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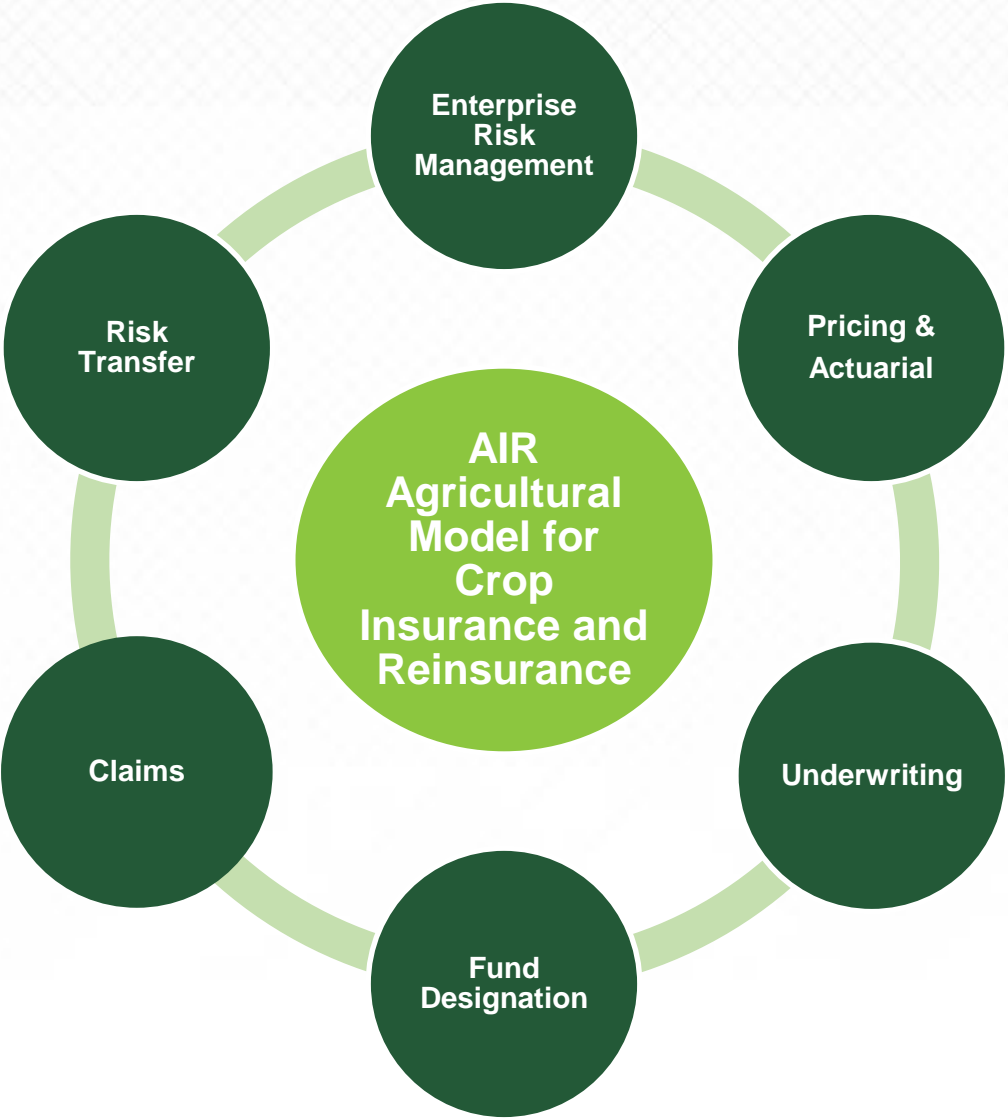
# Recap of U.S. Crop Insurance Industry Gains and Losses for the 2015 Crop Year

*Julia Borman, Ph.D., Oscar Vergara, Ph.D.,  
Sid Sasanian, Ph.D, MBA, and Katie Ward, ARE*

*Prepared for SCC-76 Conference, Pensacola, FL, March 17-19 2016*



# AIR Agricultural Model Applications

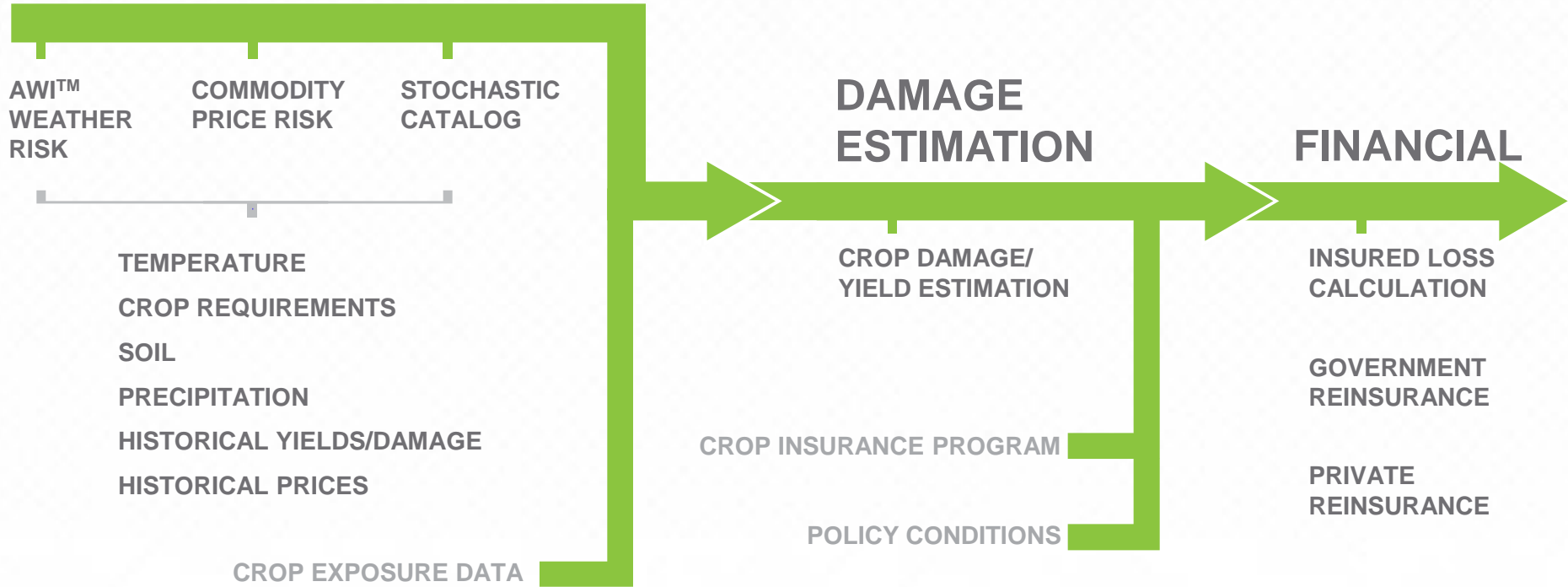


# Weather Modeling is Key for Agricultural Risk Management

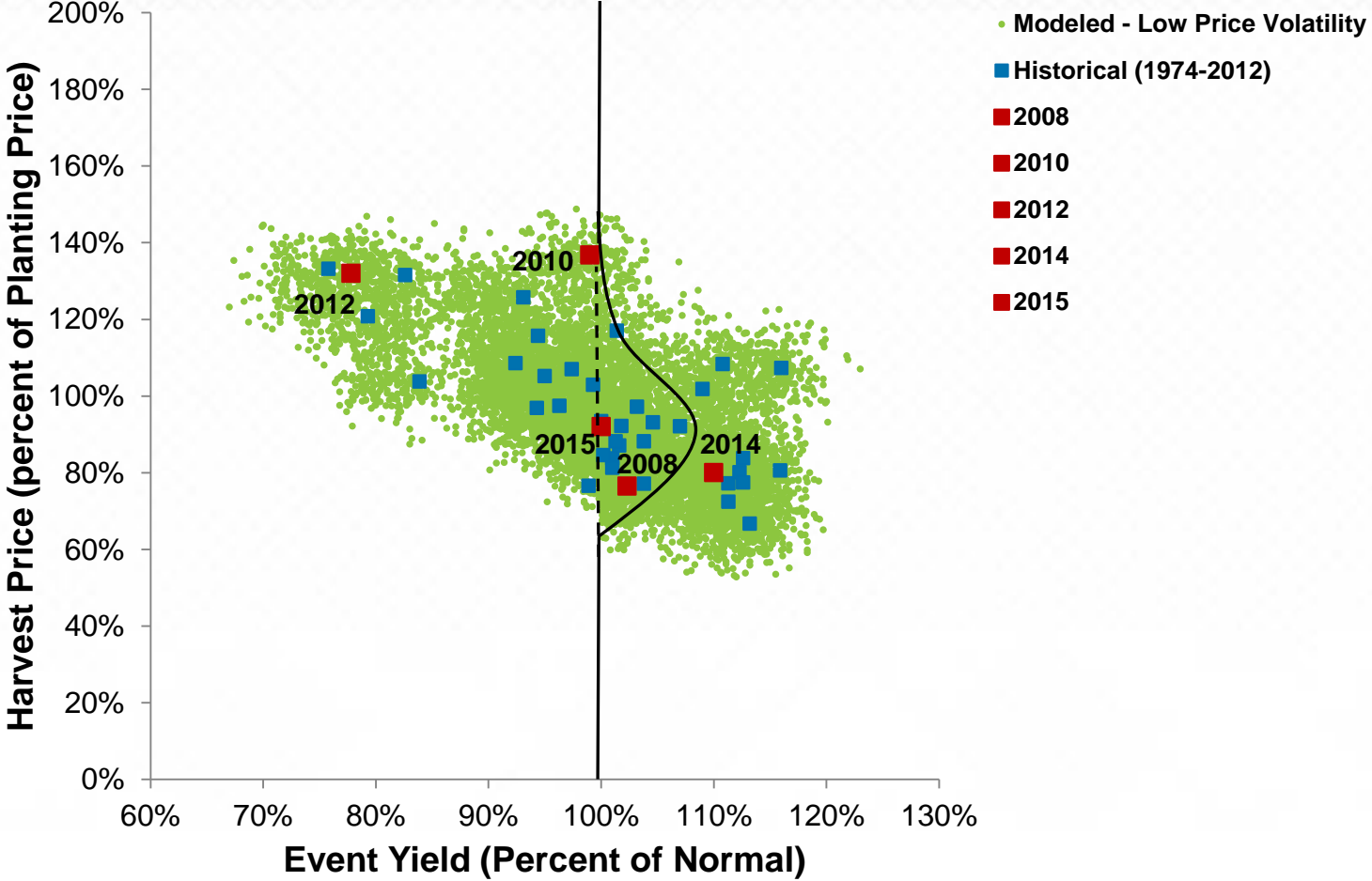
	<b>% Crop Loss</b>
Drought & Heat	37%
Excess Moisture	33%
Hail	13%
Cold, Frost & Freeze	5%
Wind & Hurricane	4%
Flood	1%
<b>Subtotal – Directly related to weather</b>	<b>93%</b>
Disease	5%
Insects & Wildlife	1%
Other	1%
<b>Subtotal – Other perils</b>	<b>7%</b>
<b>Total</b>	<b>100%</b>

# AIR's Multiple Peril Crop Insurance Models are Built from the Ground Up

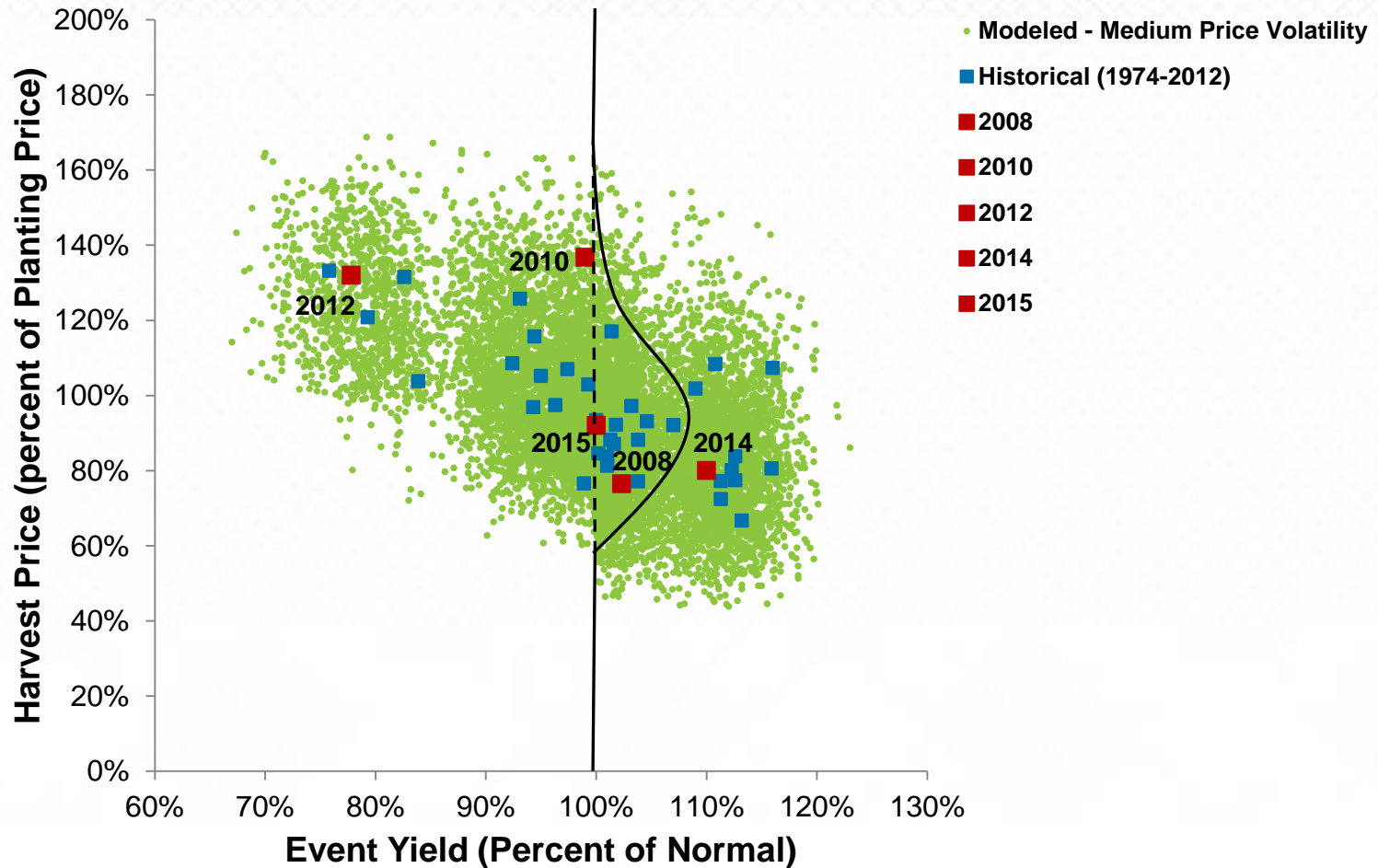
## HAZARD



# Low Volatility Catalog Reflects Price Uncertainty Similar to Historical Price Experience

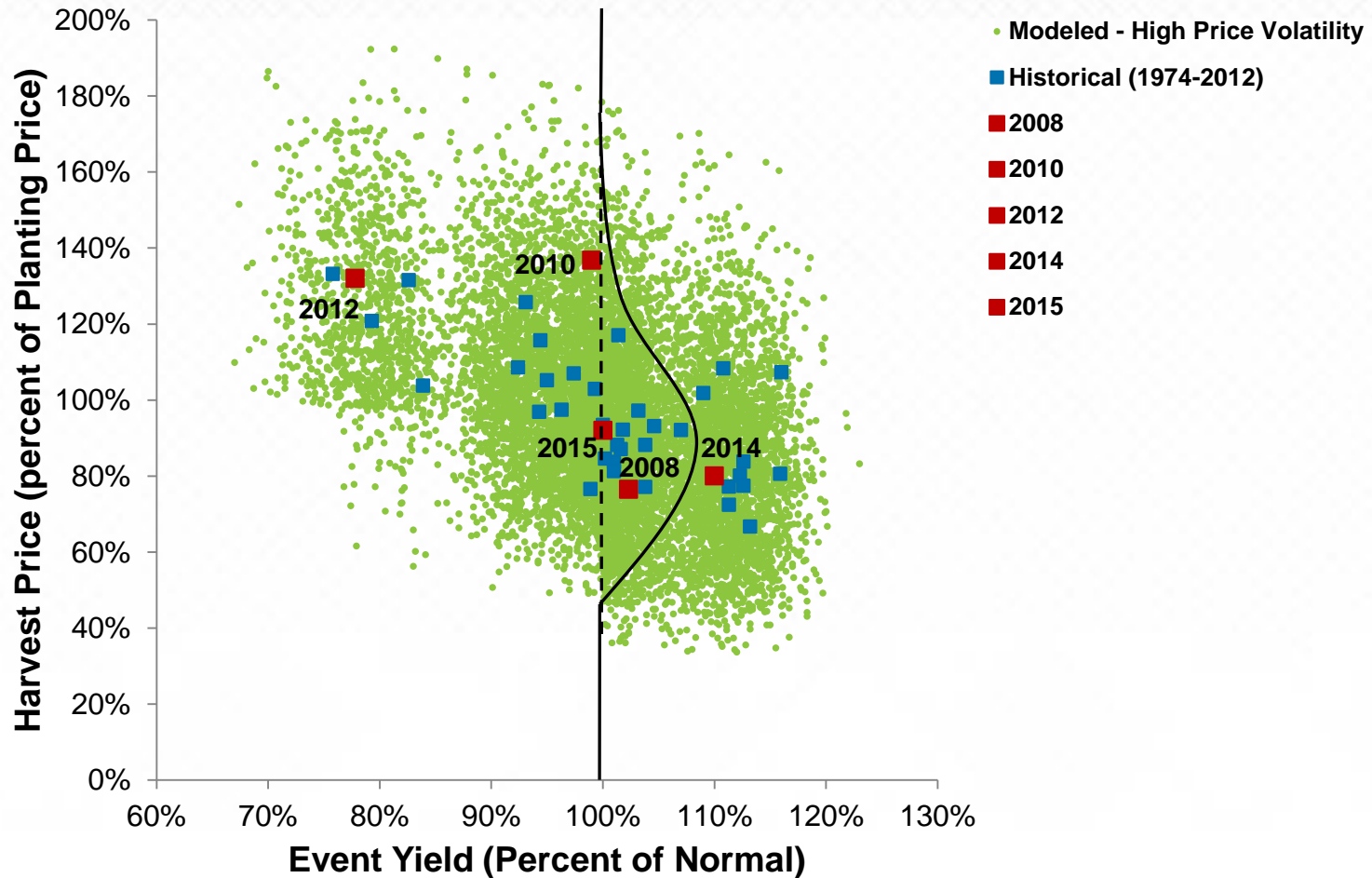


# Medium Volatility Catalog Reflects Increased Uncertainty of Harvest Price Compared to Planting Price



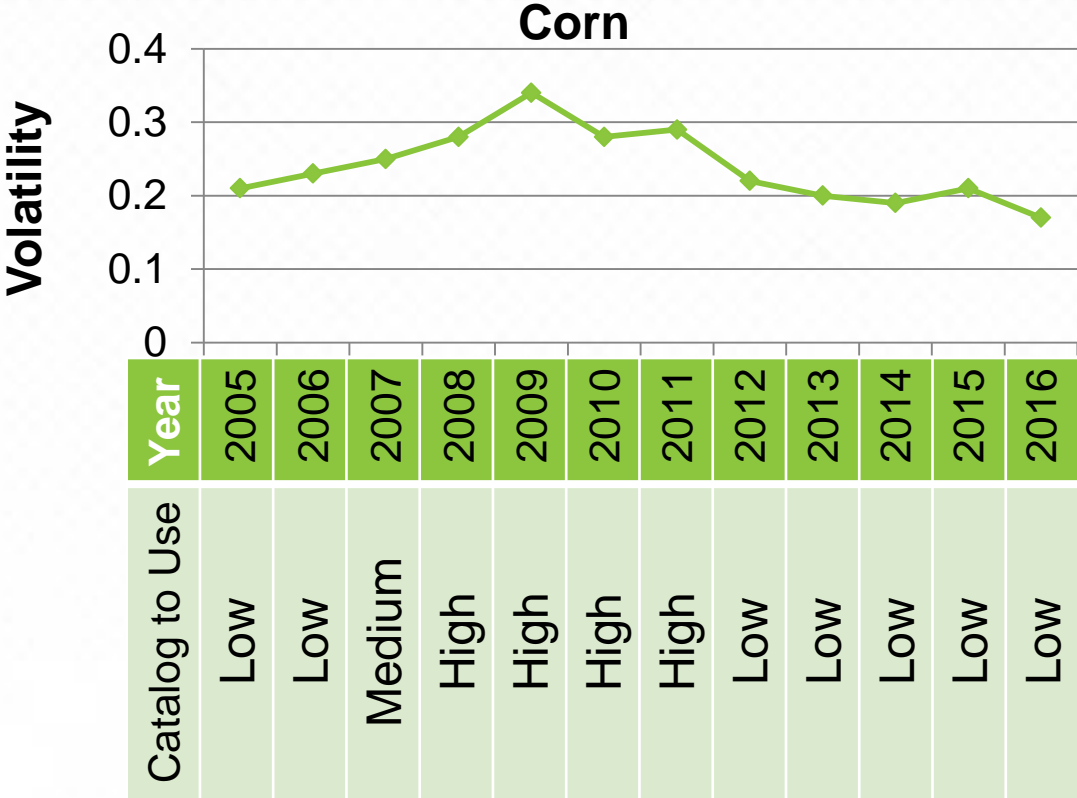


# High Volatility Catalog Reflects Large Uncertainty in Harvest Price As Experienced From 2008-2011

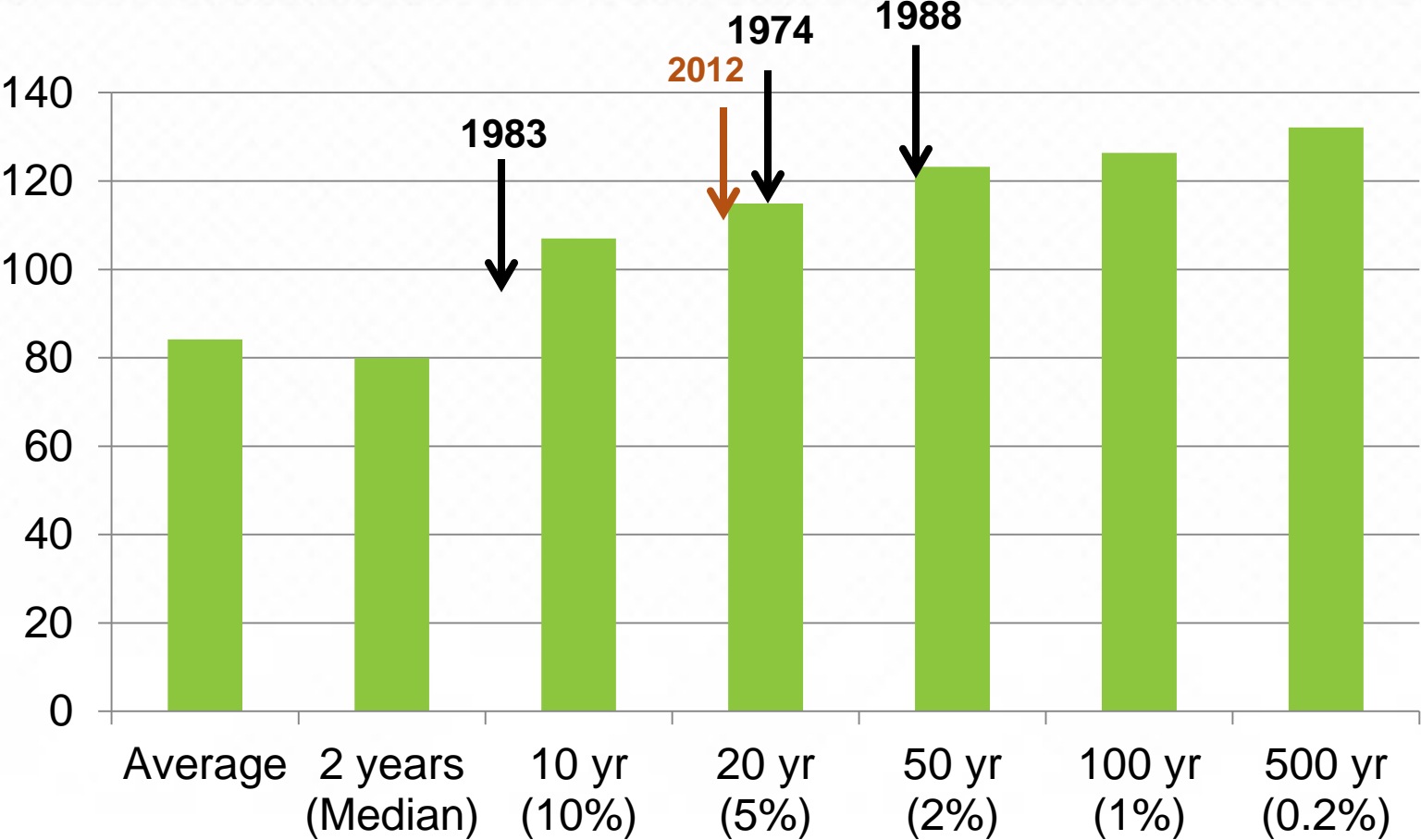




# Which Catalog Should We Use?



# Return Period of Important Historical Droughts For Industry



# RMA Summary of Business Report - March 2015

## Federal Crop Insurance Corp Summary of Business Report for 2013 thru 2016 As of March 7, 2016

*(Net Acre and Dollars in Thousands)*

	2013 Crop Year To Date	2014 Crop Year To Date	2015 Crop Year To Date
<b><u>Combined Business:</u></b>			
Policies with Premium	1,224,158	1,207,091	1,202,568
Units with Premium	3,580,774	3,577,048	3,623,107
Net Acres Insured	296,087	294,705	284,921
Liability	123,768,859	109,867,098	102,082,627
Total Premium	11,805,053	10,069,380	9,693,621
Subsidy	7,295,011	6,212,793	6,044,602
Indemnity	12,076,344	9,121,728	5,798,642
Loss Ratio	1.02	0.91	0.60

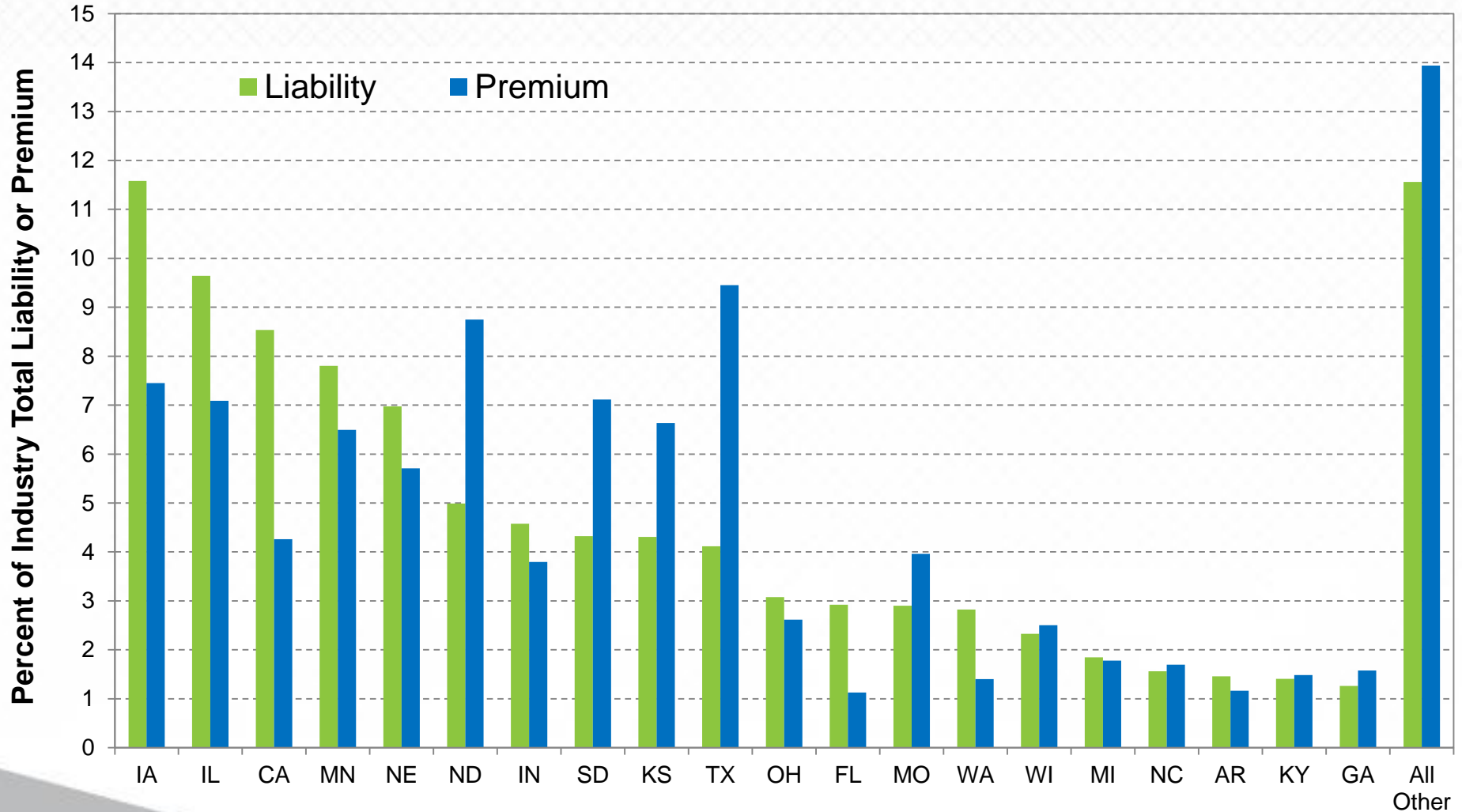
# RMA Rate Changes from 2015 to 2016



# 2015 Breakdown of Industry Liability and Premium Reveals Overall Crop Risk by State

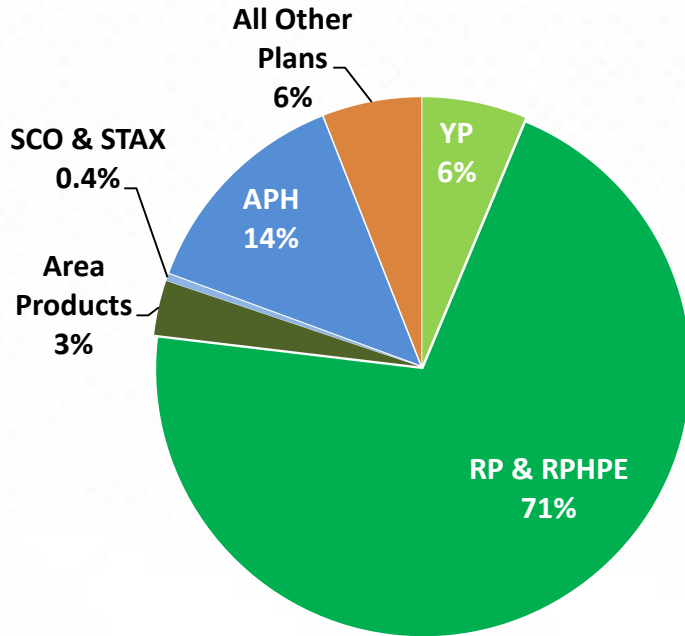
**Total Industry Liability: \$102.08 B**

**Total Industry Premium: \$9.71 B**

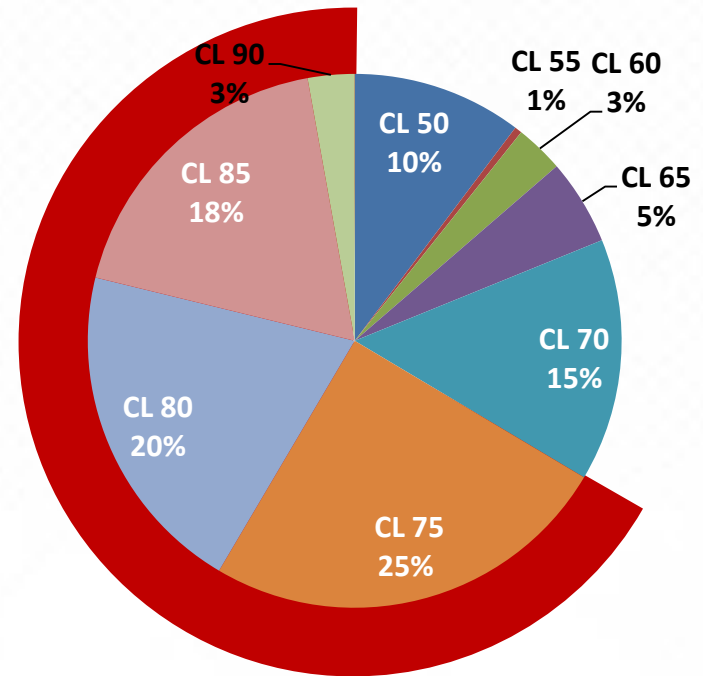


# Revenue Products with Coverage Levels 75% and Greater Are the Majority of Industry Premium in 2015

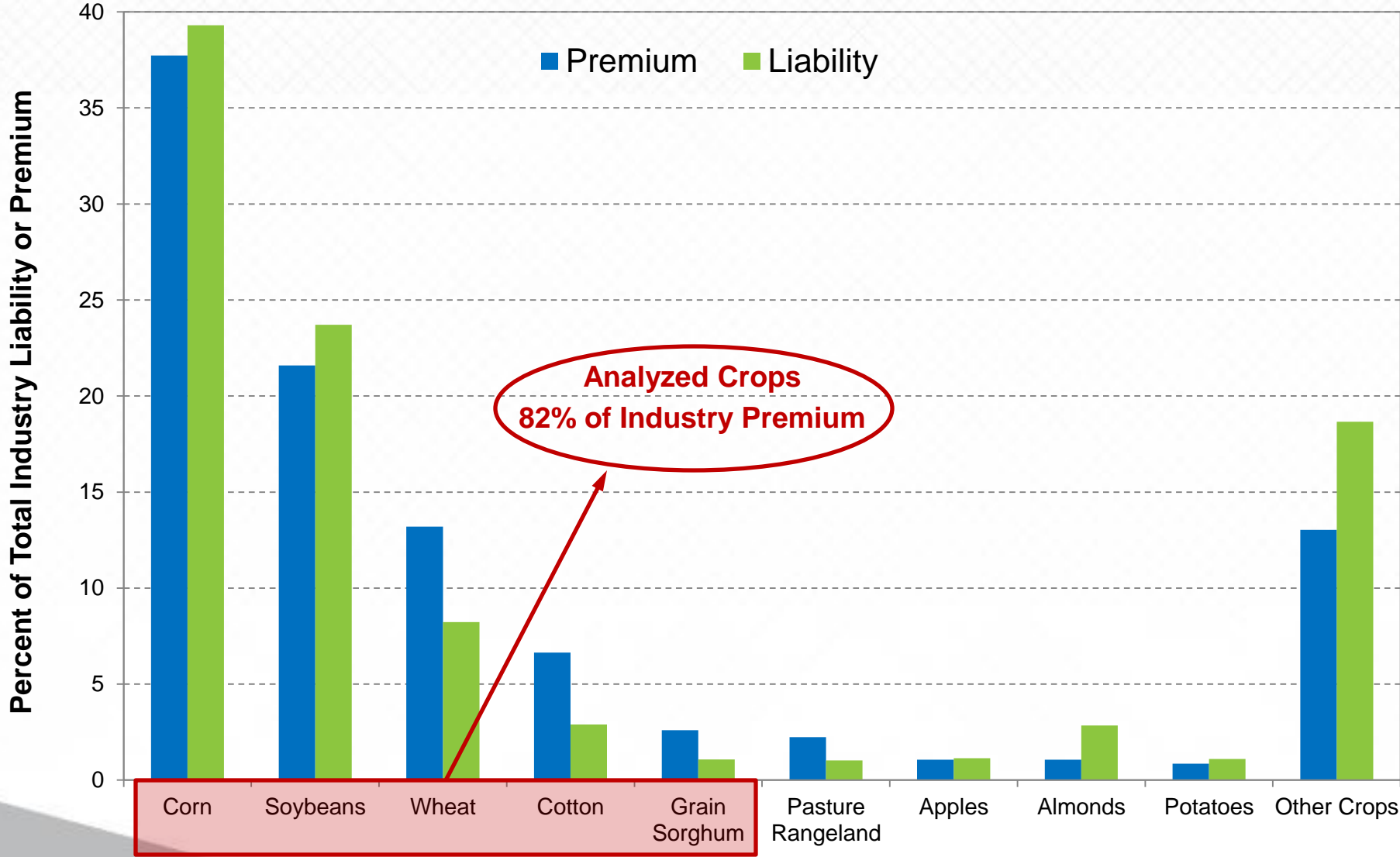
## By Insurance Plan



## By Coverage Level

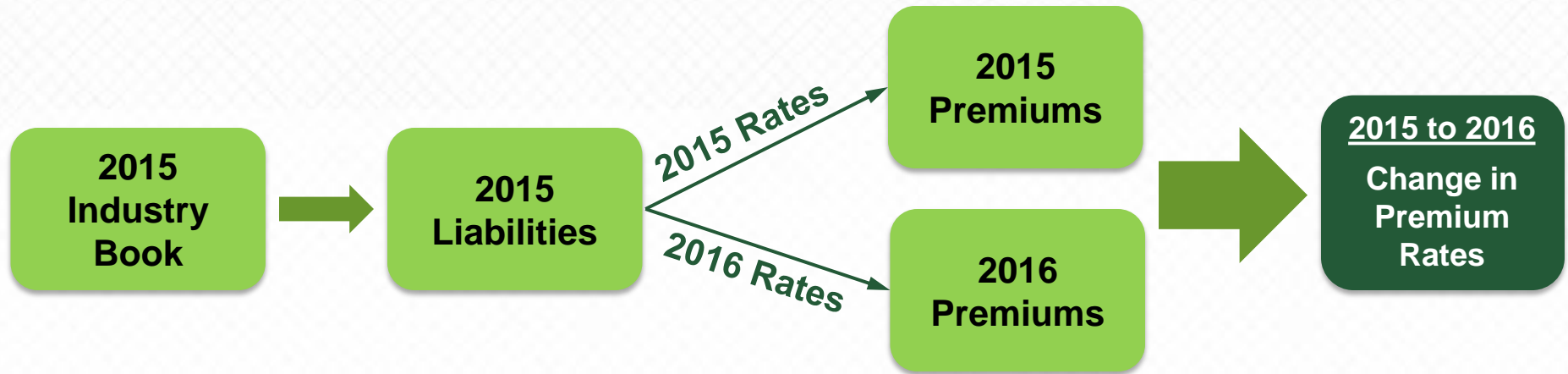


# Rate Study Performed on Top Five Crops Covers More than 80% of Total Industry Premium





# Keeping Liabilities, Prices, and Volatility Constant Allows Pure Rate Change Analysis

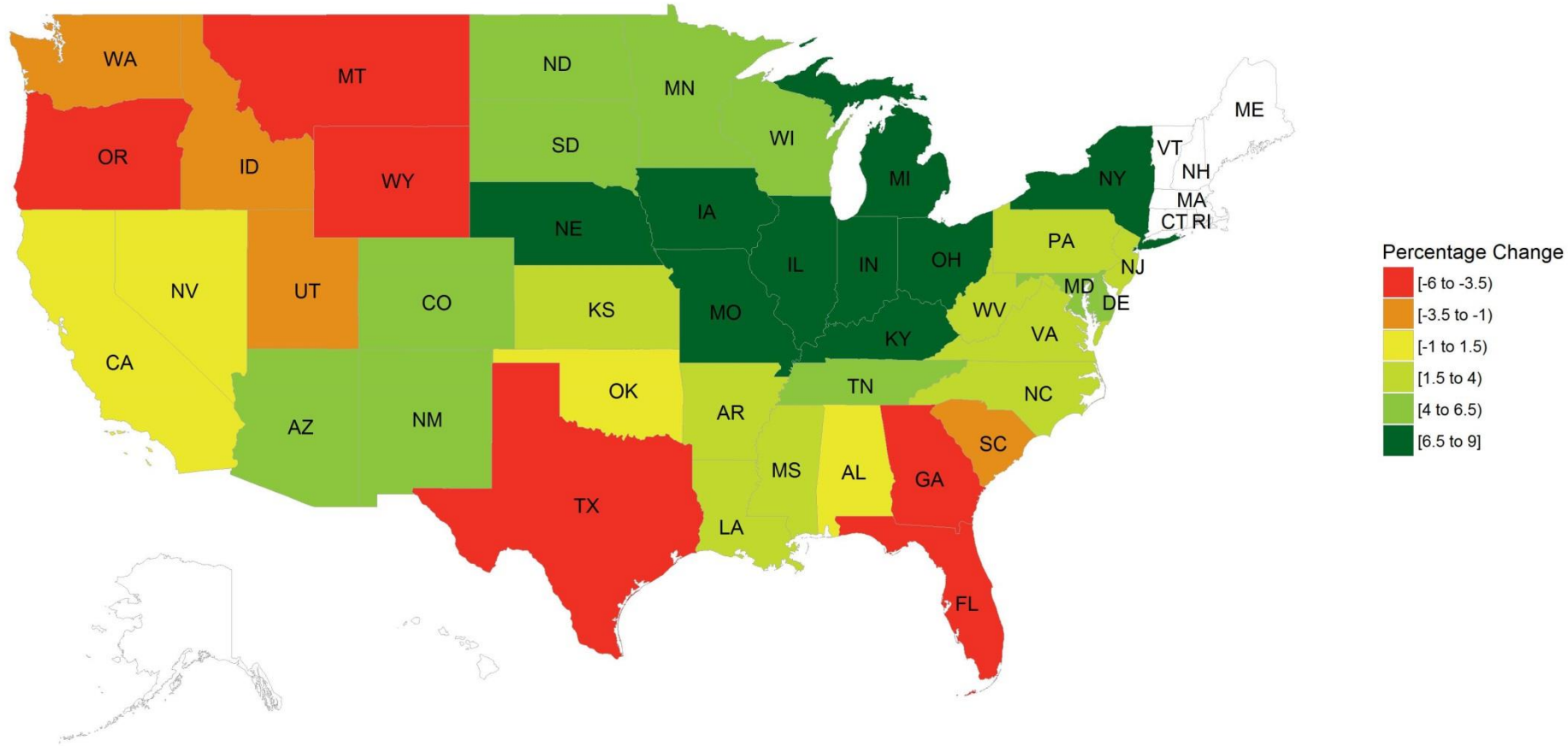


## Methodology:

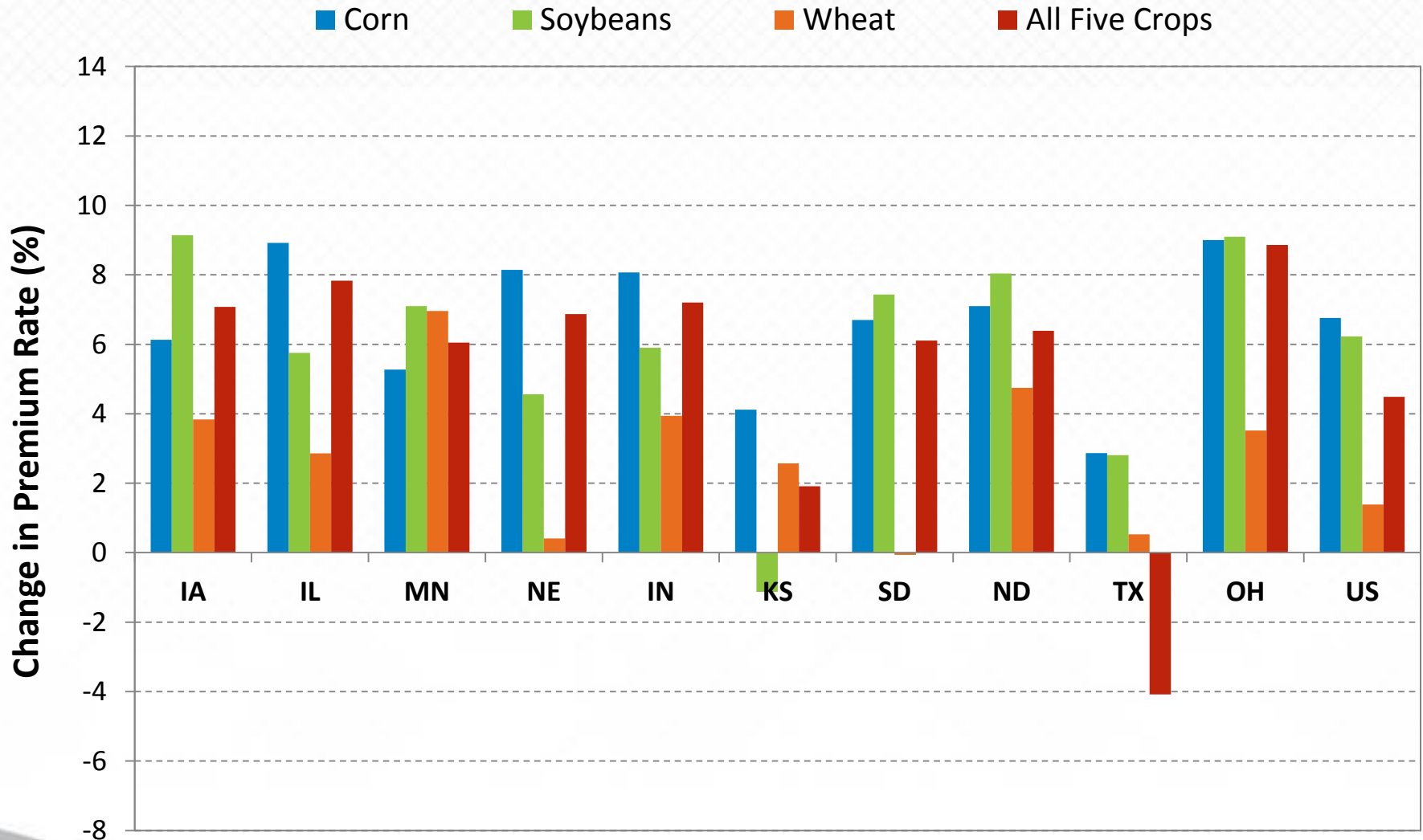
- Five major crops → corn, soybeans, wheat, cotton, grain sorghum
- Hypothetical industry book of business → All insurance policies that were written in 2015
- Constant “price” and “volatility” → Focus on pure change in “premium rates”
- Assumptions were made about “type,” “practice,” “unit structure,” and “insurance option” to build the industry book → The actual result for a specific company could be different
- “Unit structure” and “insurance option” → assumed based on available historical experience

# Premium Rate Change by State, from 2015 to 2016, Reveals Geographic Pattern

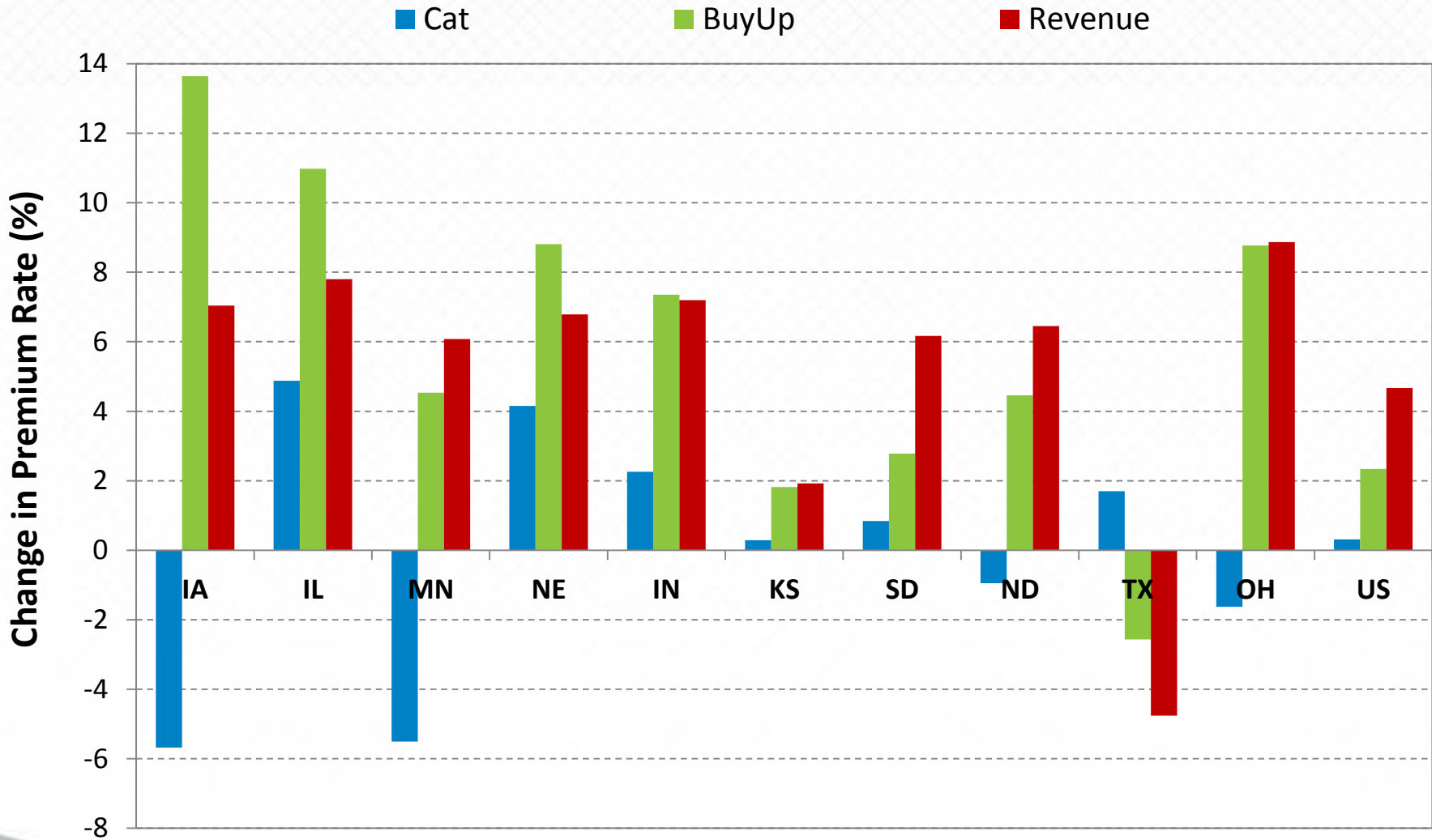
Premium Rate Change Percentage, by State



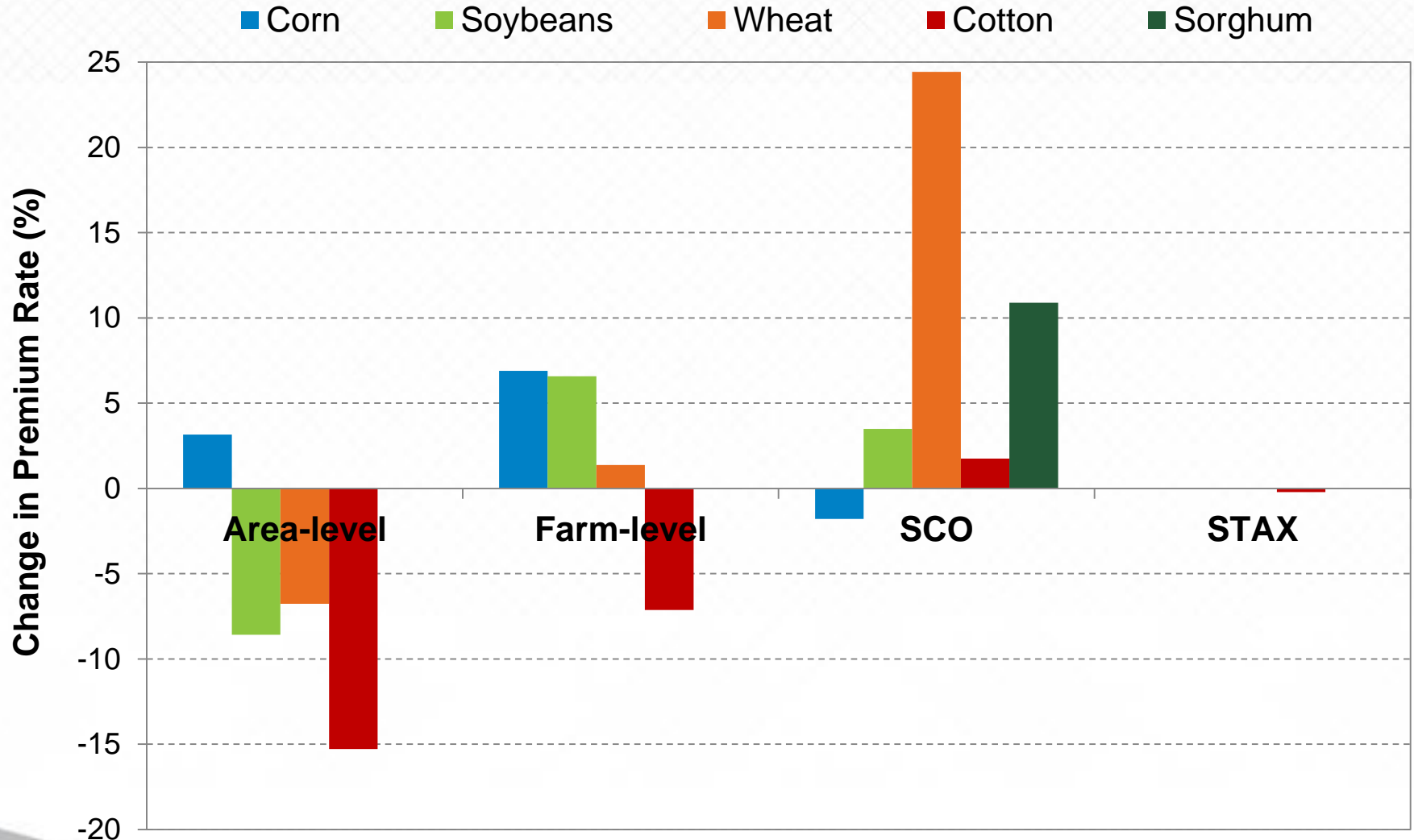
# Premium Rate Change by State, from 2015 to 2016, Reveals Crop Specific Pattern



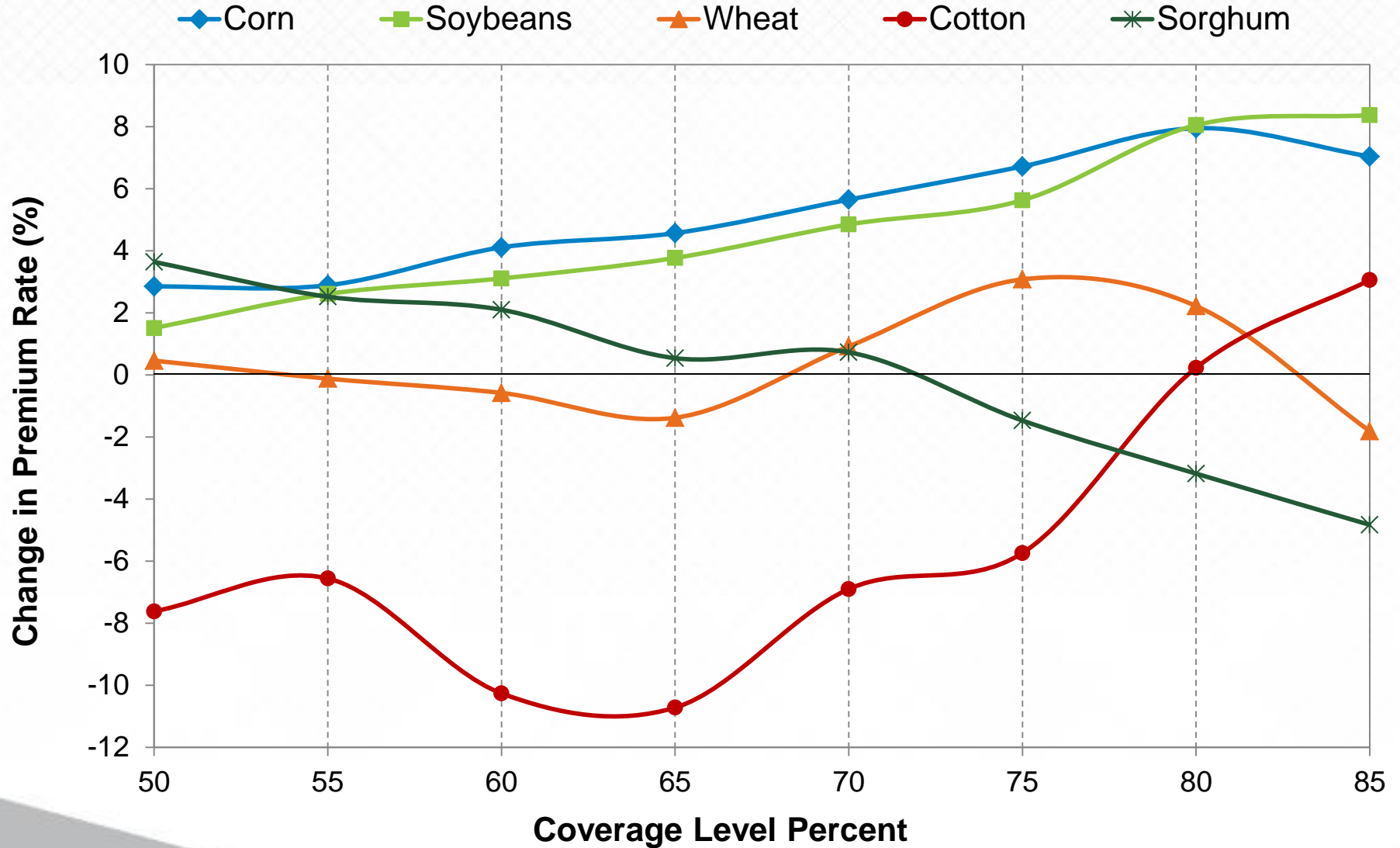
# Premium Rate Change for Revenue Policies Is Most Significant and Is Associated with a Large Liability



# Premium Rates Have Mostly Decreased for Area Products and Increased for Farm-level Products

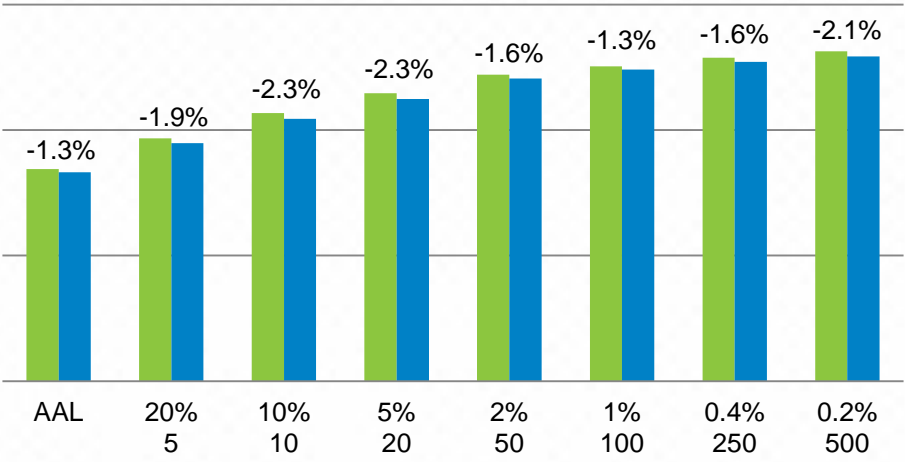


# Premium Rates Increase by Coverage Level, but Not for All Crops

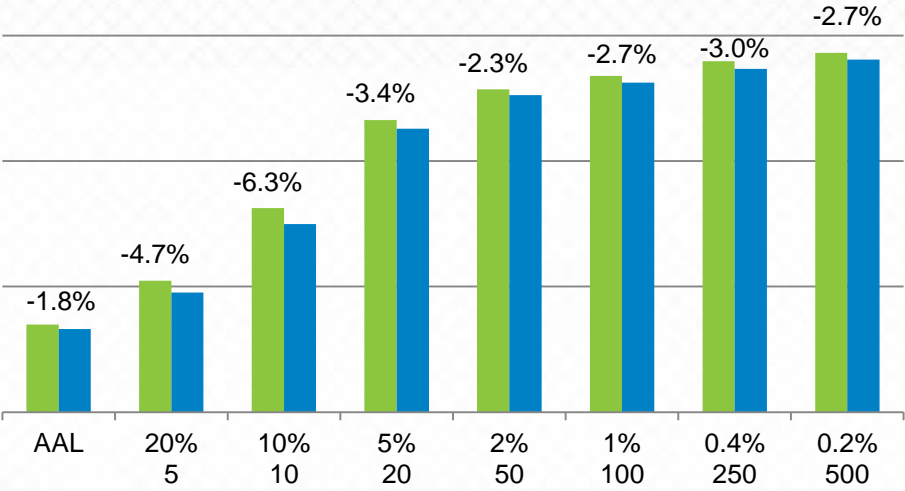


# Rate Change Has a Minor Impact on the Post-SRA Exceedance Probability Curve

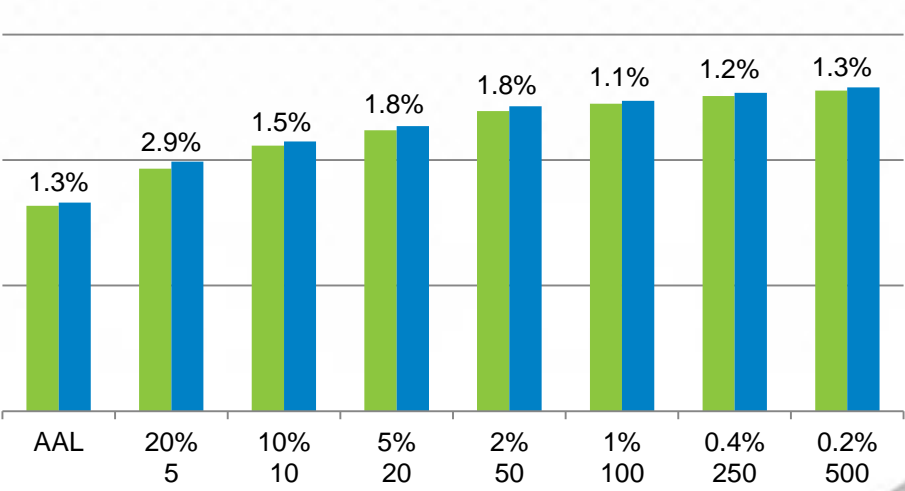
■ US 2015 ■ US 2016



■ IA 2015 ■ IA 2016



■ TX 2015 ■ TX 2016

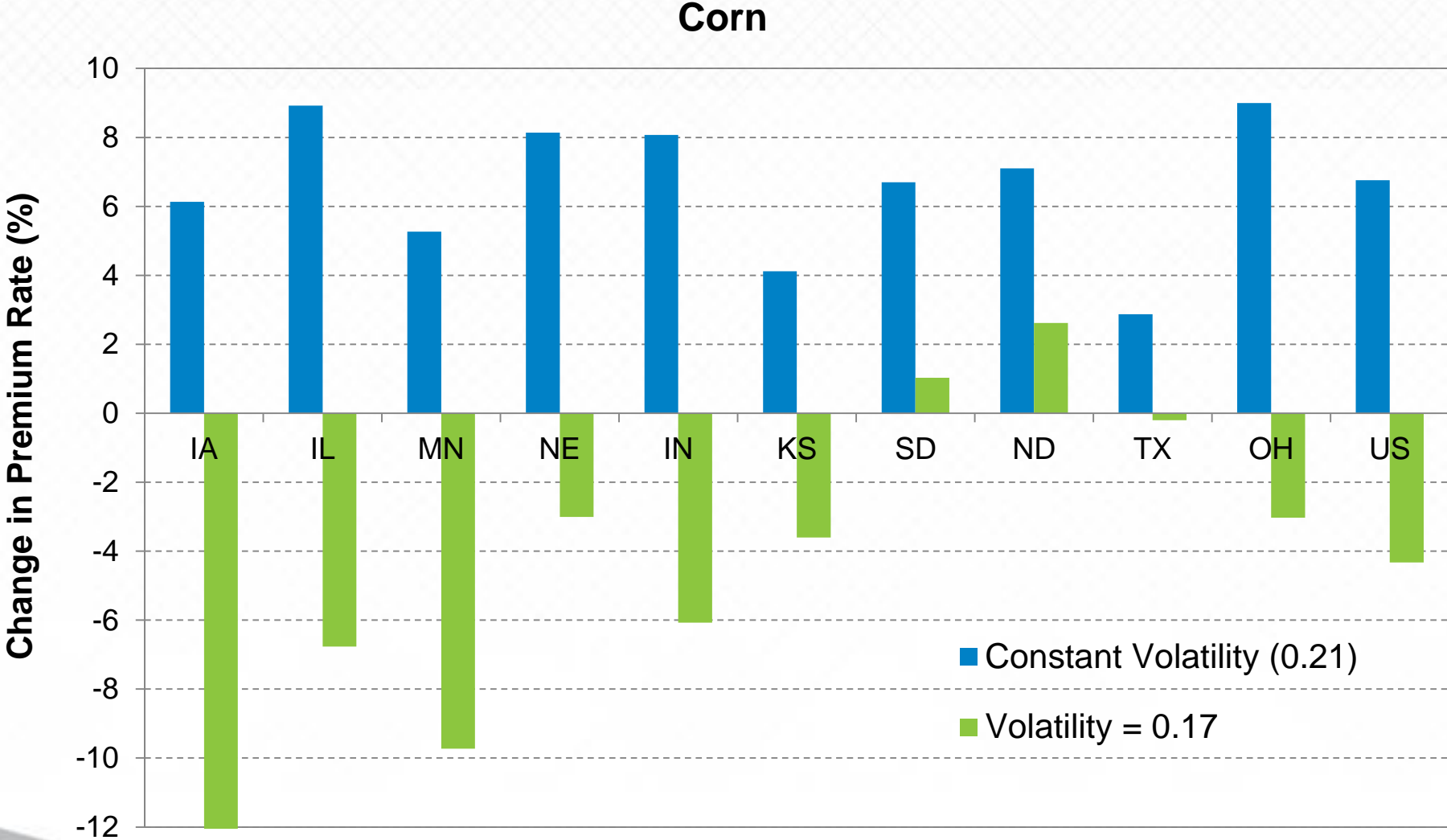




# Other External Factors Affect the Change in Final Premium Rates

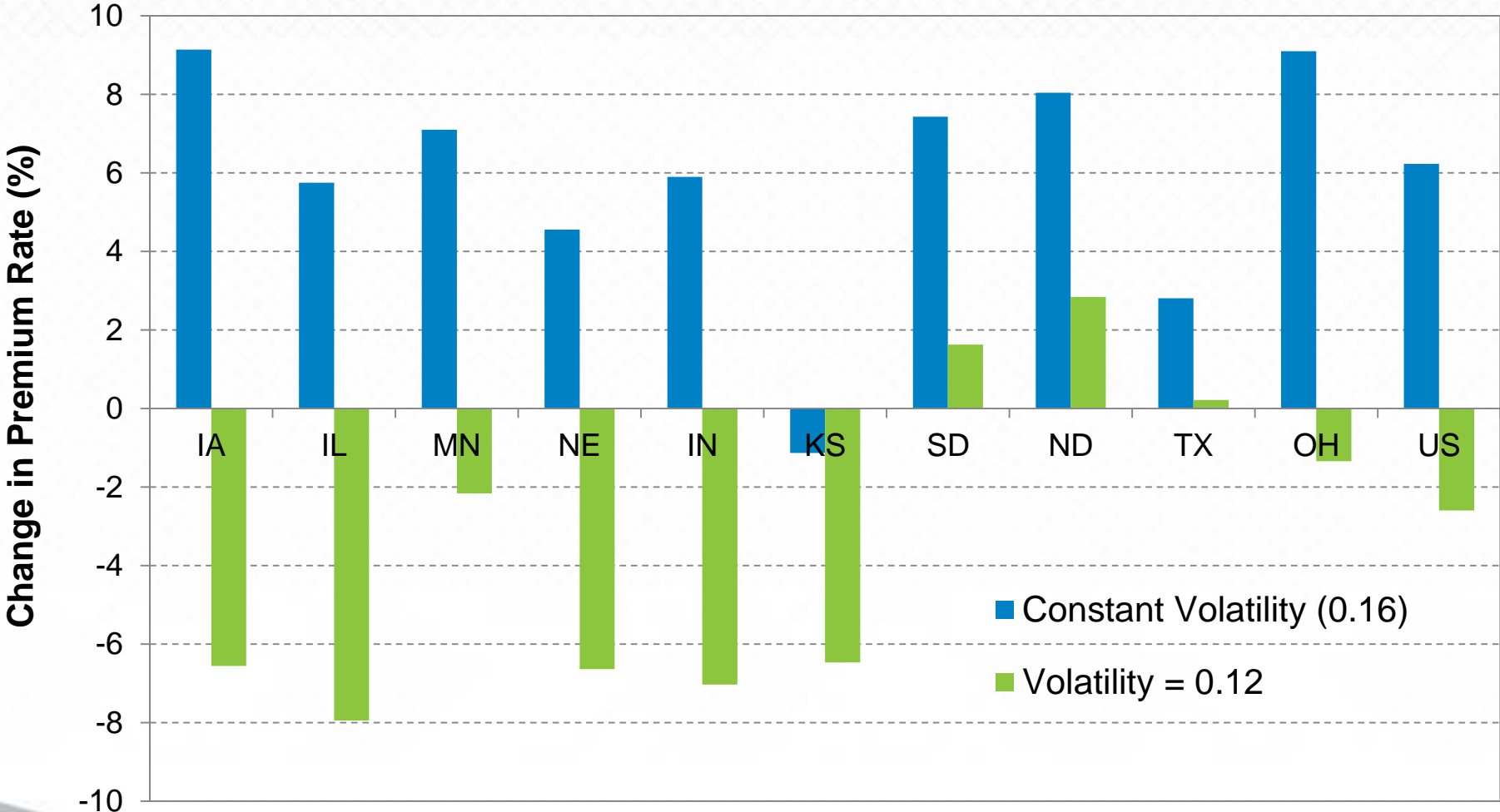
- Price volatility
- Change in producers' choice of coverage level
- TA and YE options → higher “effective” coverage levels
- Unit structure → EU vs. OU/BU
- Crop rotation and varying acreage over time

# Premium Rates for Corn Decrease with Reduced Price Volatility



# Premium Rates for Soybeans Decrease with Reduced Price Volatility

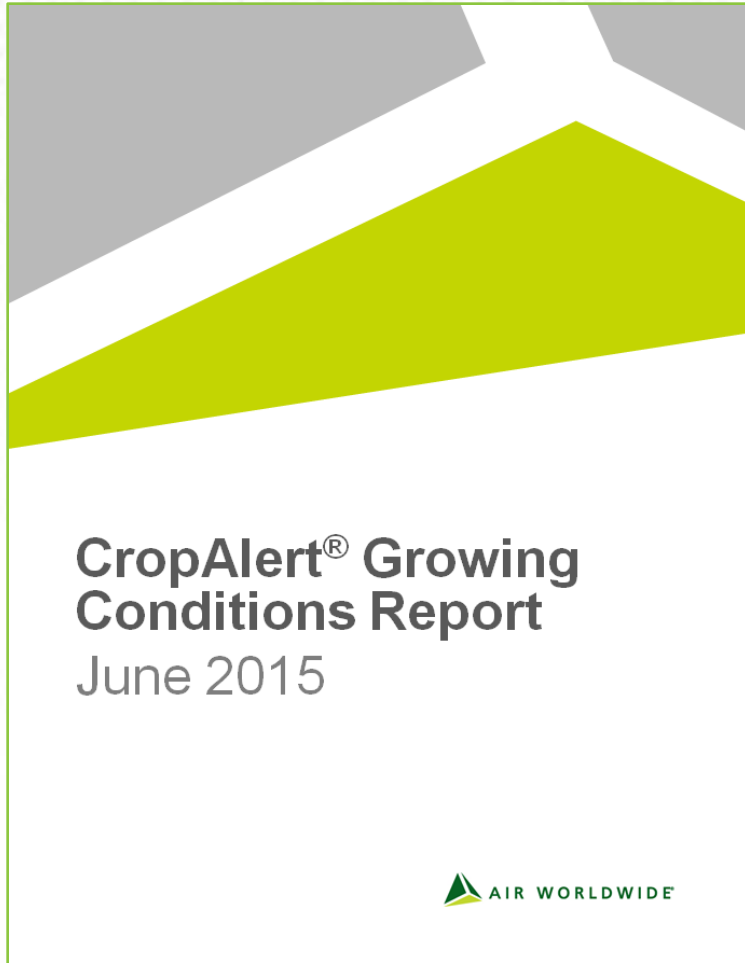
## Soybeans



# Current Research on Managing Risk in the 2016 Crop Year



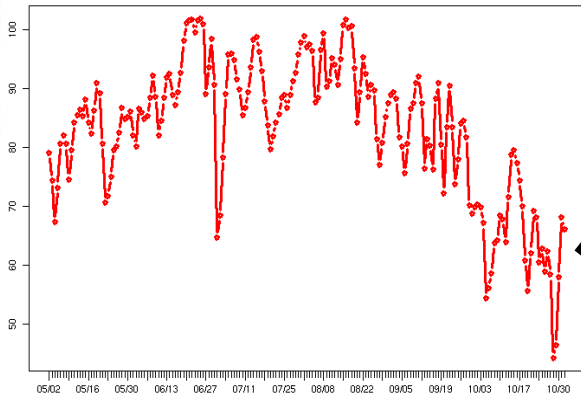
# CropAlert® Growing Conditions Report



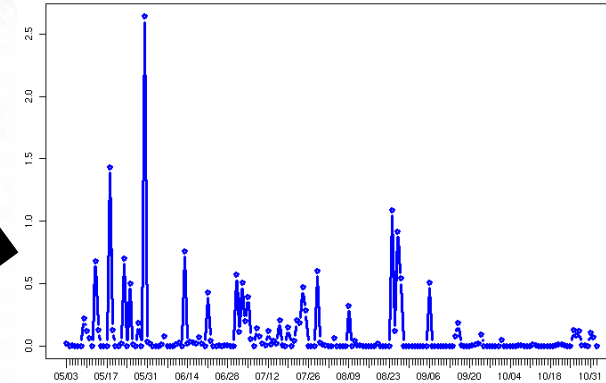
- Monthly publication from June to October
- AIR Baseline Yield Projections
- Forecasting adjustments from changing yield and price risks
- Program and Policy Analysis pieces

# AWI (Agricultural Weather Index™) Is a Measure of Yield Variability Due To Weather

## Daily Temperature

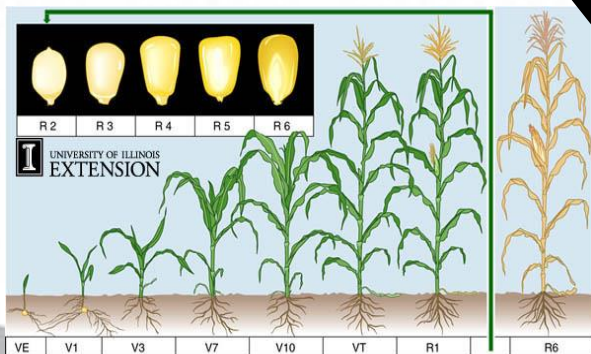


## Daily Precipitation

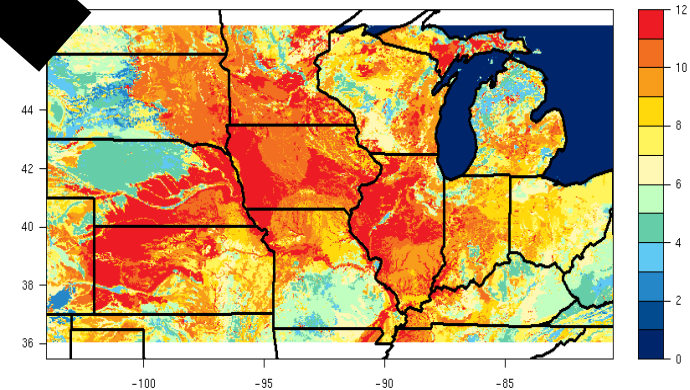


County-Specific  
AWI Index

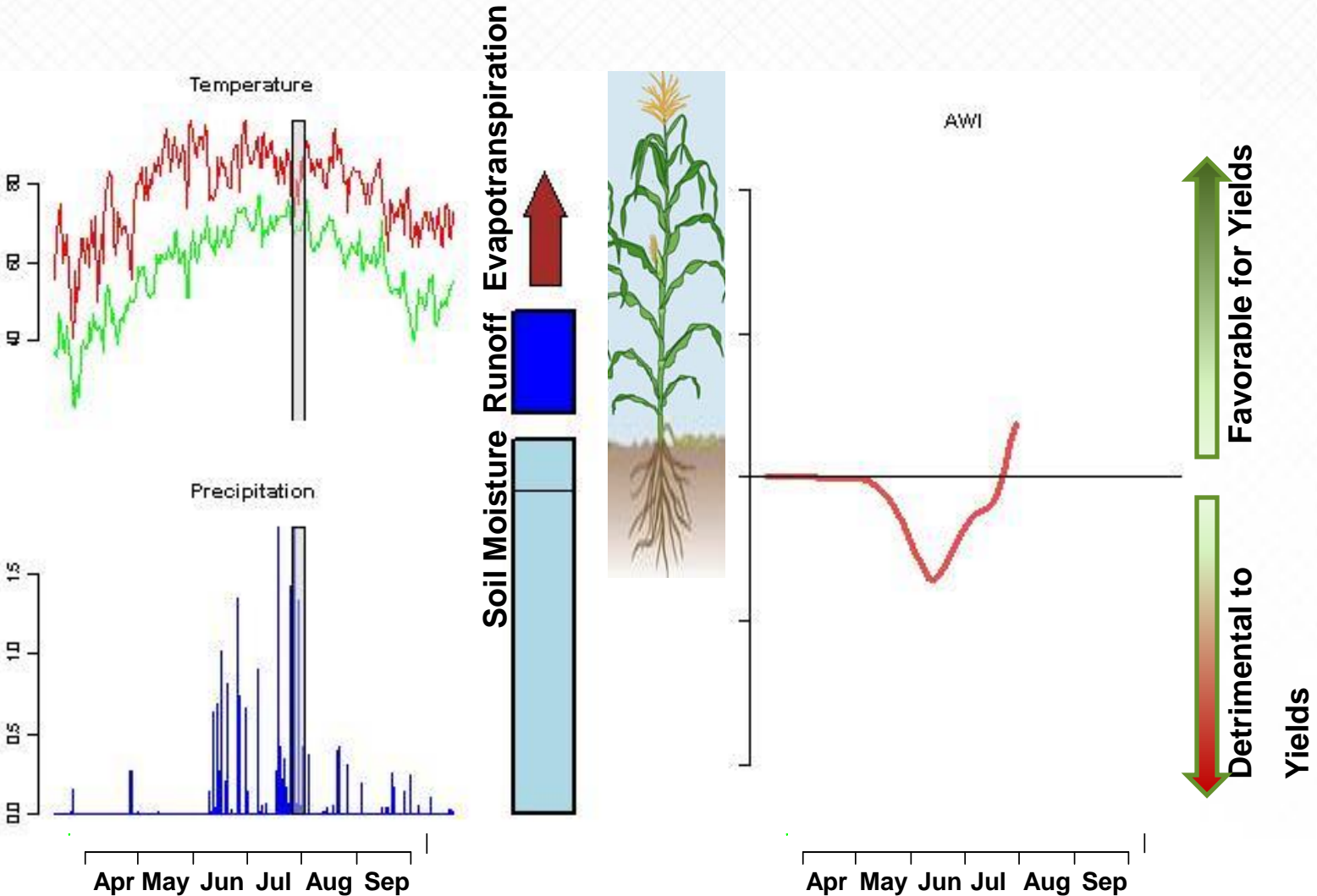
## Crop Specific Data



## Available Water Capacity

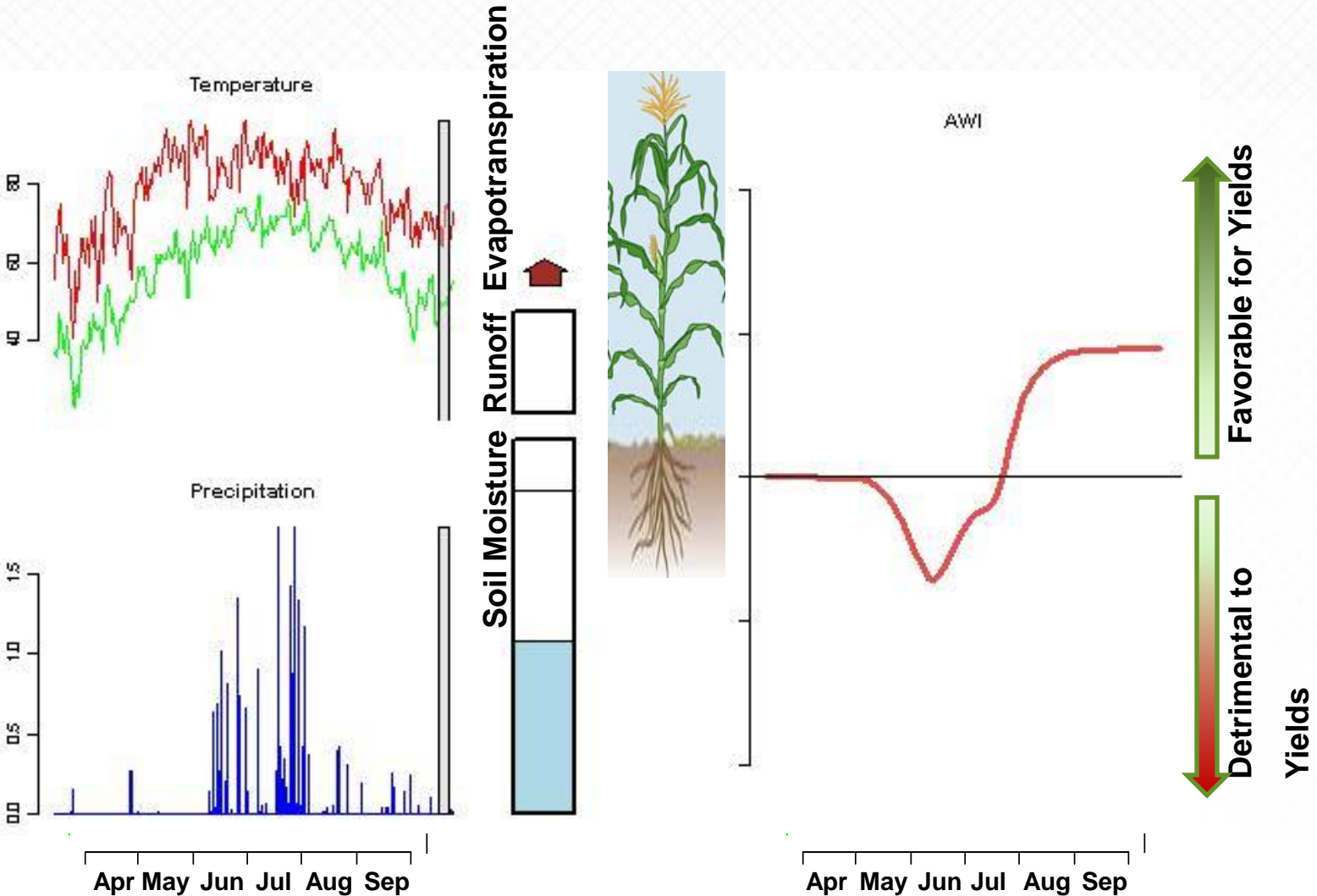


# In a Normal Year, Water Supply and Water Requirements Are Balanced and AWI Indicates Positive Yield Outcome

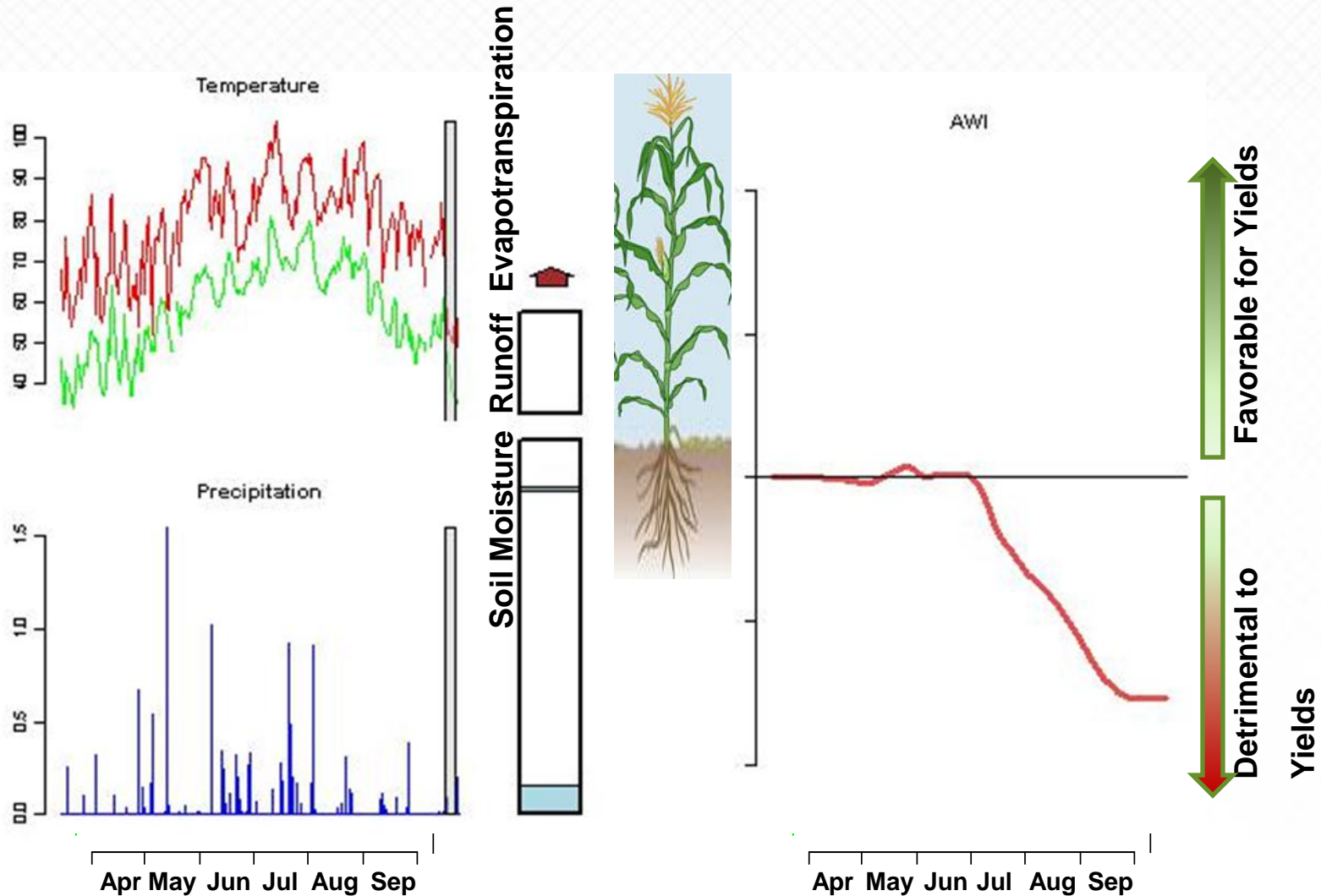




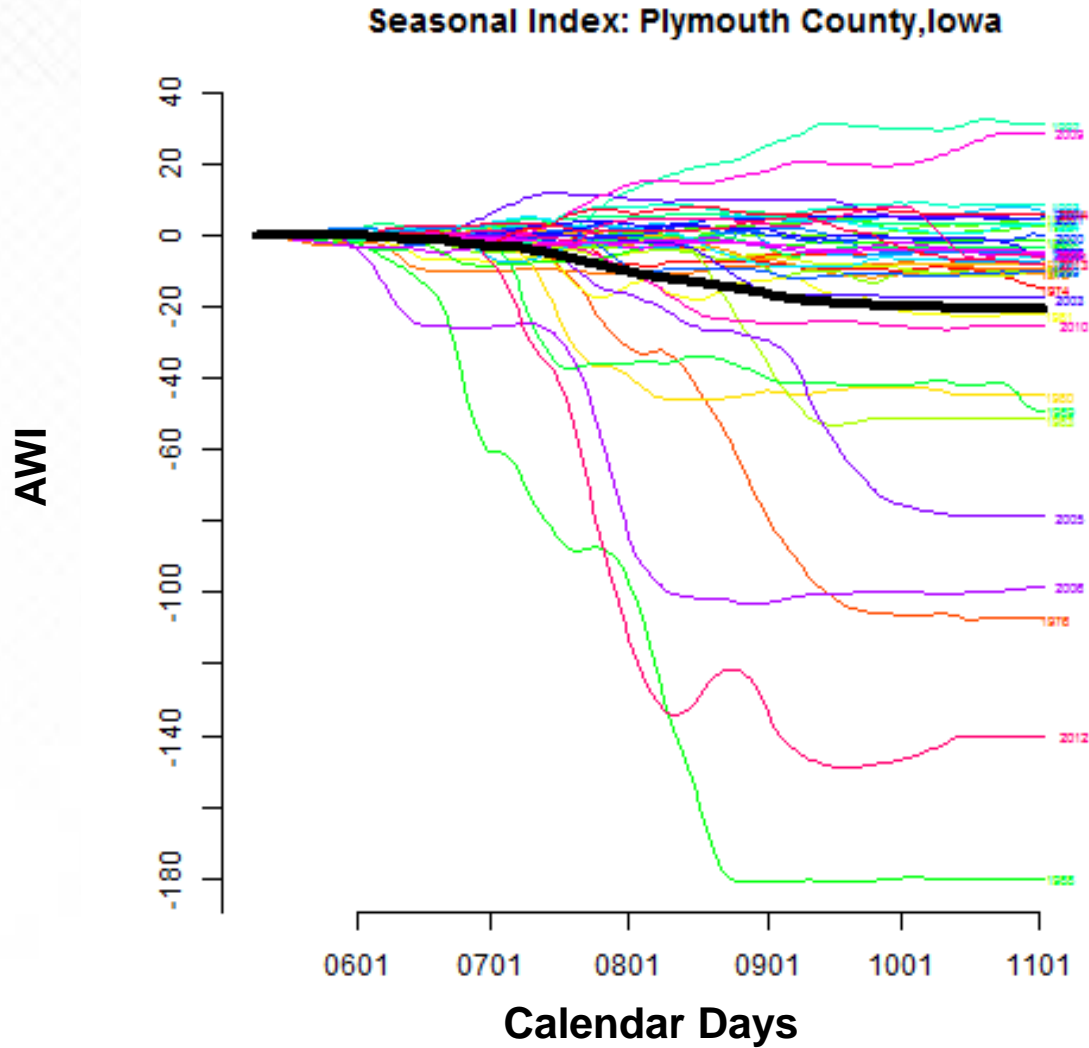
# In a Normal Year, Water Supply and Water Requirements Are Balanced and AWI Indicates Positive Yield Outcome



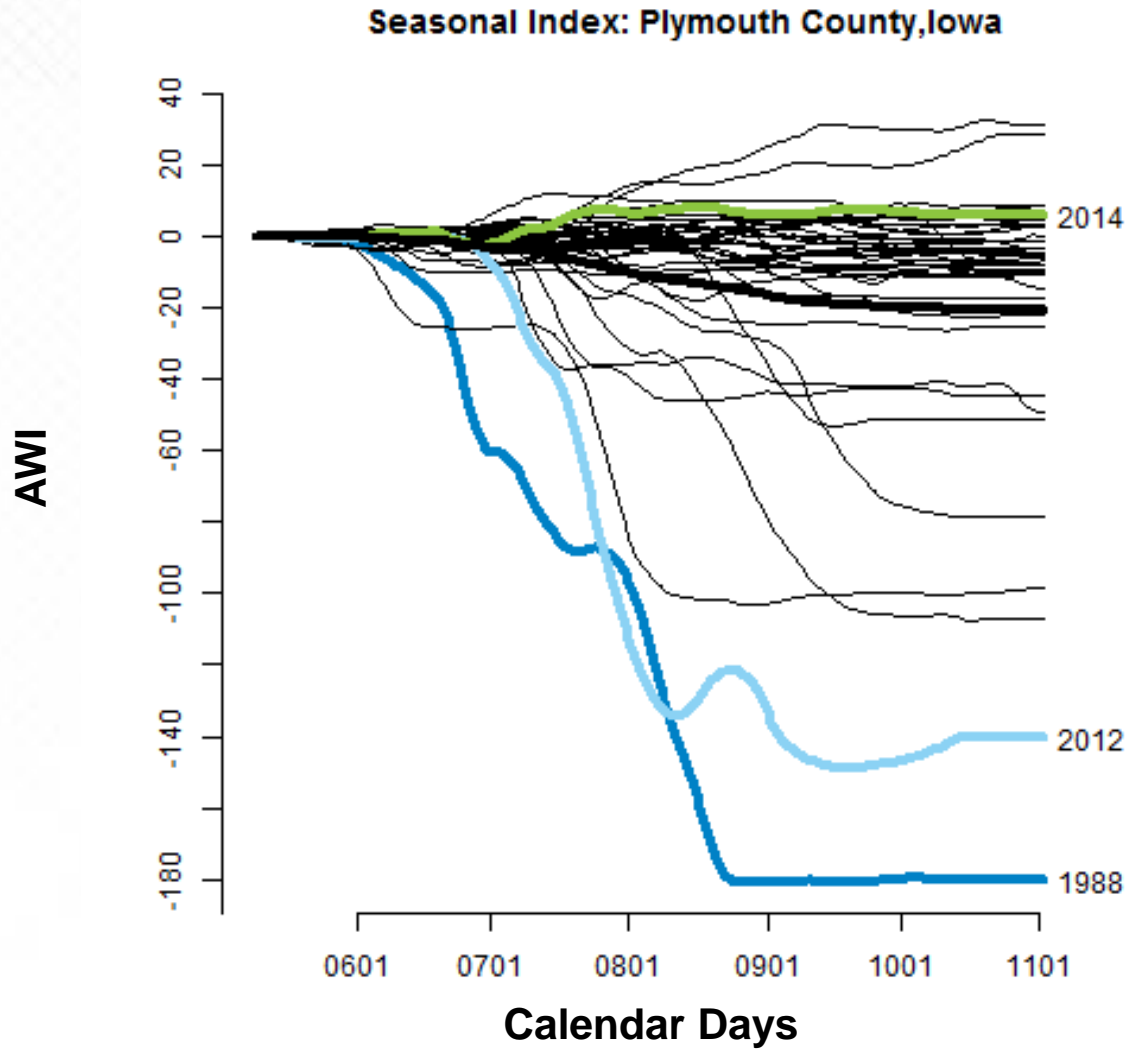
# In a Drought Year, Water Requirements Exceed the Water Supply and AWI Indicates Plant Damage



# AWI Measures County-level Crop Performance During the Season



# AWI Measures County-level Crop Performance During the Season



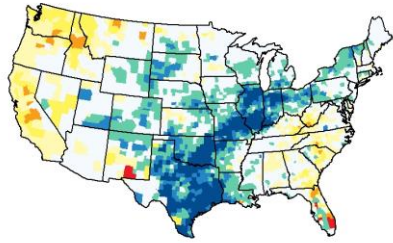
# 2015 CropAlert Corn Yields Were Based On Current Growing Conditions Up To The Month Of Release

<b>CORN</b>			
	<b>AIR</b>	<b>NASS</b>	<b>NASS</b>
<b>State</b>	Current yield projection*	Yield forecast:	Yield forecast:
	Valid through October 10, 2015	11-Sep-15	9-Oct-15
<b>IA</b>	188.8	181	183
<b>IL</b>	177.8	173	170
<b>MN</b>	182.3	183	184
<b>IN</b>	164	156	156
<b>OH</b>	167.8	163	165
<b>MO</b>	157.3	150	149
<b>WI</b>	169.8	162	164
<b>NE</b>	186.1	184	184
<b>US</b>	<b>170.5</b>	<b>167.5</b>	<b>168</b>
* Current Projection: Yield predictions based on observed crop growing conditions to current date			
Disclaimer: Predicting weather and growing conditions is an inherently subjective and imprecise process, involving assessment of information that comes from a number of sources and that may not be complete or accurate. AIR makes no warranty, express or implied, with respect to the information in this report, including any warranty of merchantability or fitness for a particular purpose or use. Past performance is not necessarily indicative of future performance. Readers use the information at their own risk.			

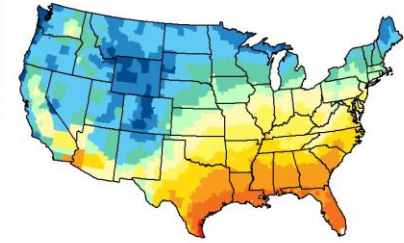


# Next Evolution of CropAlert Examines the Impacts of Current Weather Events at the County Level

Crop Moisture Index  
20150620



Accumulated Growing Degree Days Base= 50  
20150501 - 20150620

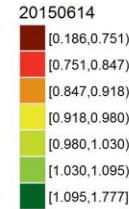
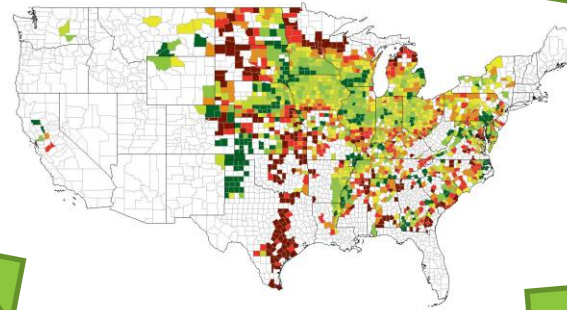


AIR WORLDWIDE

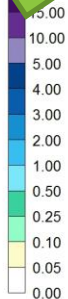
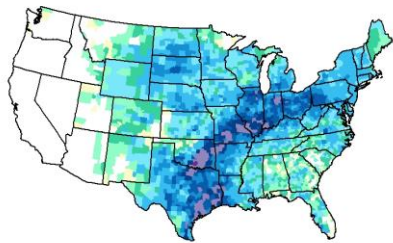
© 20150622

AIR WORLDWIDE

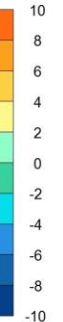
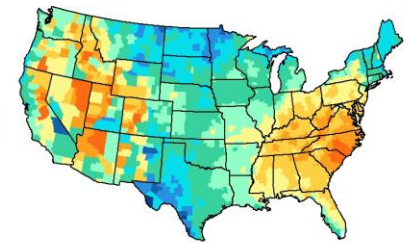
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Weekly Accumulated Precipitation  
20150614 - 20150620



Weekly Average Temperature Anomaly  
20150614 - 20150620



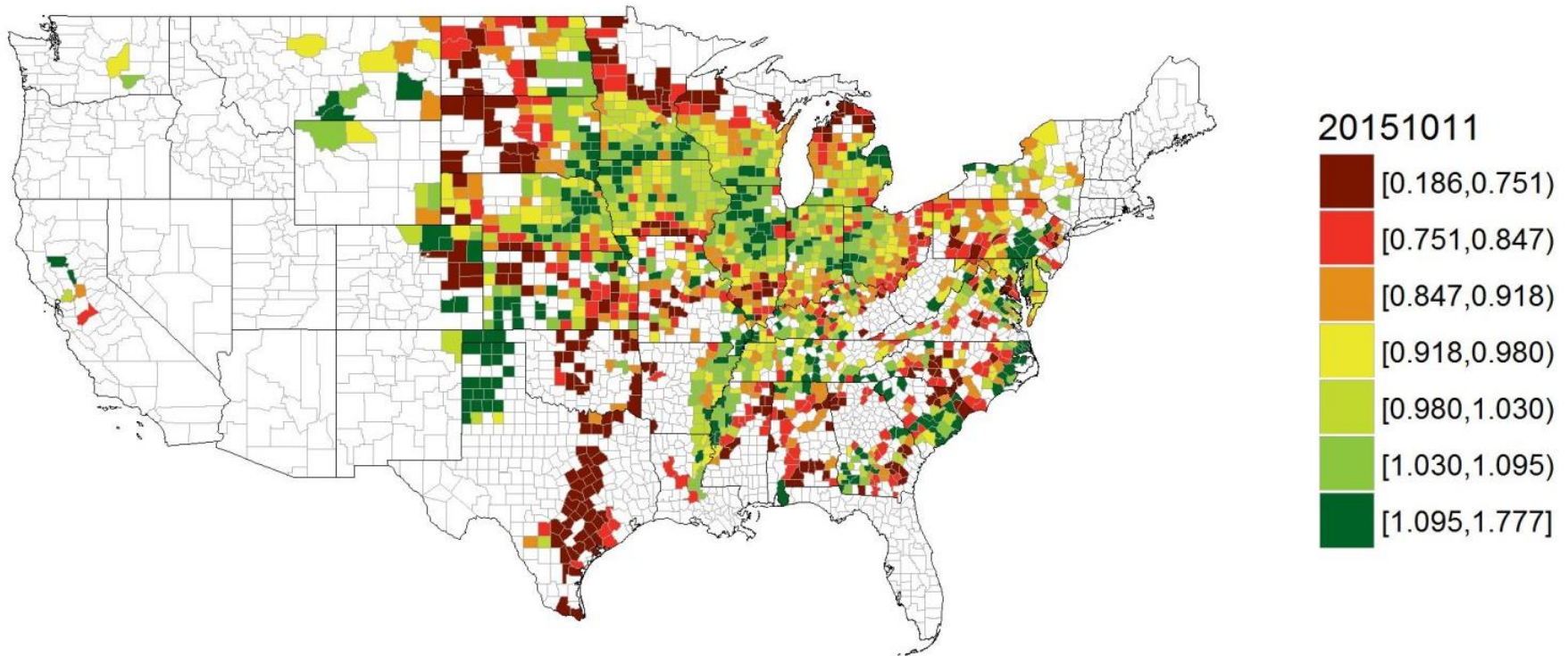
AIR WORLDWIDE

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AIR WORLDWIDE

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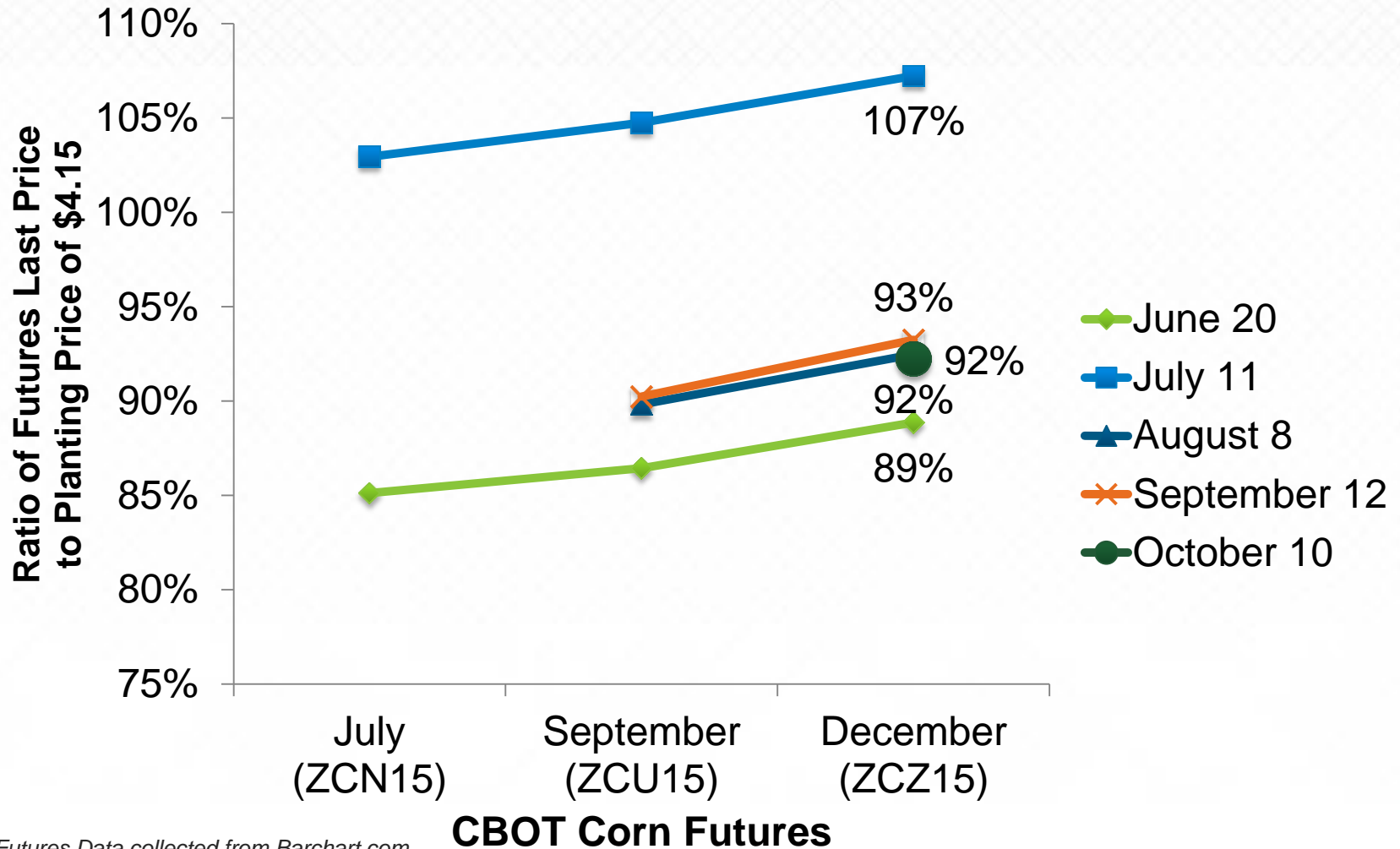
# County Estimates are Useful for Insurers with Concentrated Policy Locations, While National Estimates are Useful to Describe Price Movements



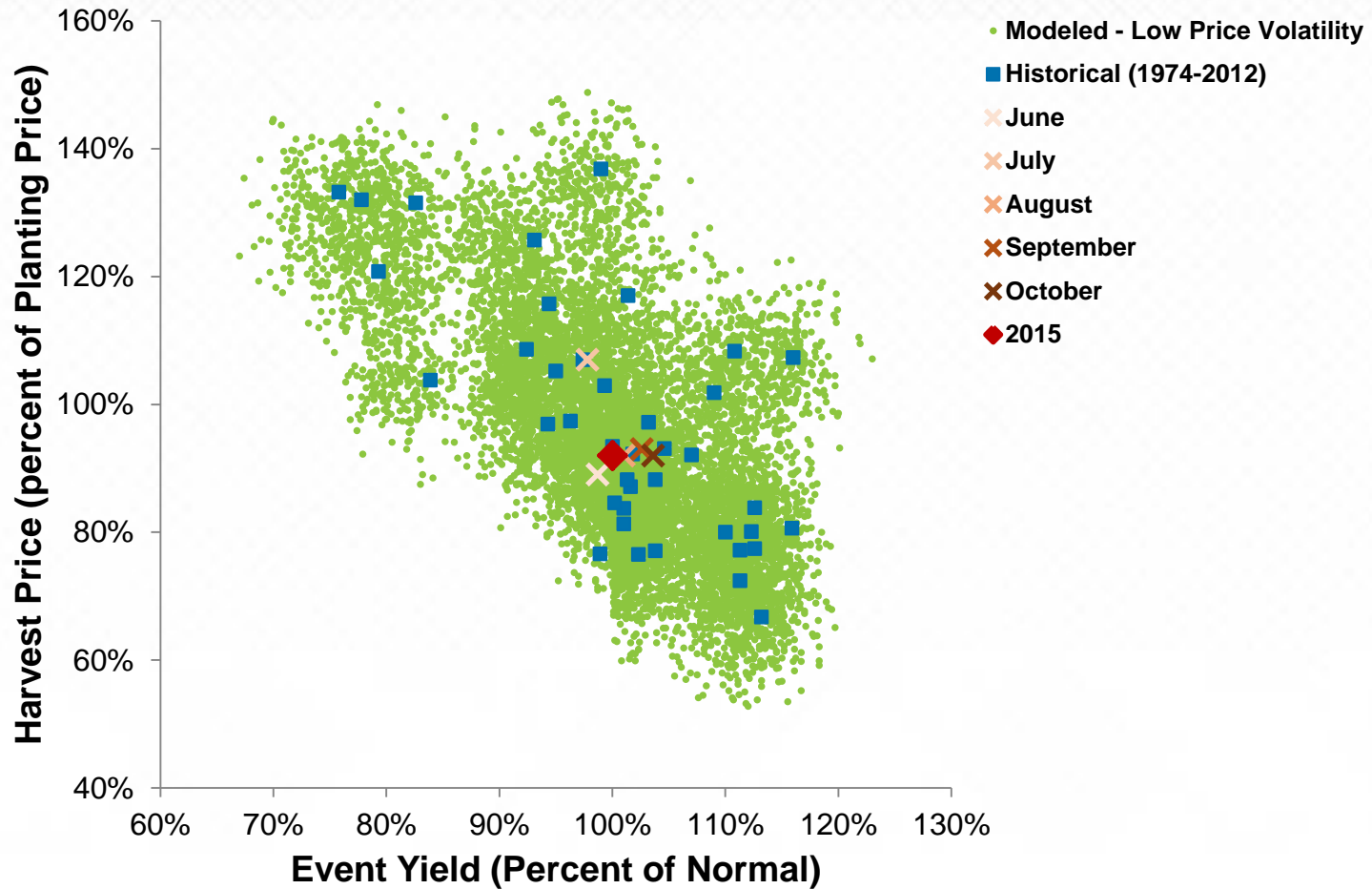
NATIONAL YIELDS	June	July	Aug	Sep	Oct	Feb, 2016
Corn Yield	162.2	160.7	166	168.8	170.5	
Final 2015 Yields						168.4



# 2015 Commodity Futures Curves Can Be Used to Build Expectations Over National Prices

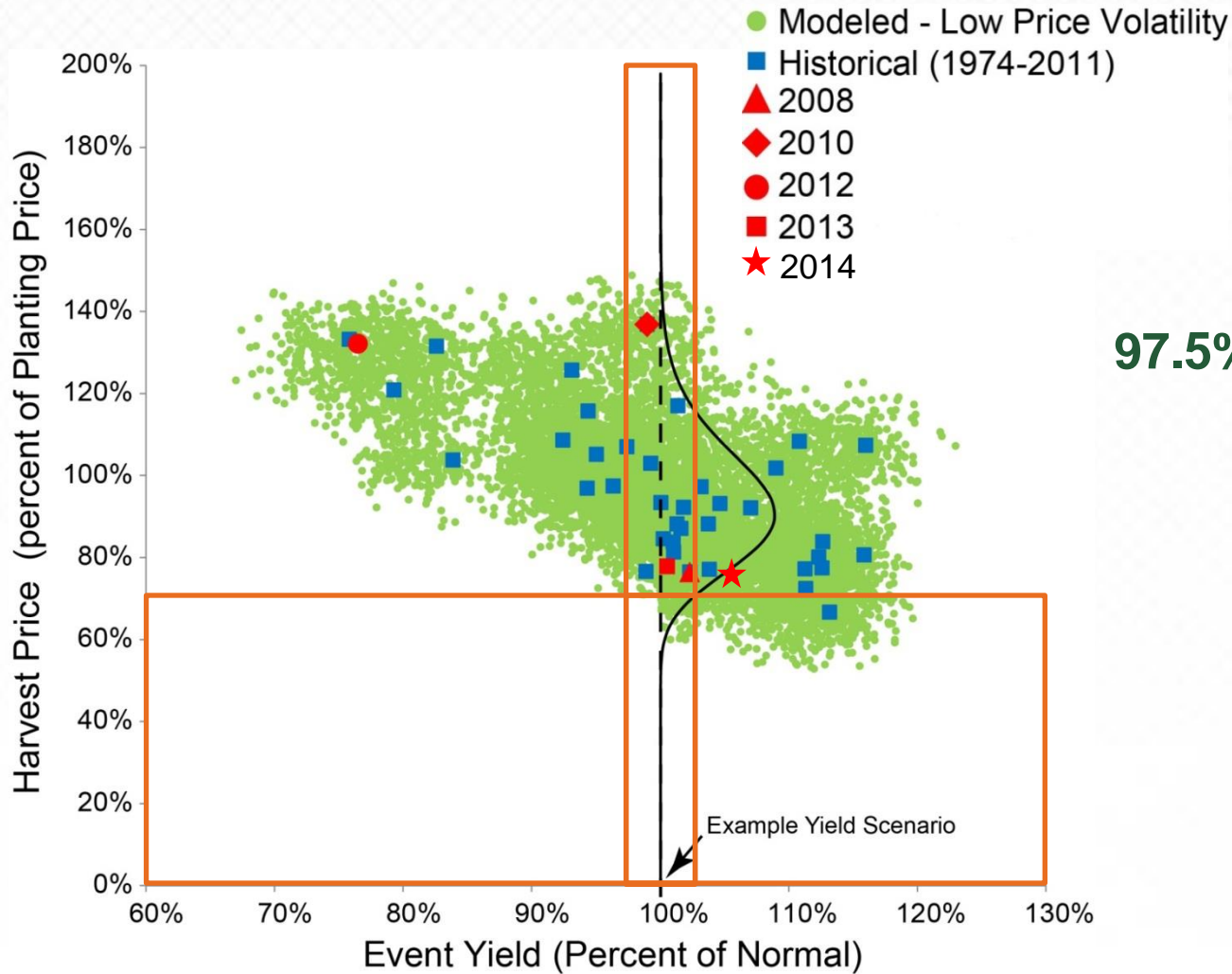


# AIR Stochastic Catalog for Corn with CropAlert National Yield and Price Outcomes Can be Used to Reasonable Expectations Over Outcomes



# A Portion of The Price-Yield Cloud Is Selected for Sensitivity Tests

## Example: Price Cap & Yield Band



**Price < 70%**  
**97.5% < Yield < 102.5%**

# A Portion of The Price-Yield Cloud Is Selected for Sensitivity Tests

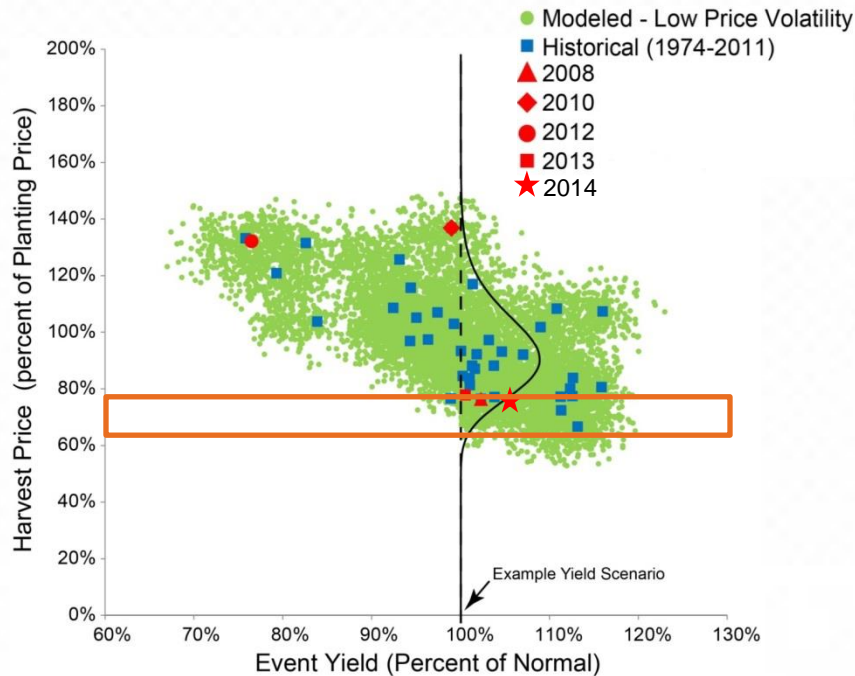
## Example: Price Band & Yield Band



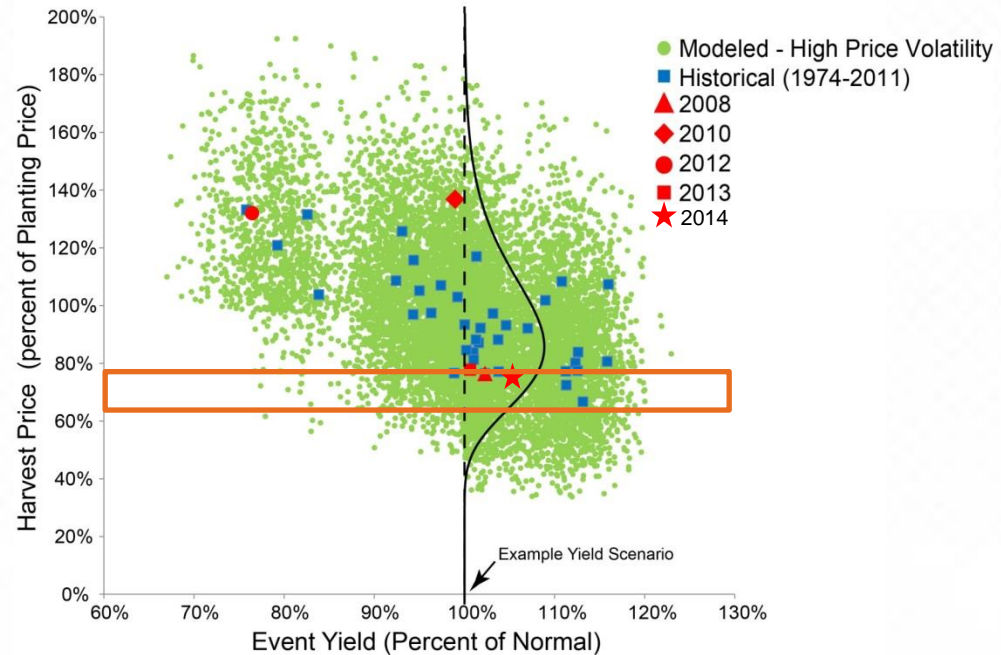
**65% < Price < 75%**  
**97.5% < Yield < 102.5%**

# We Can Utilize AIR's Different Catalogs To Run What-if Analysis in Different Price Volatility Environments

## Low Volatility Catalog



## High Volatility Catalog





# CATRADER Is Designed To Facilitate Price and Yield Sensitivity Analysis

Program Name	Type	Underwriter	Inception	Expiration	Res	Com	Auto	Agric	WC	Offshore	For	China MPC	Custom	Notes
Scenario_1	All Lines	sysop	07/01/2015	06/30/2016	100.00	100.00	100.00	100.00	100.00	0.00	...	100.00	100.00	...

Terms		Premiums		Triggers		Options		UDCs		Inuring Pro	
US Dollar	Ones	ESP: 0	Use Premiums	High Area Detail (if availat							

	Contract Name	Occ Limit	Occ Ret	Agg Limit	Agg Ret	Applies To Areas	Applies To Events	Rein-state	Status	Coin-surance	Gross Part.	Net Part.
Program	ID013417	...				United States	Some		Submitted	100.00	0.00	0.00

**Scenario 1**  
 Price Corn ≤70  
 Price Soybean ≤80

**Applies To Events**

Note: Once a filter is added, only events specified will be included in the analysis.

Filter List:

	Name	Rules	Location	Perils
1	Scenario_1	X		MPCI
2				
3				
4				
5				
6				
7				
8				
9				
10				

Add... Open... Delete... OK Cancel Help

# CATRADER Is Designed To Facilitate Price and Yield Sensitivity Analysis

Program Name	Type	Underwriter	Inception	Expiration	Res	Com	Auto	Agric	WC	Offshore	For	China MPCl	Custom	Notes
Scenario_1	All Lines	sysop	07/01/2015	06/30/2016	100.00	100.00	100.00	100.00	100.00	0.00	...	100.00	100.00	...

Terms		Premiums		Triggers		Options		UDCs		Inuring Pro	
US Dollar	Ones	ESP: 0	Use Premiums	High Area Detail (if availat							

	Contract Name	Occ Limit	Occ Ret	Agg Limit	Agg Ret	Applies To Areas	Applies To Events	Rein-state	Status	Coin-surance	Gross Part.	Net Part.
Program	ID013417	...				United States	Some		Submitted	100.00	0.00	0.00

**Scenario 1**  
 Price Corn ≤70  
 Price Soybean ≤80

Event Filter

Scenario\_1

Rules: Location By Lat/Long | Location By Area Name

	Parameter	Condition	Value 1	Value 2
1	MPCI-Corn Price	<=	70.000000	
2	MPCI-Soybean Price	<=	80.000000	
3	HU Max Landfall Windspeed			
4	HU Radius of Max Winds			
5	MPCI-Corn Price			
6	MPCI-Corn Yield			
7	MPCI-Cotton Price			
8	MPCI-Cotton Yield			
9	MPCI-Rice Price			
10	MPCI-Rice Yield			
	MPCI-Soybean Price			
	MPCI-Soybean Yield			
	MPCI-Wheat Price			
	MPCI-Wheat Yield			

OK Cancel Help



# CATRADER Is Designed To Facilitate Price and Yield Sensitivity Analysis

Program Name	Type	Underwriter	Inception	Expiration	Res	Com	Auto	Agric	WC	Offshore	For	China MPCI	Custom	Notes
Scenario_1	All Lines	sysop	07/01/2015	06/30/2016	100.00	100.00	100.00	100.00	100.00	0.00	...	100.00	100.00	...

Terms		Premiums		Triggers		Options		UDCs		Inuring Pro	
US Dollar	Ones	ESP: 0	Use Premiums	High Area Detail (if availat							

	Contract Name	Occ Limit	Occ Ret	Agg Limit	Agg Ret	Applies To Areas	Applies To Events	Rein-state	Status	Coin-surance	Gross Part.	Net Part.
Program	ID013417	...				United States	Some		Submitted	100.00	0.00	0.00

**Scenario 1**  
 Price Corn  $\leq 70$   
 Price Soybean  $\leq 80$

Pre-Analysis Configuration:

Use Saved Results

Program(s)... Scenario\_1

Event Period... Program Specific

Mkt.Shares... Program Specific

Event Set... U.S. Multi-Peril Crop Insurance (10K MPCI - Low Volatility)

Zones..... None

Area Detail... Program Specific Program Loss Adj... Program Specific

Results Detail... Event Total Standard

Demand Surge Program Specific Adj Factor File Set... None

Currency Table... Default Custom LOBs..... Off

Perils.....

Earthquake  Fire Following  MPCI (Agri)

Terrorism  Wind  Crop Hail

Flood  Wjldfire  Pandemic

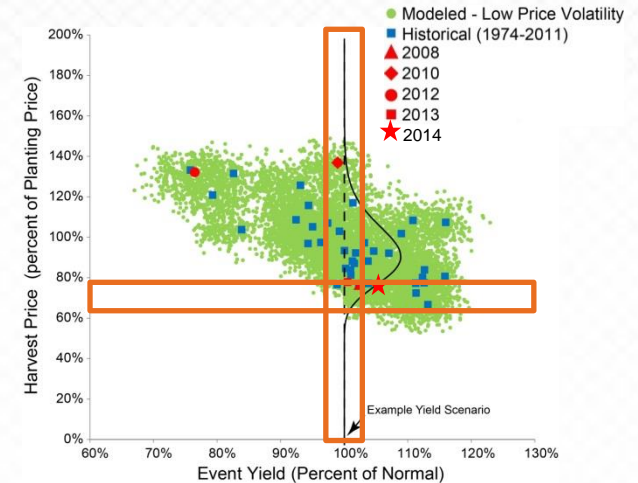
Scenario\_1

# Normal Yield Coupled with Reduced Price Could Cause High Loss Ratios, Especially in High Price Volatility Environment

## Low Volatility Catalog

Average Loss Ratio    Minimum LR    Maximum LR

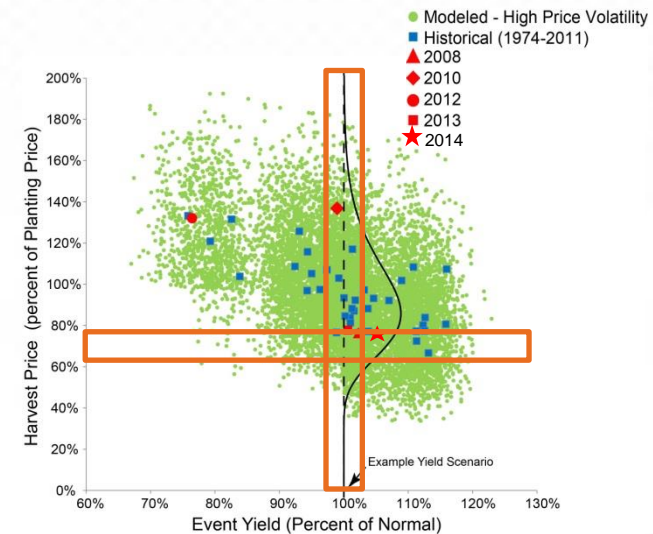
Scenario	Average Loss Ratio	Minimum LR	Maximum LR
<b>Scenario 3</b>			
Price Corn 65-75	87%	65%	122%
Price Soybean 75-85			
<b>Scenario 4</b>			
Price Corn 65-75	105%	94%	122%
Price Soybean 75-85			
Yield Corn 97.5-102.5			
Yield Soybean 97.5-102.5			



## High Volatility Catalog

Average Loss Ratio    Minimum LR    Maximum LR

Scenario	Average Loss Ratio	Minimum LR	Maximum LR
<b>Scenario 3</b>			
Price Corn 65-75	88%	65%	128%
Price Soybean 75-85			
<b>Scenario 4</b>			
Price Corn 65-75	98%	89%	111%
Price Soybean 75-85			
Yield Corn 97.5-102.5			
Yield Soybean 97.5-102.5			



# Summary of 2015 and Future Research for 2016

- The Industry performed well in 2015
- Premium rerating was favorable for rate increases, but overall premium in 2016 will be lower due to low price volatilities
- Insurers looking to manage risks may benefit from county level forecasting during the growing season
- Using commodity futures along with CropAlert national yields we can subdivide the AIR Stochastic Catalog to understand price and yield risks over the growing season