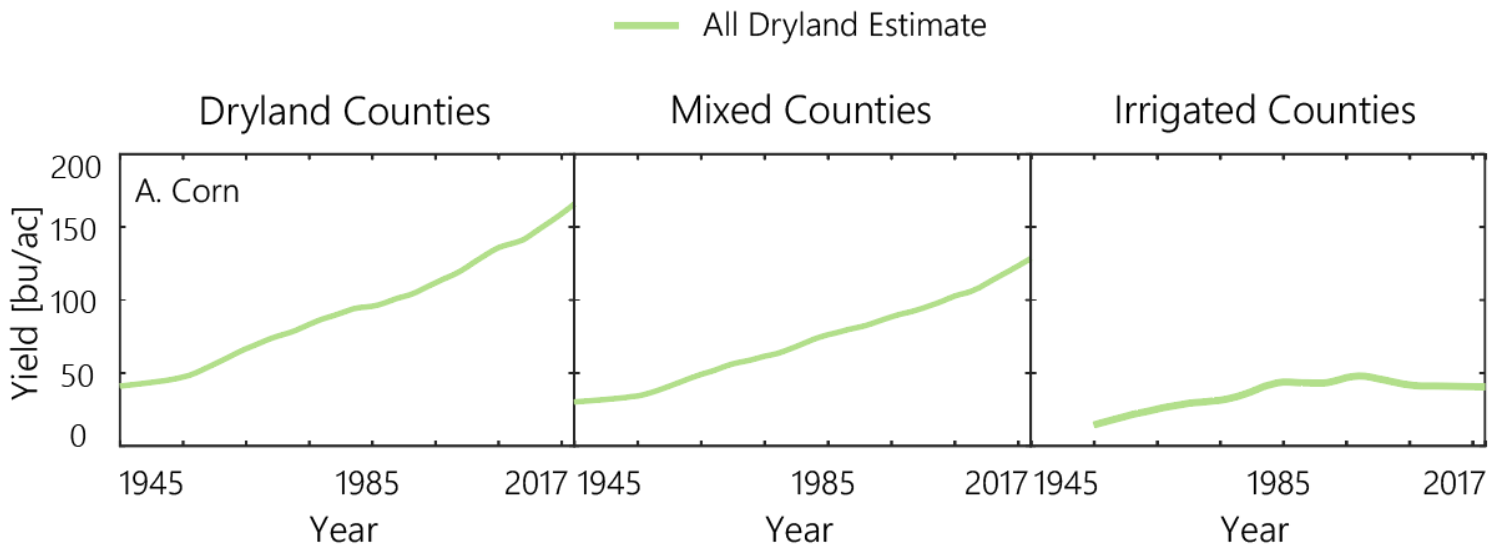


(Smidt et al., In Prep)

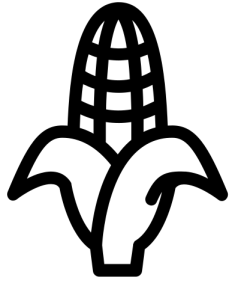
Model results are strong despite highly variable agricultural data.



Dry R²
0.95



Model results are strong despite highly variable agricultural data.

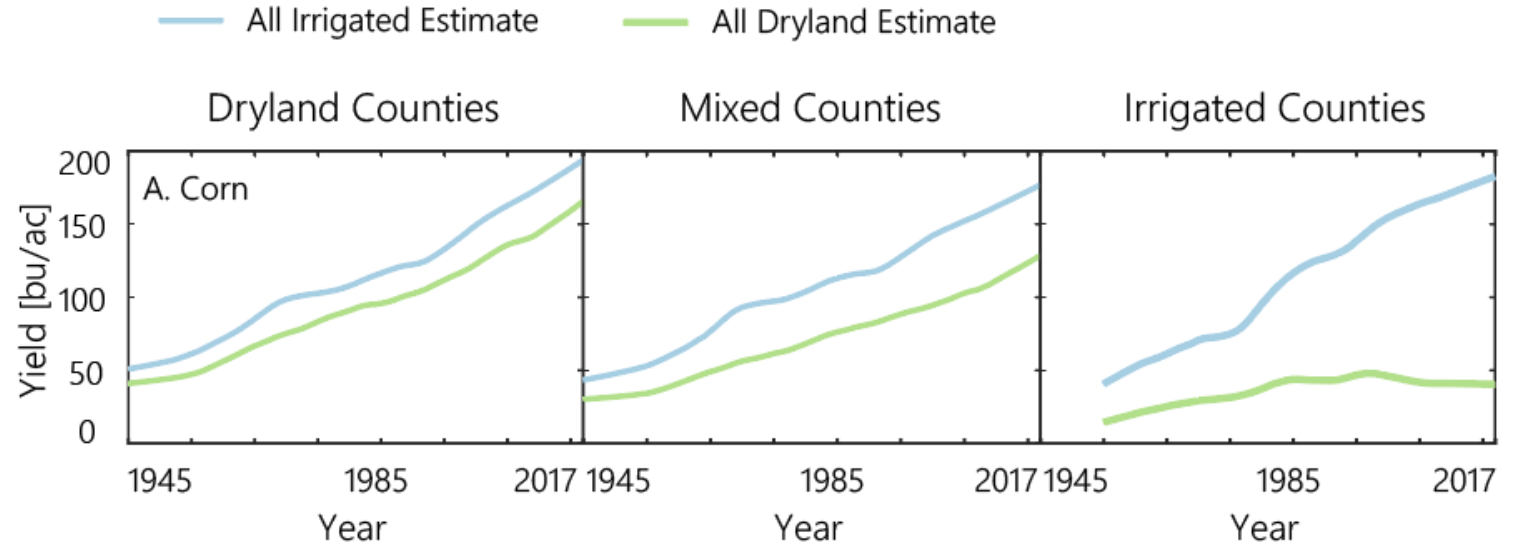


Dry R²

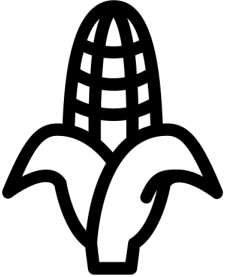



0.95

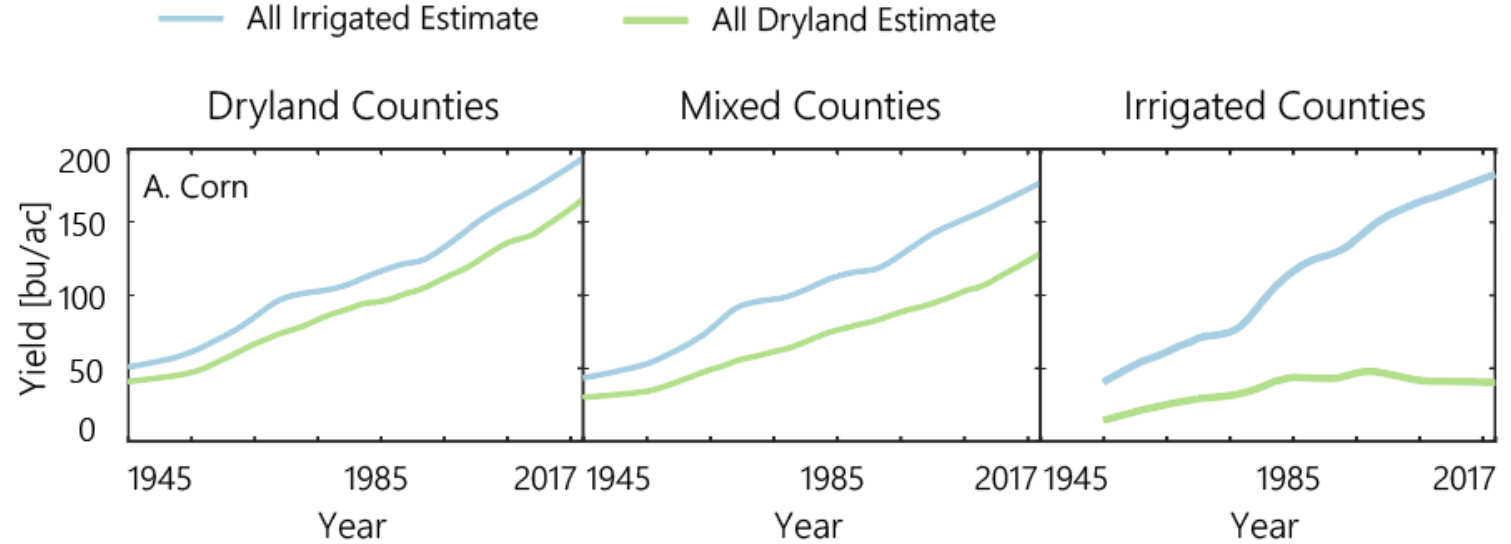
Irrig R²

0.87

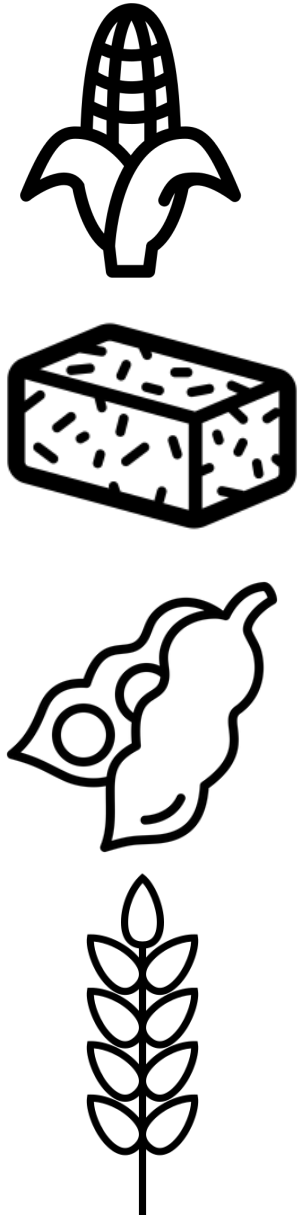


Model results are strong despite highly variable agricultural data.

	<u>Dry R²</u>	<u>Irrig R²</u>
	0.95	0.87
	0.90	0.84
	0.94	0.82
	0.86	0.82



Model results are strong despite highly variable agricultural data.



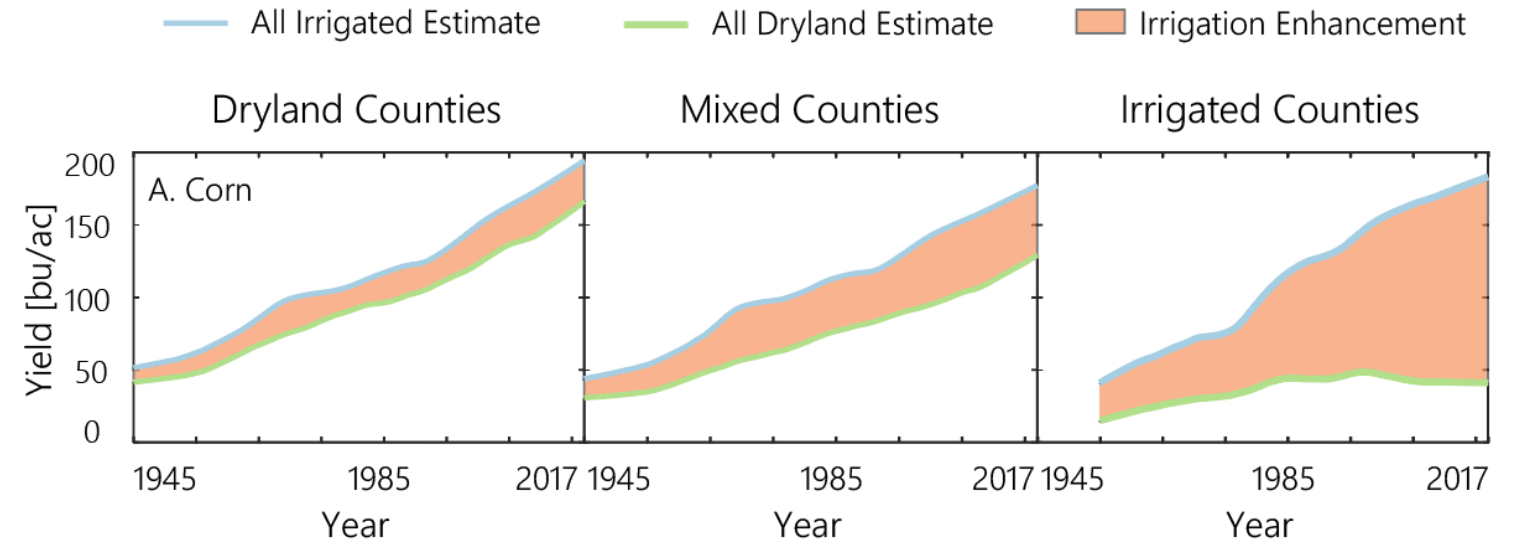
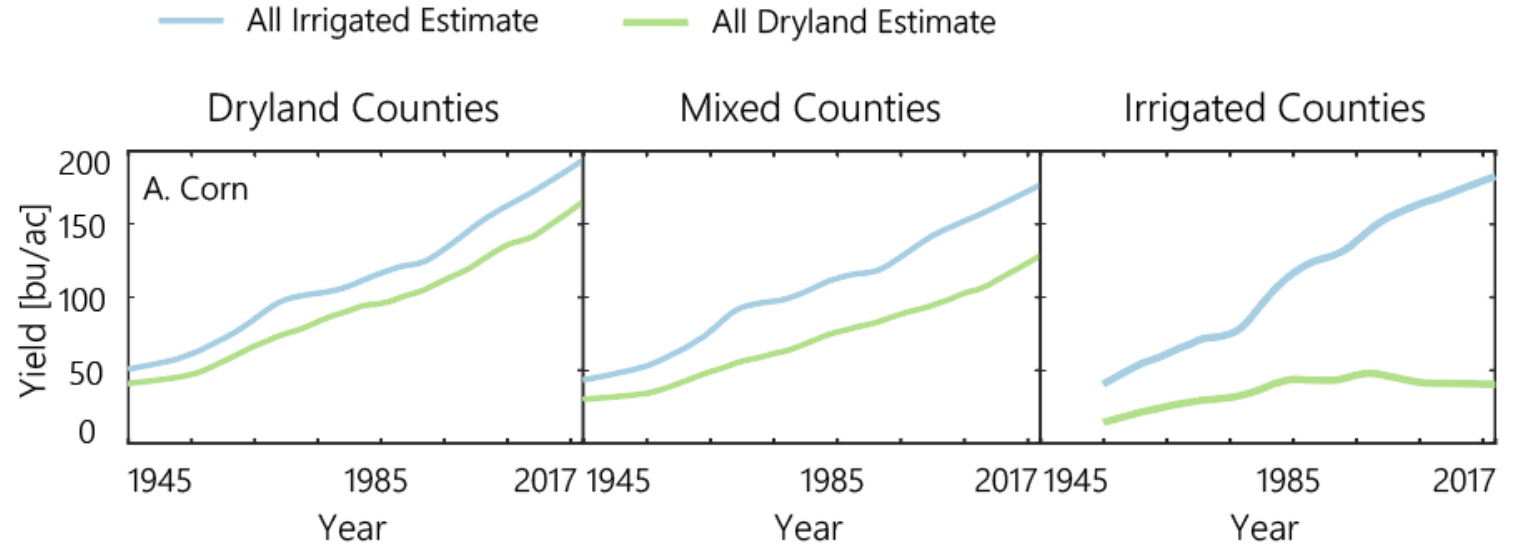
Dry R² Irrig R²

0.95 0.87

0.90 0.84

0.94 0.82

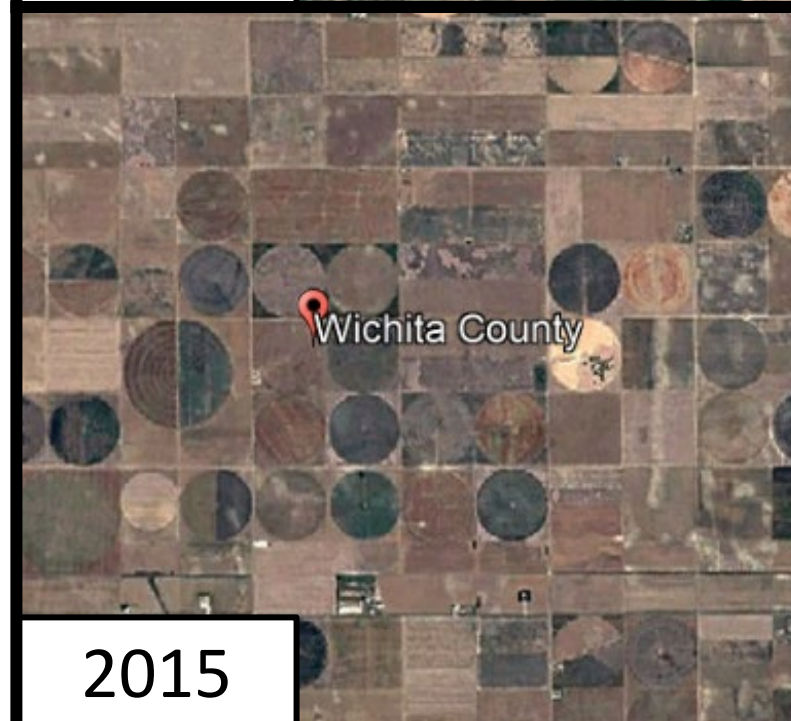
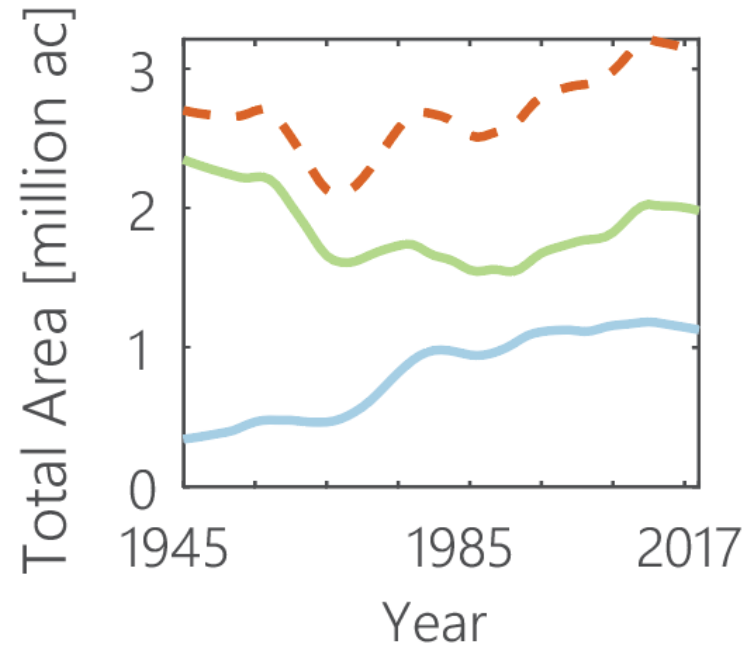
0.86 0.82



Irrigated production continues to increase.

- Irrigated Area
- Dryland Area
- - Total Area

Mixed Counties

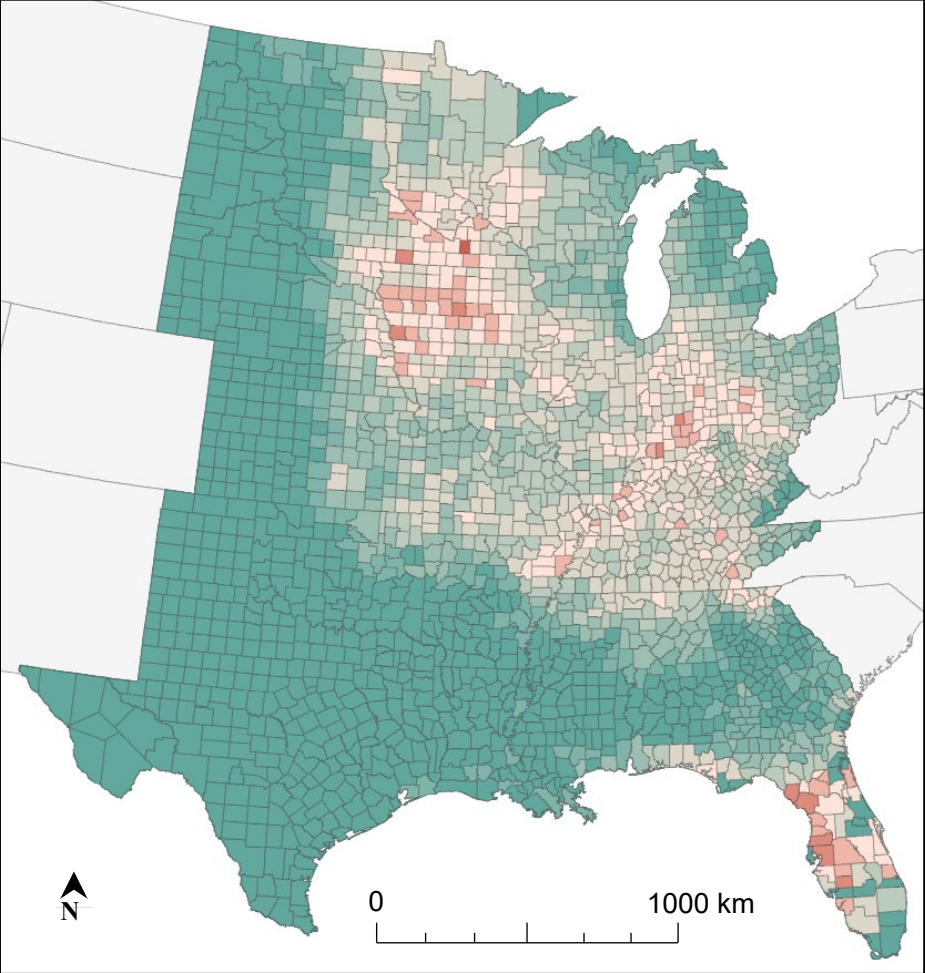


(Smidt et al., In Prep)

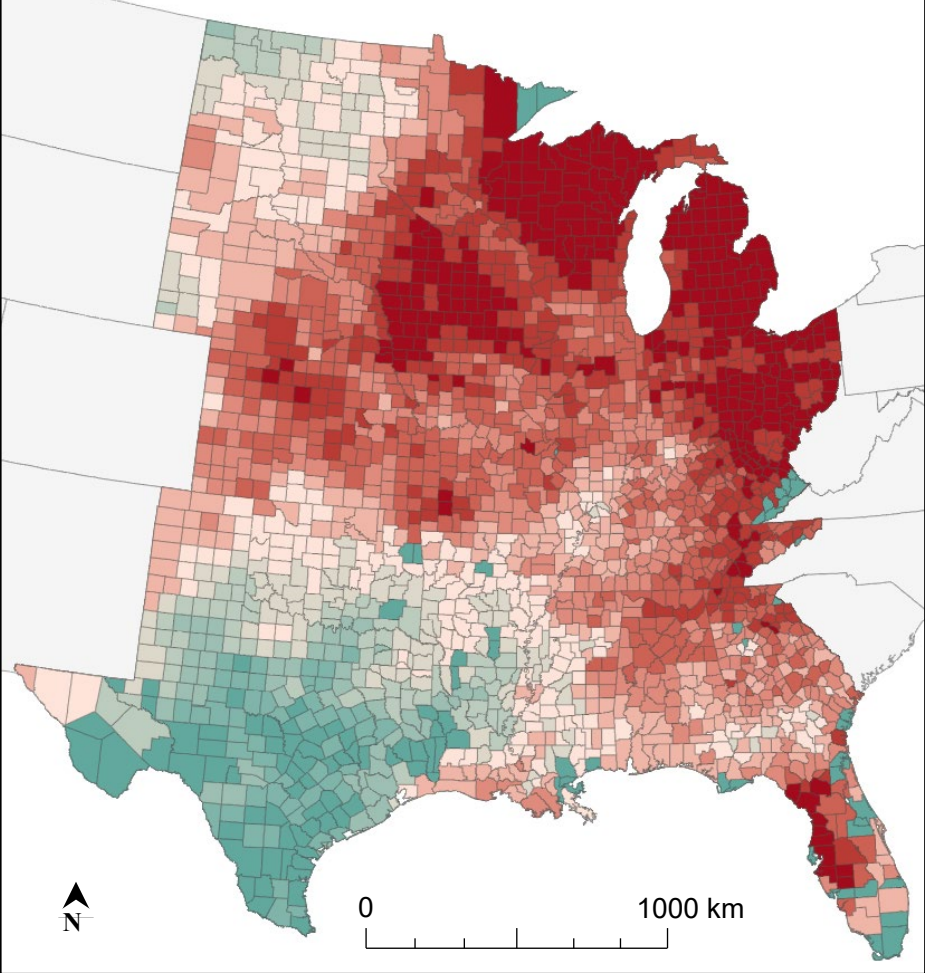
Applications/Collaborations

Irrigation use to meet future crop demand

Dryland Corn



Irrigated Corn



Applications/Collaborations

Irrigation as drought mitigation



Historical Use of Irrigation in Response to Regional Drought

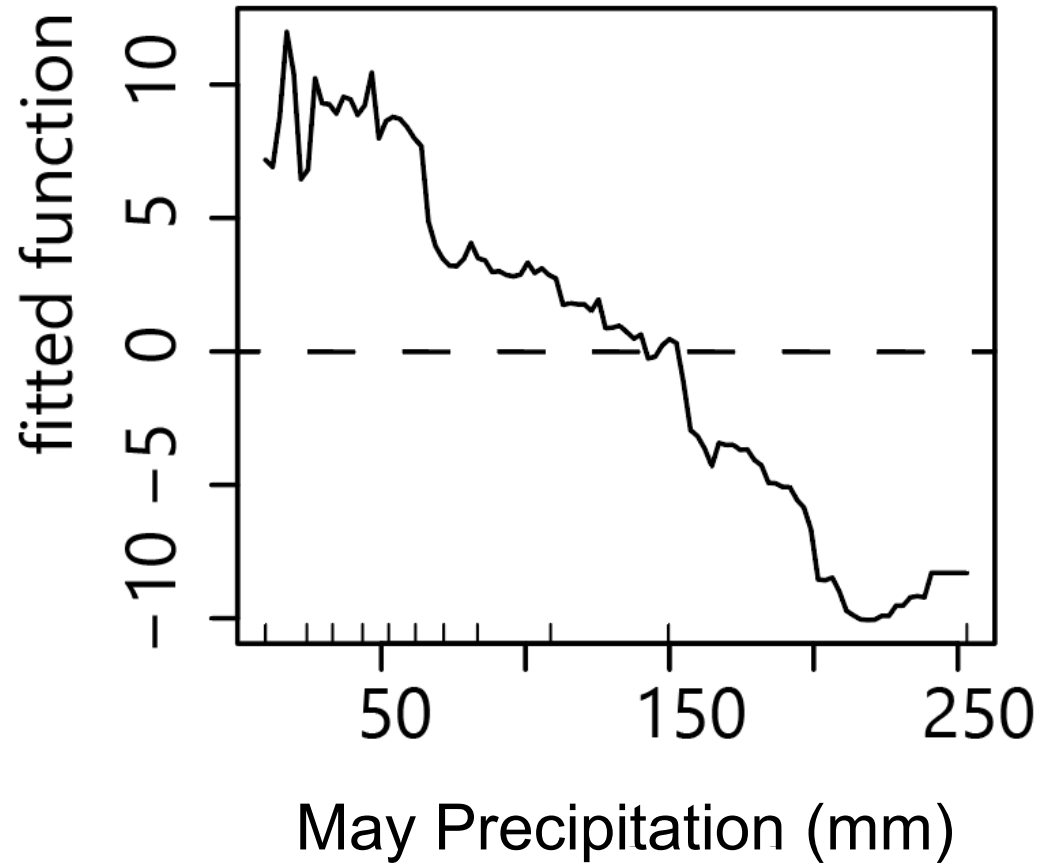
Alexandra G. Dixon¹, Hannah L. Lukasik², Jennifer R. Dierauer², Samuel J. Smidt¹

¹Soil and Water Sciences Department, University of Florida, Gainesville, FL 32611 ²College of Natural Resources, University of Wisconsin-Stevens Point, Stevens Point, WI 54481



Applications/Collaborations

Changing climate scenarios/environmental risk



(Lamb et al., 2021)

Applications/Collaborations

- Track irrigation migration
- Overlay with soil fertility/soil health
- Yield BMPs
- Many others...

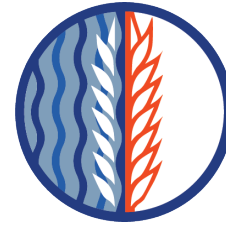


Co-authors

Susan Lamb, University of Florida

Anthony Kendall, Michigan State University

Dave Hyndman, University of Texas at Dallas



Land and Water Lab

University of Florida

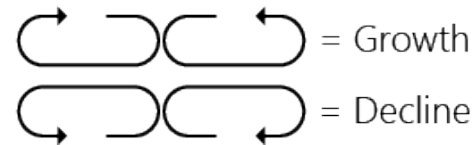
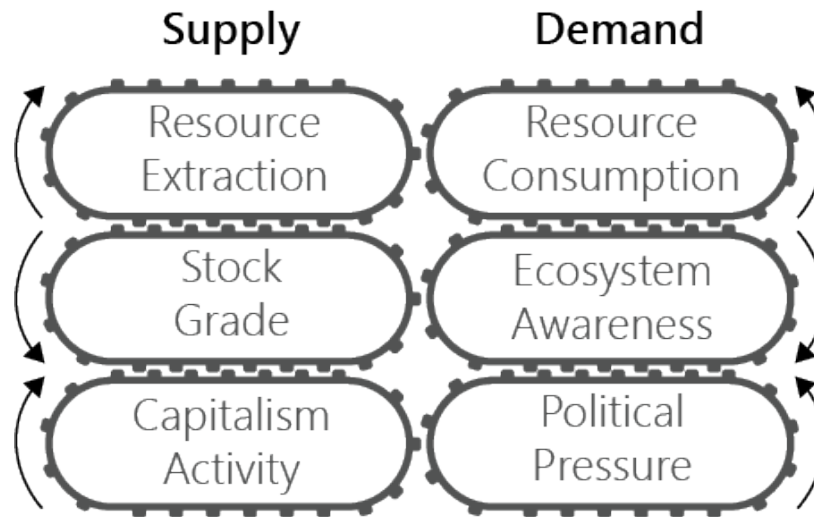
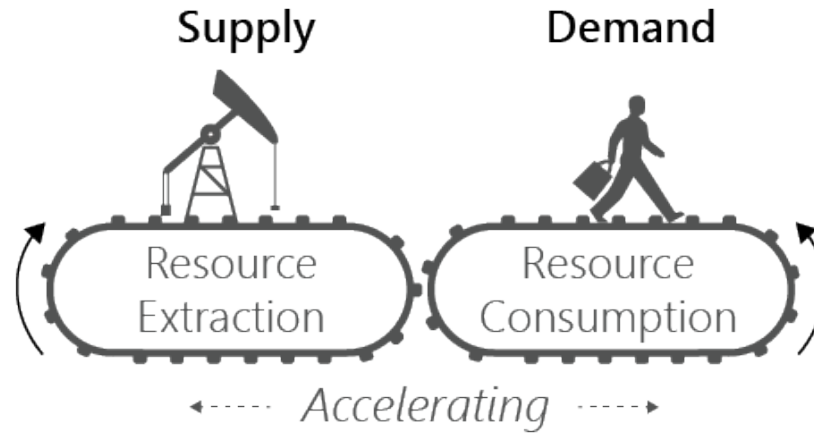
landandwaterlab.org



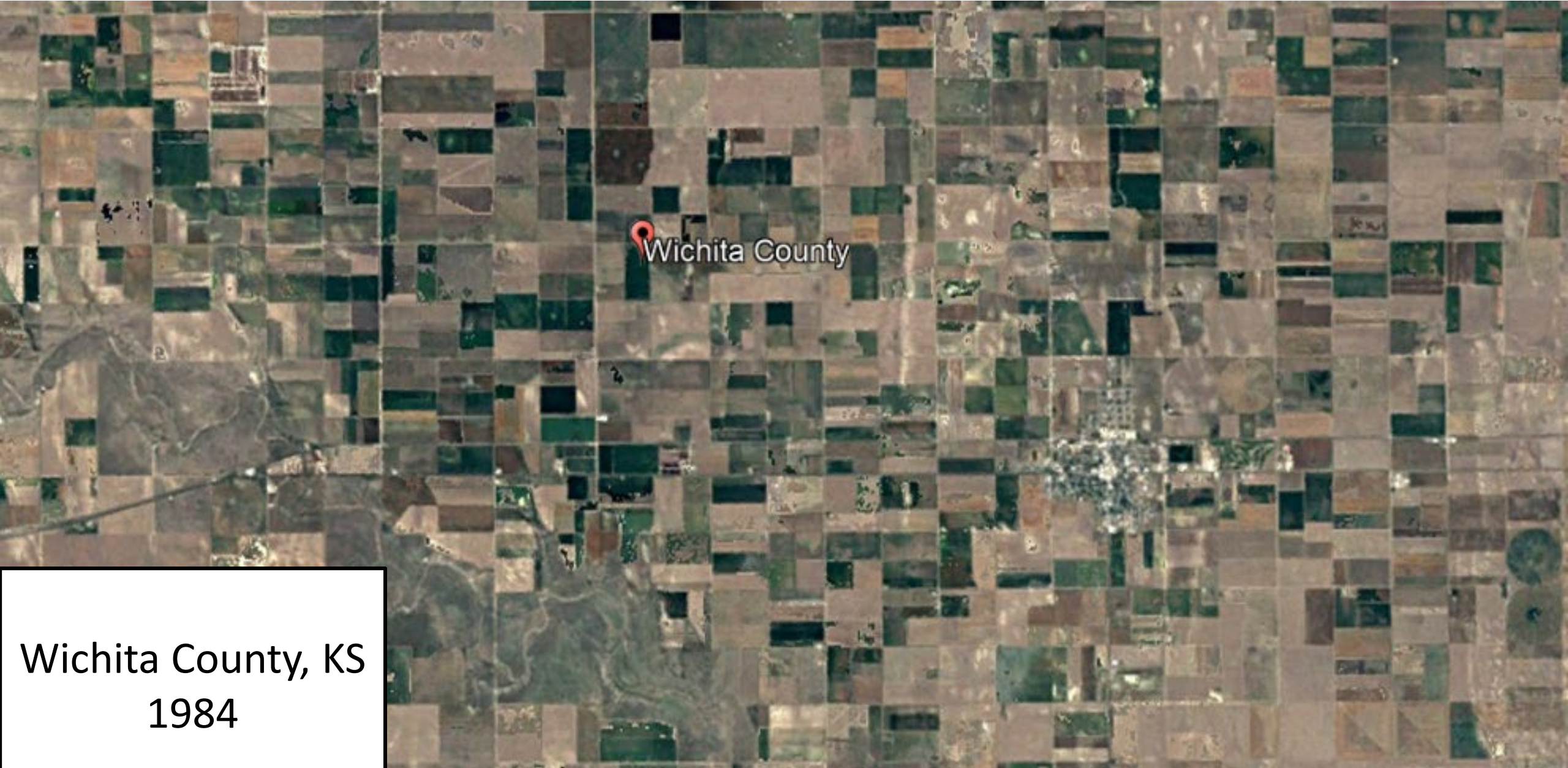
Contact: ssmidt@ufl.edu

Soil and Water Sciences Department, UF Gainesville

The Treadmill of Production demonstrates supply and demand.



High efficiency irrigation is dominant in the western US.



Wichita County, KS
1984

High efficiency irrigation is dominant in the western US.



Wichita County, KS
2015

Efficient irrigation systems are now common across the HPA.

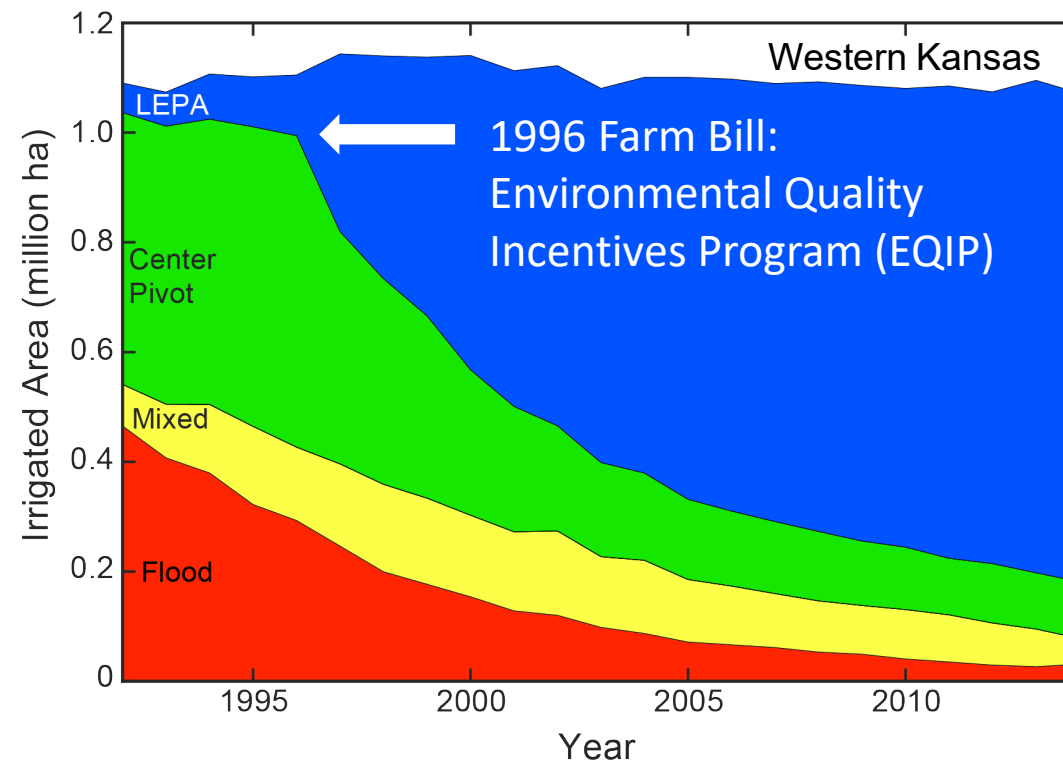
Flood



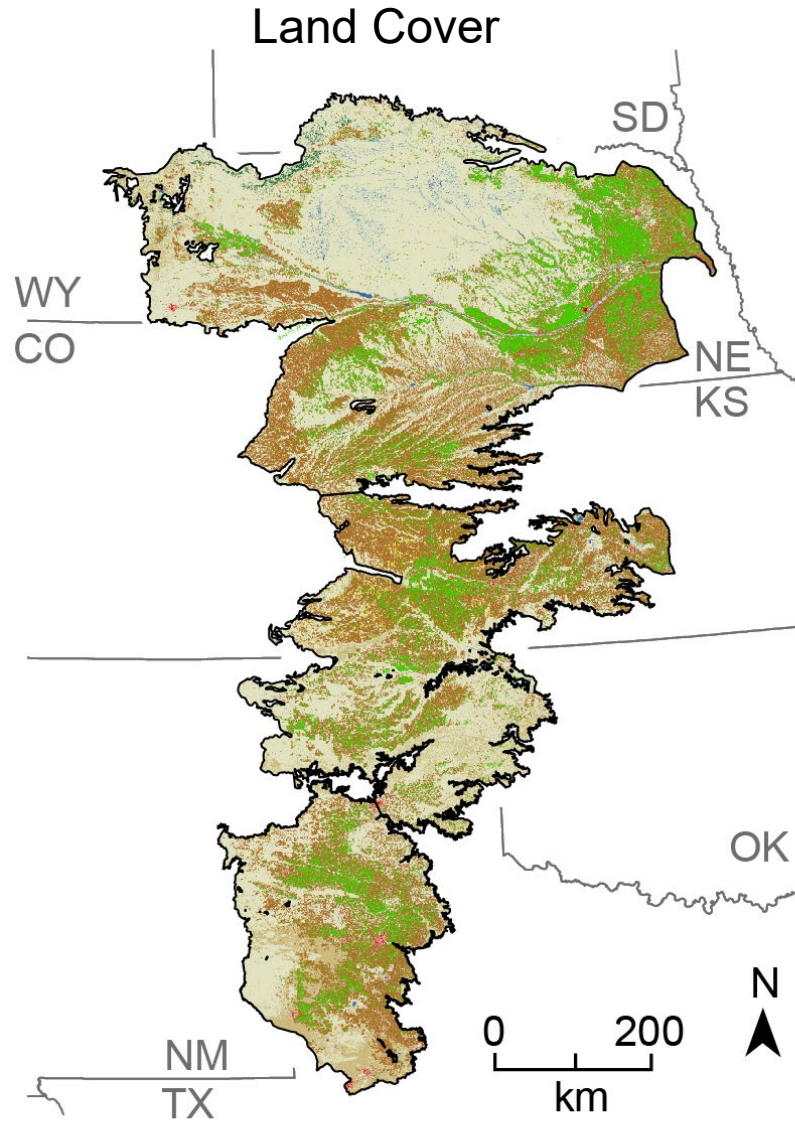
Center Pivot



LEPA

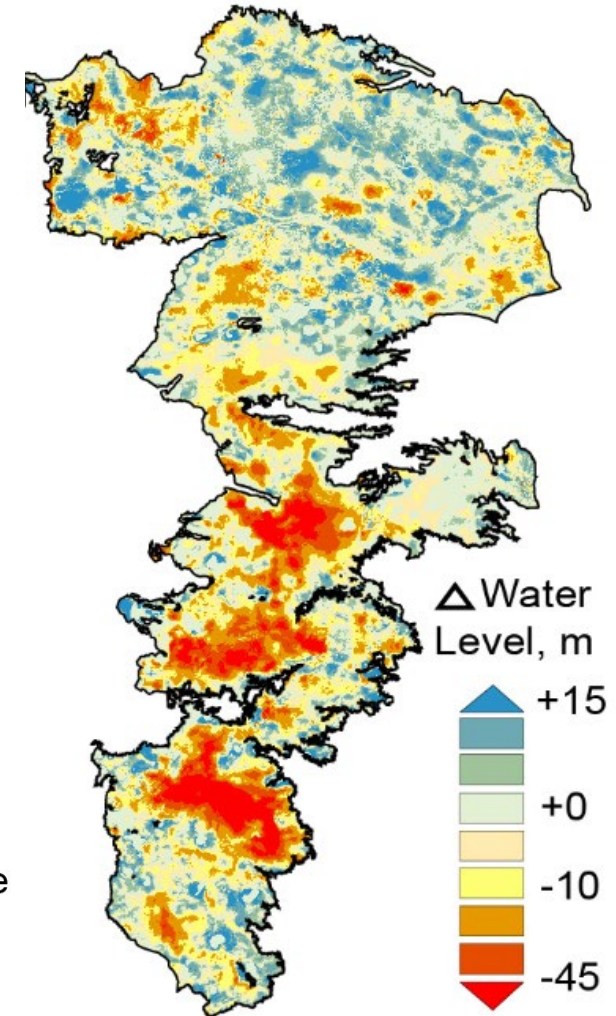


Groundwater decline is connected to irrigation use.

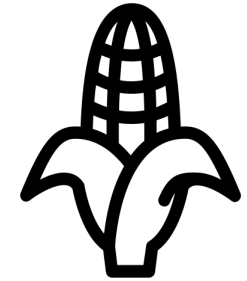


- Urban
- Water
- Grass/Range
- Cropland
- Irrigated Cropland

Groundwater Level Decline



Model results are strong despite highly variable agricultural data.



Dry R²

Irrig R²

0.95

0.87



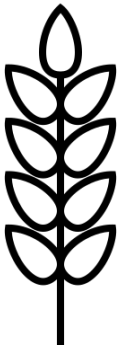
0.90

0.84



0.94

0.82



0.86

0.82

