CONSERVATION PRACTICES TO INCREASE RESILIENCY

Making sure we can handle the extremes!

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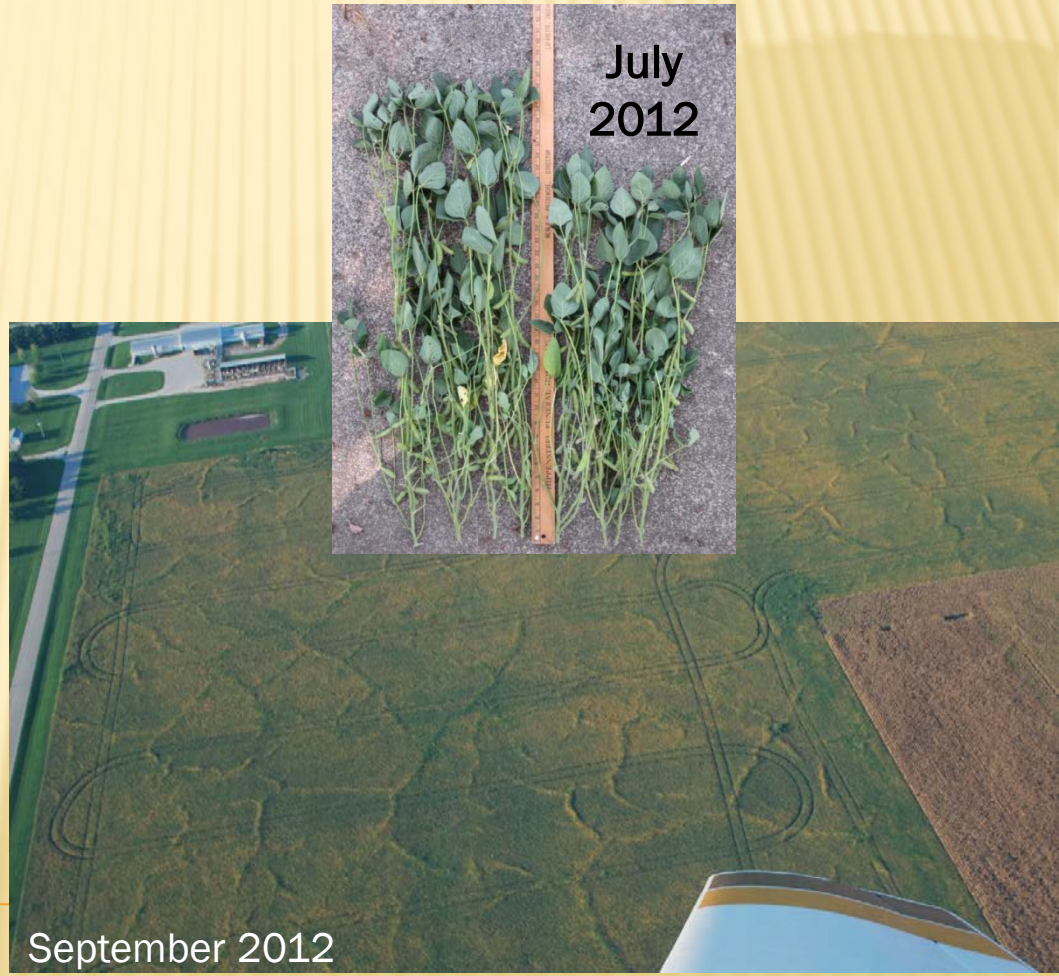
SOIL MANAGEMENT AND SOIL HEALTH

FACTORS AFFECTING RESILIENCY

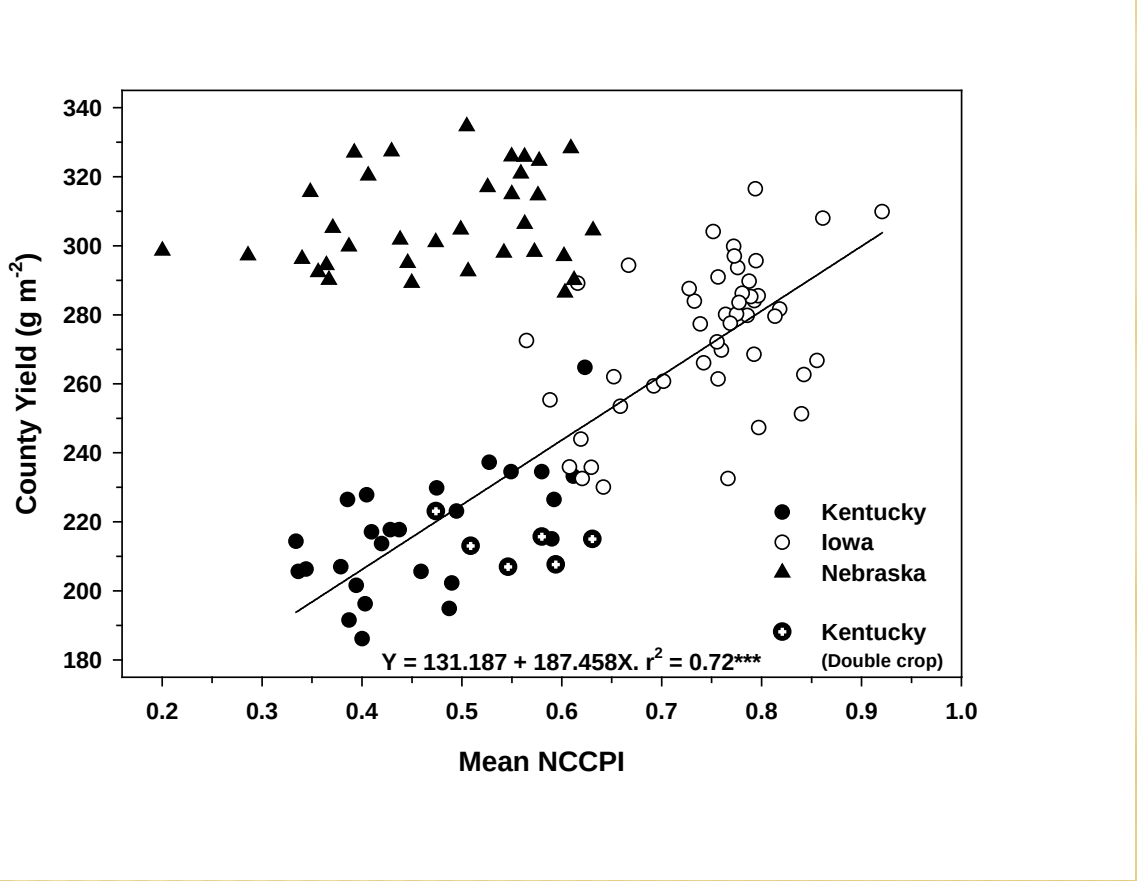
- Inherent Soil Properties
  - texture
  - mineral content
- Dynamic Properties
  - Water Holding Capacity
  - Organic Matter Content
  - Soil Moisture
  - Soil Temperature



Images Courtesy Purdue University

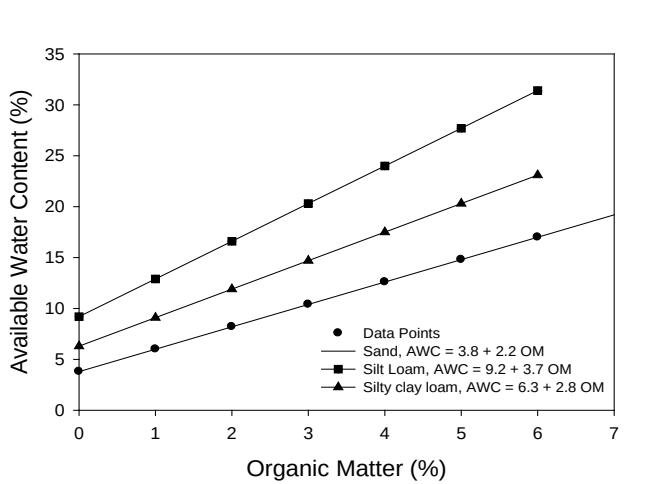
GOOD SOILS = GOOD YIELDS

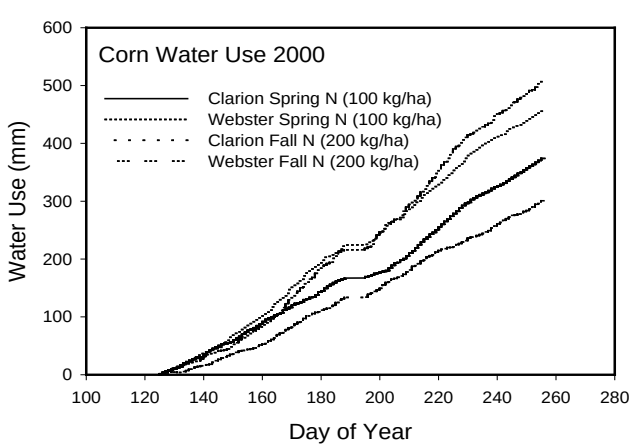
Soybean yields across Iowa, Kentucky, and Nebraska



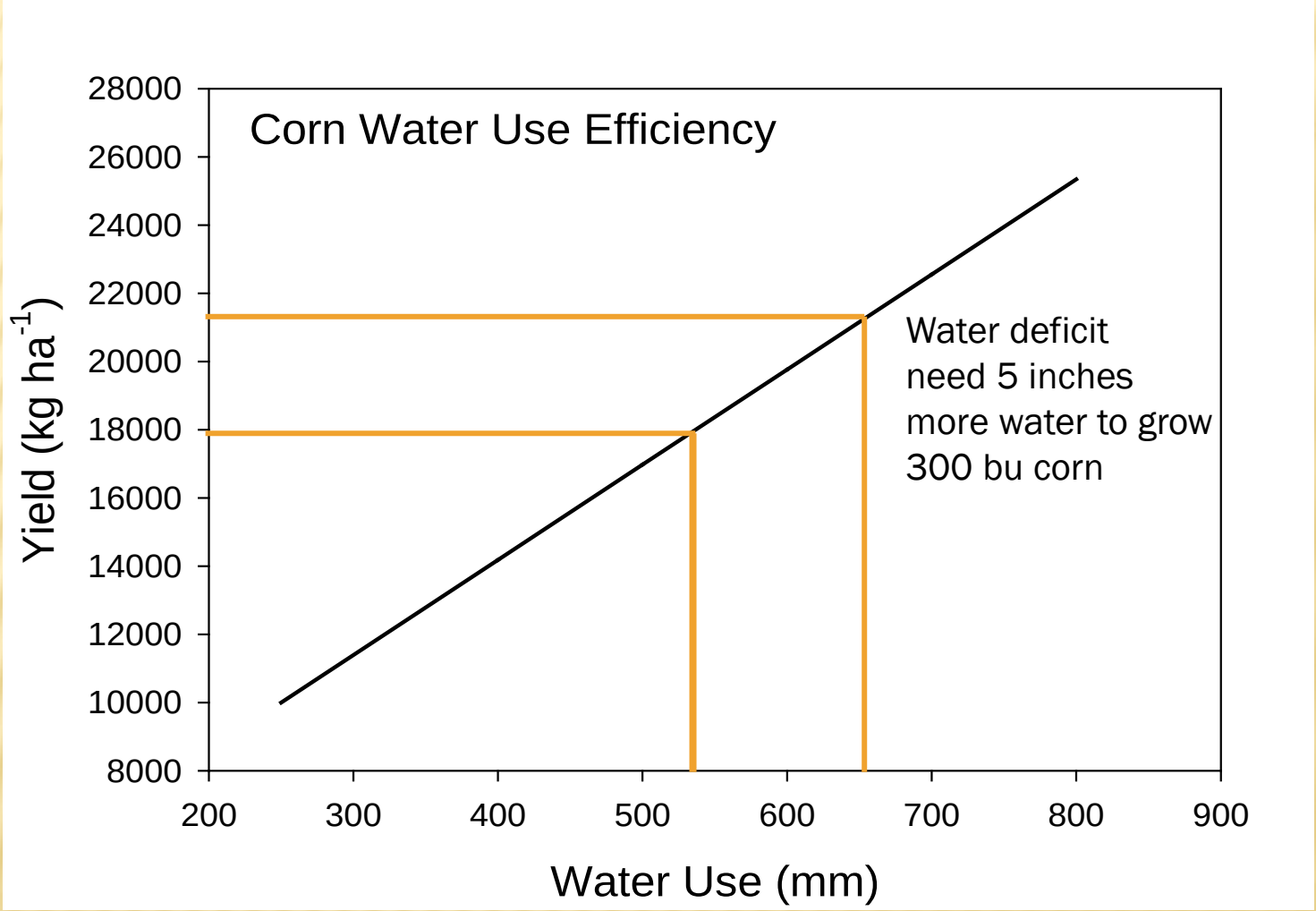
SOIL WATER BALANCE

		Inputs		Losses
Soil Water	=	Precipitation irrigation	-	Evapotranspiration (ET) Runoff Drainage





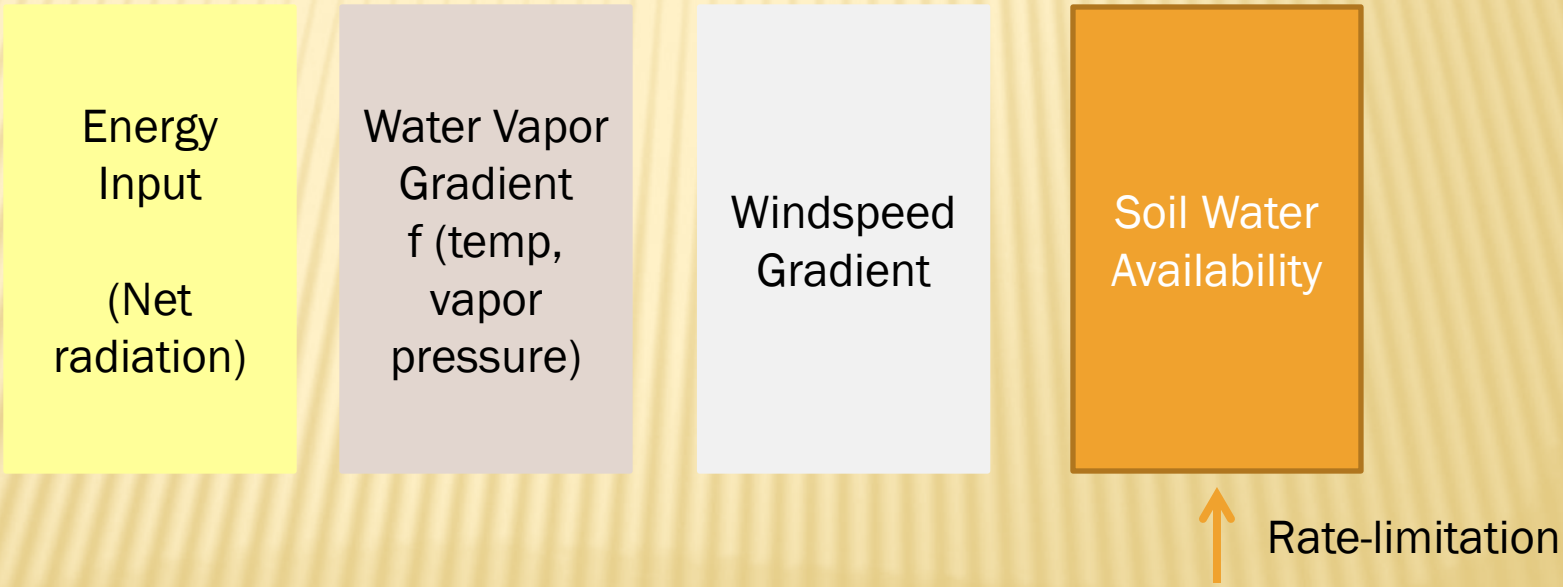
WATER IS REQUIRED FOR GRAIN PRODUCTION



EVAPOTRANSPIRATION

ET = Soil water evaporation + Plant transpiration

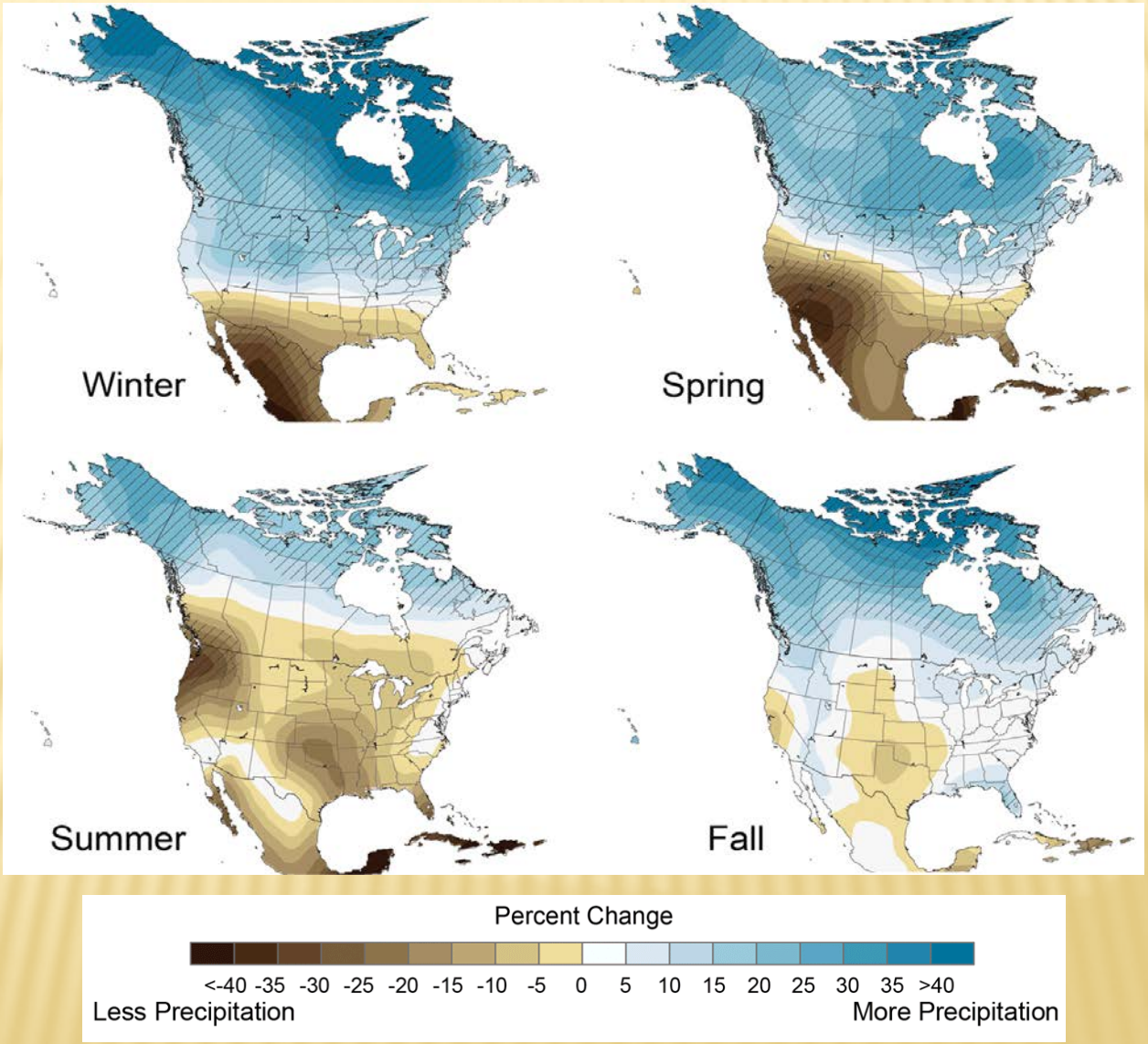
Components of ET



Potential ET (how much could evaporate) vs Actual ET (how much does)

PROJECTED CHANGE IN NORTH AMERICAN PRECIPITATION

BY 2080-2090



PRECIPITATION CHANGES

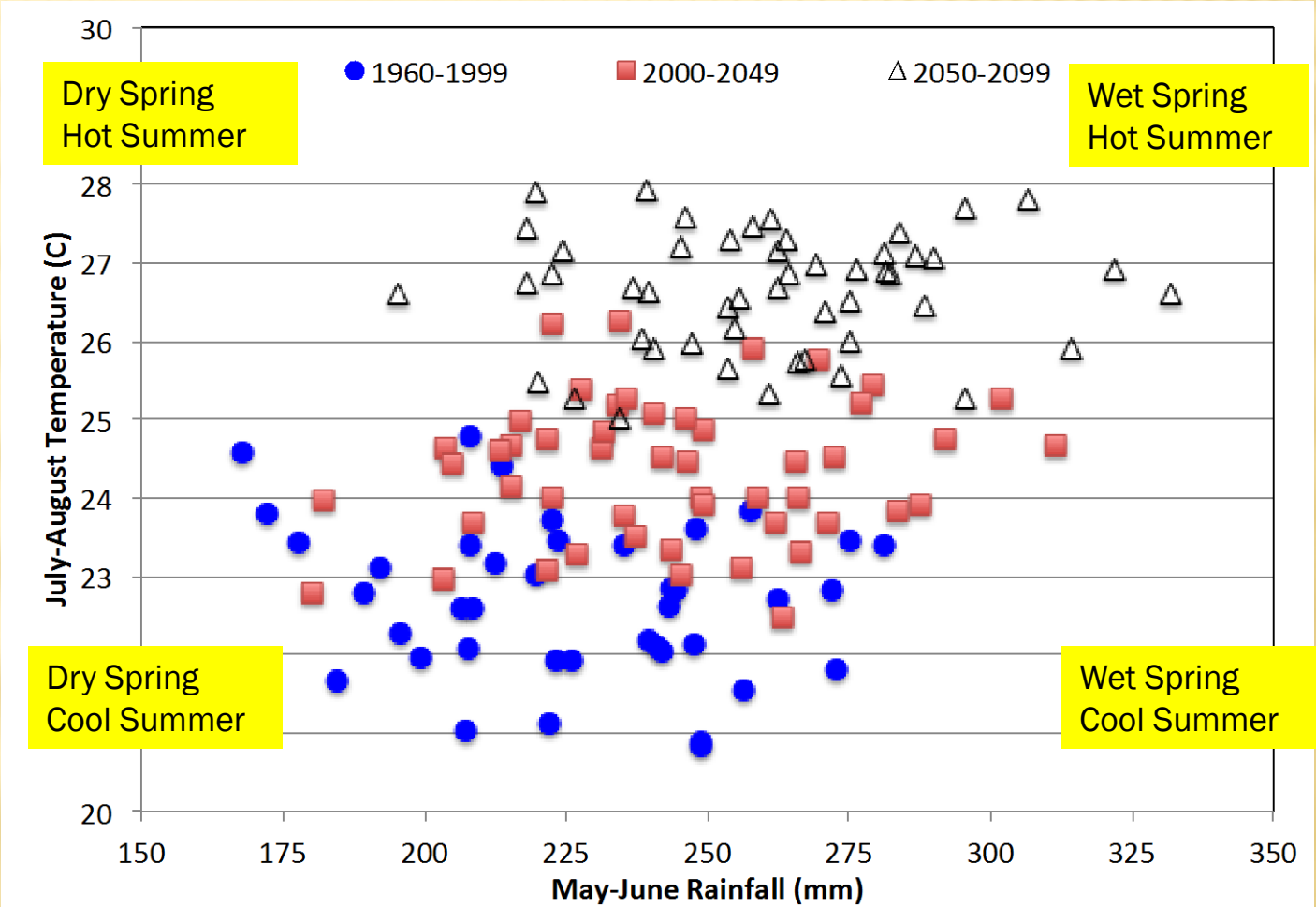
- Change in seasonality
- Change in intensity
- Change in frequency
- Change in regional distribution

IMPLICATIONS

- Soil water availability will become more variable because the input will be more variable
- How do we manage soil water when the supply has an increased variation

CLIMATE PROJECTION: WETTER SPRING, HOTTER SUMMER

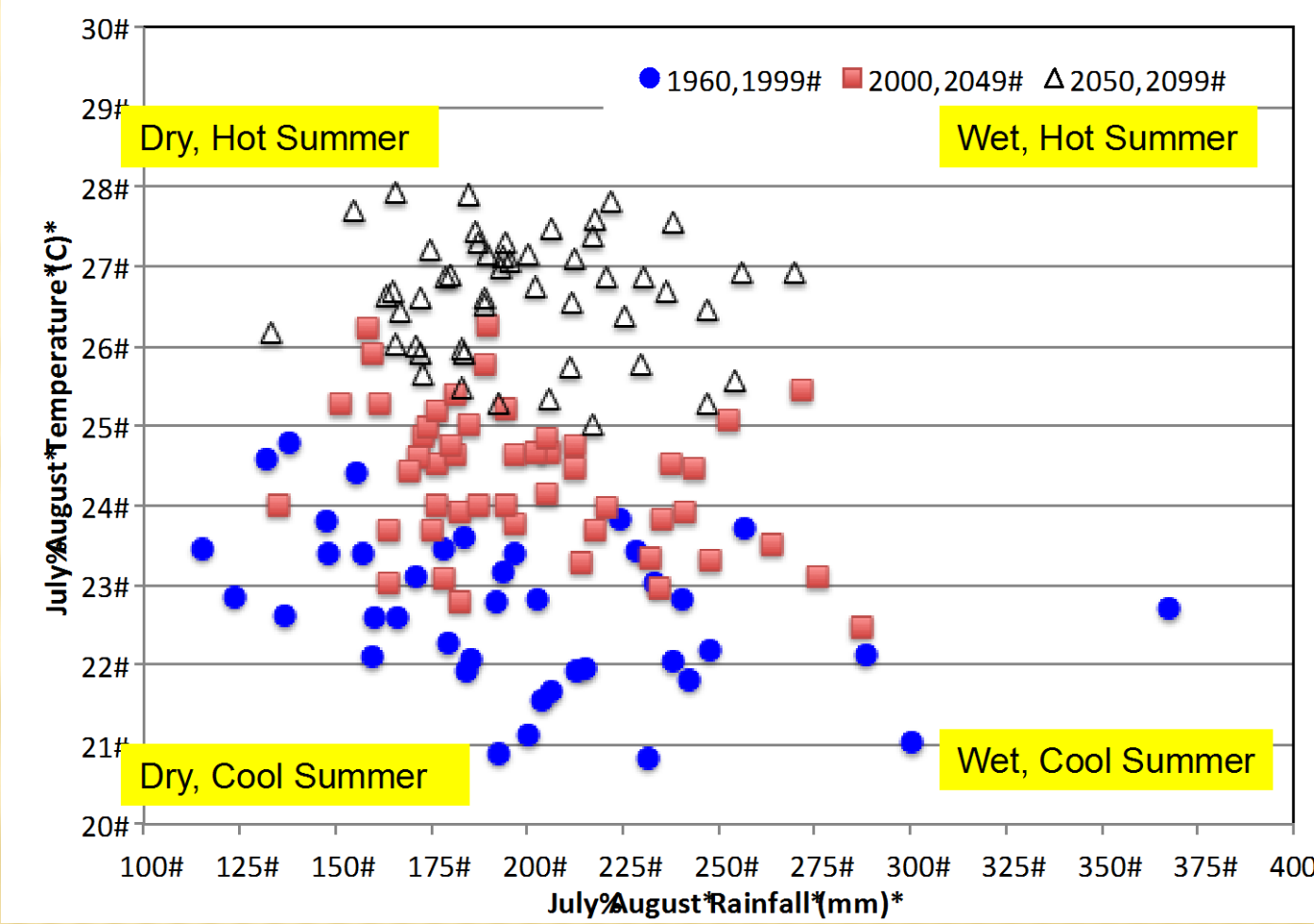
- Iowa climate projection is average May-June rainfall and July-August temperature using 9 downscaled climate scenarios, spanning 3 GCMs and 3 emissions scenarios.
- Training period for downscale method is 1960-1999.



Data Source: Stoner et al. (2013)

CLIMATE PROJECTION:
FEWER WET SUMMERS, MORE HOT SUMMERS

- Iowa climate projection is average May-June rainfall and July-August temperature using 9 downscaled climate scenarios, spanning 3 GCMs and 3 emissions scenarios.
- Training period for downscale method is 1960-1999.

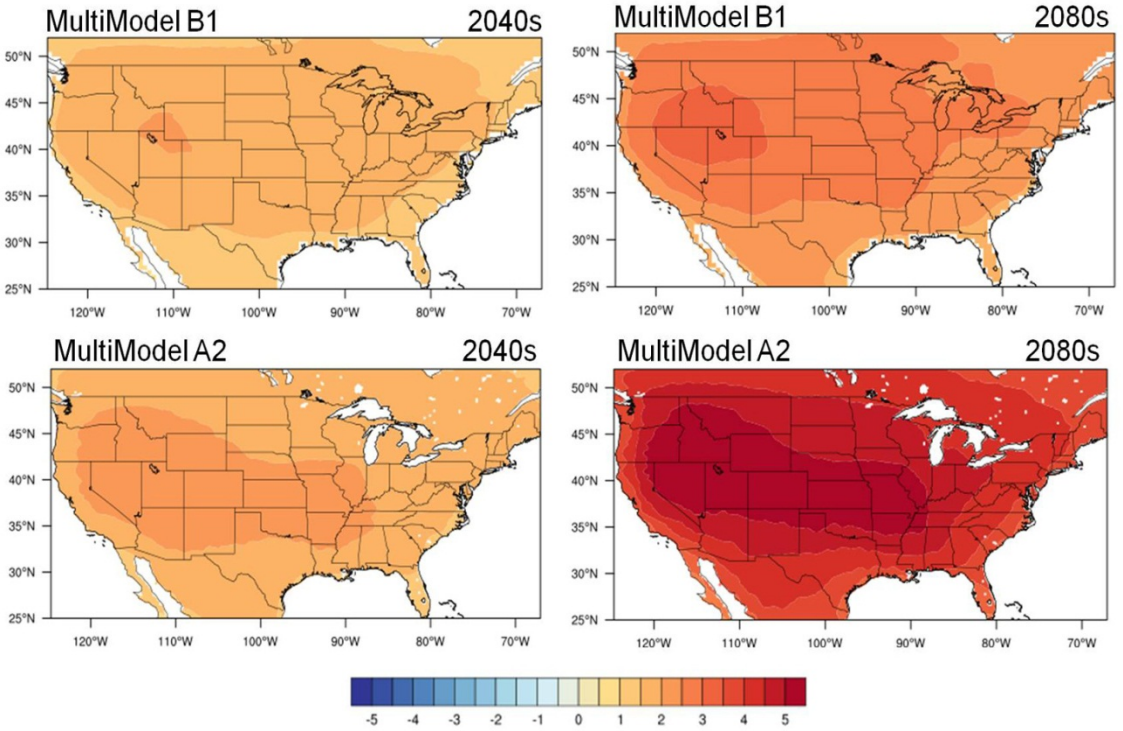


Data Source: Stoner et al. (2013)

TEMPERATURE CHANGES

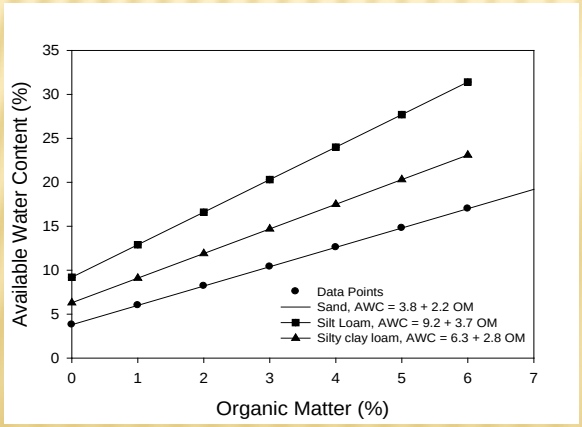
- Warmer temperatures increase ET demand through vapor pressure deficit
- Warmer temperatures will increase the rate of water use inducing agricultural drought more quickly

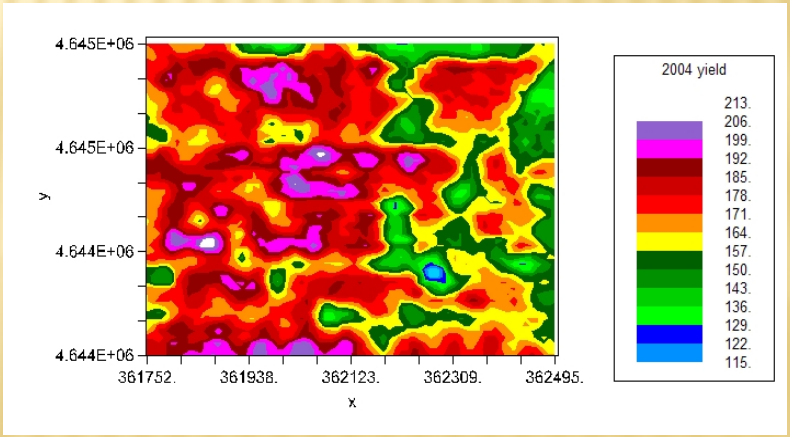
Summer Temperature Change



OBSERVATIONS

- Tillage increases the soil water evaporation rate
- Yield differences among soils within a field is related to organic matter content and soil water holding capacity
- Water use patterns within a field cause “drought” stress to occur in every year





BENEFITS OF CONSERVATION AGRICULTURE

- Short-term
  - Reduce soil water evaporation
  - Increase infiltration of rainfall or irrigation events
  - Reduce the overall of evapotranspiration rate if plants are grown in standing stubble
- Long-term
  - Increase the soil water holding capacity through improved organic matter content
  - Increase water availability to the crop
  - Increase rooting depth

RESILIENCY STRATEGIES

Conservation practices focused on dynamic soil properties such as improving soil organic matter and water holding capacity - broadly, soil health

- Conservation tillage
- Cover Crops
- Residue Management

No Till Conventional

CONSERVATION PRACTICES

- Can't make it rain any more often and at the optimum time to have best yield
- Will increase the ability of the soil to capture more water, reduce the evaporation rate from the soil surface, and increase water availability to the crop
- Over the long-term will increase the capacity of the soil to store more water and make water available to the plant
- Will increase the overall resiliency of the cropping system to withstand climate stresses (variable precipitation and temperature extremes)