

Corn Belt Farmers' Adaptation to Increased Precipitation

BY LOIS WRIGHT MORTON, JONATHAN HOBBS, J. GORDON ARBUCKLE JR. AND ADAM LOY

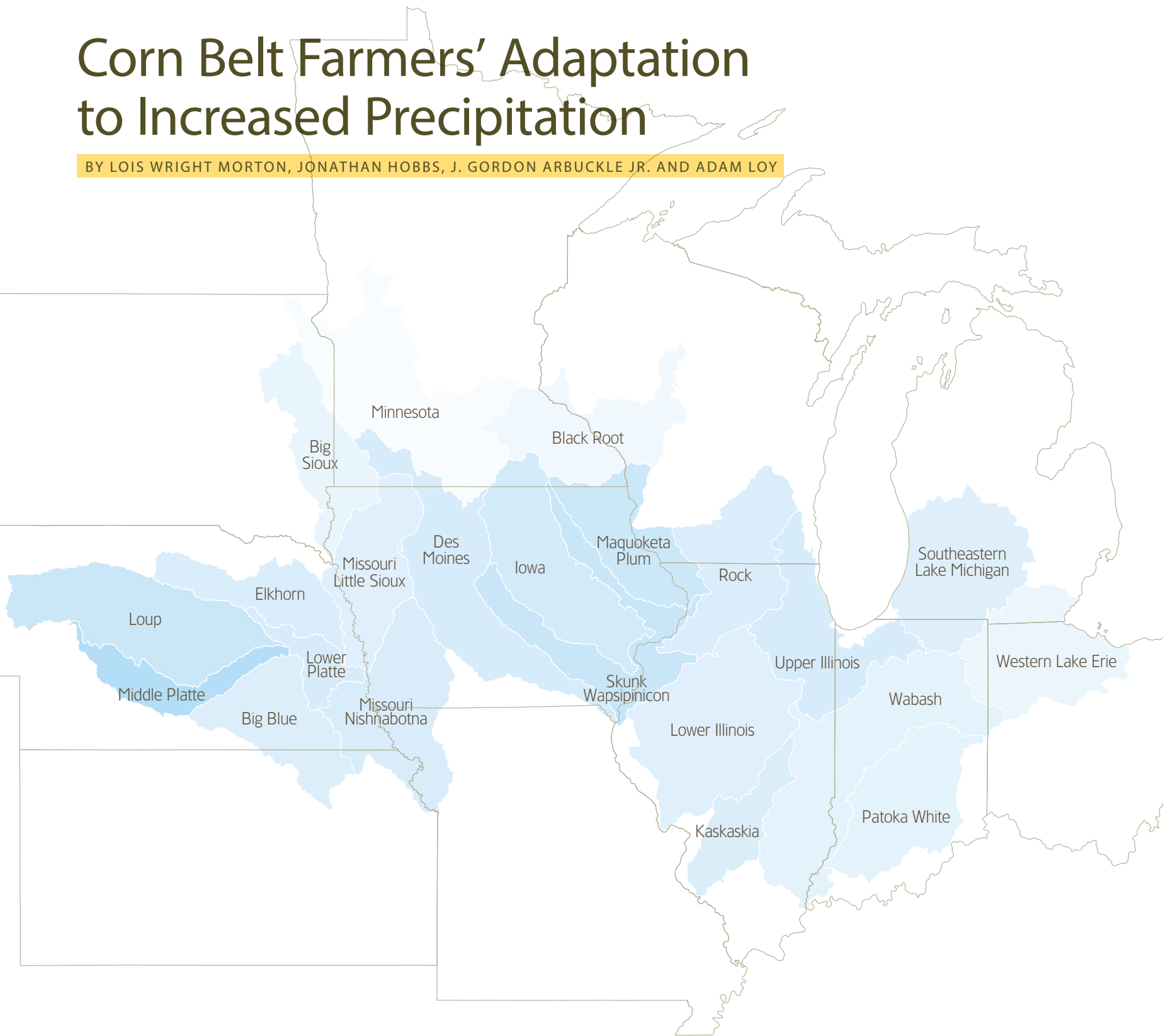


FIGURE 1 | 2007-2011 PRECIPITATION

Percentile rank of total April to September precipitation for 2007-2011 (compared to all data from 1971-2011). Watersheds with values above the 50th percentile were markedly wetter during 2007-2011 relative to the historical norm (1971-2011).



While climate change is a global phenomenon, it often has variable and unpredictable localized effects. From 2007 through 2011 the Upper Midwest recorded some of the highest levels of precipitation during the growing season (April–September) compared to the last 40 years (Fig. 1). The corn-soybean rotation is the dominant cropping pattern in the Corn Belt, which runs from Ohio west into the Great Plains. Recorded precipitation across this region is not evenly distributed and varies considerably, which impacts the timing of planting, nitrogen applications, and harvest dates, as well as pest vulnerabilities and corn development throughout the season. Consequently, when making decisions, each farmer must consider climate and weather data as well as the unique farm-specific soil, hydrology, and topographic geophysical conditions; past experiences with flooding, saturated soils, and erosion; diversification of production system; and anticipated markets.

The complexity of on-farm management decisions can be illustrated by three adaptive responses to precipitation (see Fig. 2) that Sustainable Corn Project scientists have been examining. Using data from a 2012 random sample survey of 4,778 Upper Midwest farmers (see article, page 23), three models were constructed to discover important factors that influence farmers’ decisions to implement no-till and cover crops, and to plant more crops on highly erodible land (HEL) on their farms. Two noteworthy patterns were found:

- 1) Actual past climate and precipitation can have a significant effect on the type of management put in place.
- 2) Seasonal precipitation varies greatly across the upper Midwest and has a differential impact on the type of management.

It follows that under different climate conditions farmers are likely to make different management decisions based on their perceptions of risk and anticipation of future opportunities. Further, if they have a river running through their lands or marginal soils highly vulnerable to erosion or not generally suited to row crops, they are more likely to be using no-till. Cover crop management is associated with marginal soils, experience with flooding over the last five years, use of no-till, and diversified production systems and markets that include cattle.

In 2012, when this survey was conducted, we found that farmers’ use of cover crops was negatively influenced by seed and farm chemical dealers. In more recent years there has been significant farmer utilization of cover crops to increase soil organic matter, reduce off-farm nitrogen loss to proximate streams, and hold soil in place. We suspect that if the survey were conducted today we would find that cover crop advice from agricultural advisors has changed.

One of the most worrisome trends across the region is the increase in crops planted to highly erodible lands. As illustrated in Fig. 2, this mal-adaptation is associated with marginal soils not suited to cultivated cropping systems, with farmers reporting increased erosion over the past five years and the use of cover crops. Diversified markets and production systems that include

FIGURE 2 | INFLUENCING FARMERS’ MANAGEMENT DECISIONS

NS no significant influence + significant positive influence - significant negative influence

	Factors influencing adaptive management	No-Till	Cover Crops	Plant HEL
Geophysical context	River runs through/nearby	+	NS	+
	Marginal soil	+	+	+
On farm experiences with too much water, diversification of production systems and markets	Saturated soils	-	-	-
	Flooding	NS	+	NS
	Erosion	NS	NS	+
	Diverse Corn Markets	NS	+	+
	Relationship with seed dealers and farm chemical dealers	NS	-	NS
	Cattle	NS	+	+
	Hogs	NS	NS	+
Suite of associated practices	Artificial Drainage	NS	-	-
	No-Till		+	+
	Cover Crops	+		+
	Plant HEL	+	+	
Climate across the region	Seasonal Precip Median	+	NS	+
Region specific climate	Region			
Seasonal precipitation percentile rank	04 — Great Lakes	-	NS	NS
	05 — Ohio	NS	-	-
	07 — Upper Miss. (IL)	NS	NS	NS
	07 — Upper Miss. (IA)	+	NS	+
	07 — Upper Miss. (MN/WI)	+	NS	NS
	10 — Missouri	+	NS	+

cattle and hogs are significant and seem to influence farmer decisions to plant their highly erodible lands. Increased planting to highly erodible land is significantly associated with two specific river basins: Iowa in the Upper Mississippi River Basin and Missouri-Nishnabotna.

Lois Wright Morton, Ph.D., is a professor of sociology at Iowa State University and the project director of the Sustainable Corn Project; J. Gordon Arbuckle Jr. is the lead sociologist on the team; Jonathan Hobbs and Adam Loy were graduate students assisting in the analysis.