

Midwest Farmer Adaptive Management Responses to Perceptions of Excess Water-related Risks

Farmer adaptive management responses to changing weather patterns have potential to reduce crop losses and address degrading soil and water resources. This research used farmer survey (n = 4778) and climate data (1971–2011) to model variable influences on farm management practices.

Predictor variables:

Geophysical Context:

- My farm proximity to creek/river/stream
- Marginal soil: County soil capability classification (4-8)

Climate/Recent Weather (last 5 years):

- Daily precip: proportion of Apr-Sep days from 2007-2011 with precip exceeding 99th percentile (heavy rains)
- Seasonal Precip: average rank 2007-2011 Apr-Sep total precip compared to last 40 years
- Median Seasonal Precip: median Apr-Sep total precip from historical records (1971-2011)

On-Farm Experience:

- Saturated Soils: problems with saturated soils, ponding last 5 years
- Flooding: experienced significant flooding last 5 years
- Erosion: some land experienced significant soil erosion over last 5 years
- Variable Weather: noticed more variable/unusual weather last 5 years

Perceived Risk:

- Water Risk: latent current “concern” factor constructed from 5 items (increased flooding, more frequent extreme rains, saturated soils and ponded water, loss of nutrients into waterways, soil erosion)
- Diverse Corn Markets: total count (commodity, ethanol, livestock-silage, specialty-value added or organic, seed, other)

Relationship Influence:

- Overall Influence: latent factor constructed from 8 influence items (4 factors below)
- Public Ag: NRCS, state climatologist, Extension, State Dept. of Ag
- Private Ag: seed dealers, farm chemical dealers
- Ag Peers: other farmers
- Farm organizations

Predicted variables:

Self-reported in 2011; percent of land (owned and/or rented):

- Artificially drained through tile or other methods
- Reduced Tillage (e.g. strip, ridge tillage)
- No-till
- Planted to cover crops
- Highly eroded land (HEL) planted to crops

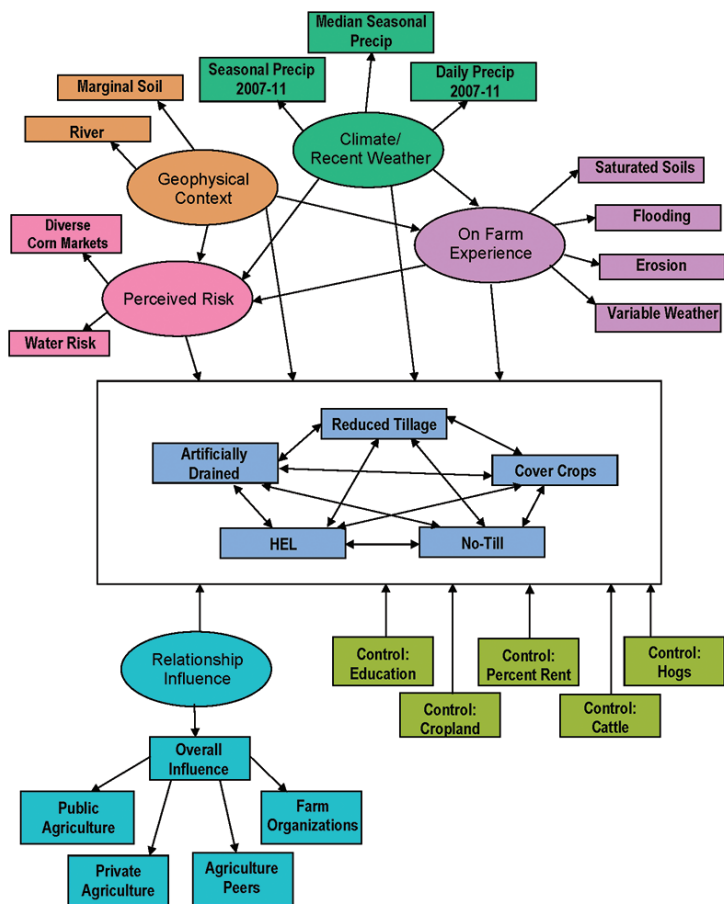


Figure 1. Structural equation modeling the relationships among farmer adaptation strategies and predictor variables geophysical context, climate/recent weather, on-farm experience last 5 years, relationship influence, and perceived risks; controlling for education, number of acres in cropland, percent rented land; total cattle; total hogs.

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TABLE: Farmer adaptive management responses to on-farm experiences, perceived risk and past climate.¹

KEY: * p ≤ .05; ** p ≤ .01; *** p ≤ .001; HEL = highly erodible land; Pos = the variable caused a positive response

Concept	Variables	Adaptive Management Response							
		Artificial Drainage		No Till		Cover Crops		Plant HEL	
		+ or -	Sig.	+ or -	Sig.	+ or -	Sig.	+ or -	Sig.
Geophysical	River	Pos	***	Pos	***			Pos	***
	Marginal Soil	Neg	***	Pos	***	Pos	***	Pos	***
On Farm Experience	Saturated Soils	Pos	***	Neg	***	Neg	*	Neg	***
	Flooding	Neg	**			Pos	**		
	Erosion	Neg	*					Pos	***
Perceived Risk	Variable Weather								
	Water Risk								
Relationship Influence	Diverse Corn Markets					Pos	***	Pos	**
	Overall Influence			Pos	**				
	Public Agriculture			Pos	*				
	Private Agriculture					Neg	***		
	Farm Organizations								
Other Adaptive Practices	Agriculture Peers								
	Artificial Drainage					Neg	***	Neg	***
	No Till					Pos	***	Pos	**
	Cover Crops	Neg	***	Pos	***			Pos	***
Demographics	Plant HEL	Neg	**	Pos	***	Pos	***		
	Education	Pos	***	Pos	***				
	Cropland								
	Percent Rented Land	Pos	***			Neg	***		
	Cattle	Neg	**			Pos	***	Pos	*
Climate	Hogs	Pos	**					Pos	*
	Median warm season precip	Pos	***	Pos	***			Pos	***
Daily Extreme Precip Frequency	Great Lakes	Pos	**						
	Upper Miss (MN/WI)	Pos	**						
	Missouri	Pos	***						
Warm season Precip Anomaly (Increased Wetness Last 5 yrs relative to past 40 yrs)	Great Lakes	Neg	***	Neg	*				
	Ohio	Neg	**			Neg	**	Neg	*
	Upper Mississippi (IL)								
	Upper Mississippi (IA)			Pos	***			Pos	***
	Upper Mississippi (MN/WI)	Neg	***	Pos	*				
	Missouri	Neg	***	Pos	***			Pos	***
Daily x Seasonal Precip	Upper Mississippi (IL)					Neg	*		
	Missouri			Neg	***			Neg	***
Error Variance			0.281		0.483		0.184		0.234
Gelman-Pardoe R			0.451		0.318		0.144		0.288

¹ Random sample survey; N=4778 farmers, 11 states. This model examined six regions: Great Lakes; Ohio; Missouri; Upper Mississippi (IA); Upper Mississippi (IL); and Upper Mississippi (MN/WI). Only regions with significant climate and weather results are shown in the table.