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Abstract

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»Abstract

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Simulating Soil-Water Movement through Loess-Veneered Landscapes Using Nonconsilient Saturated Hydraulic Conductivity Measurements

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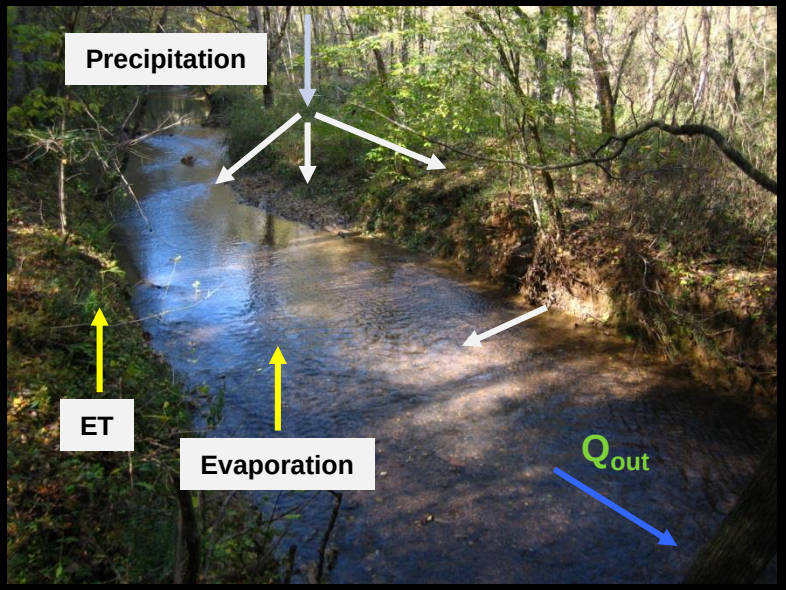
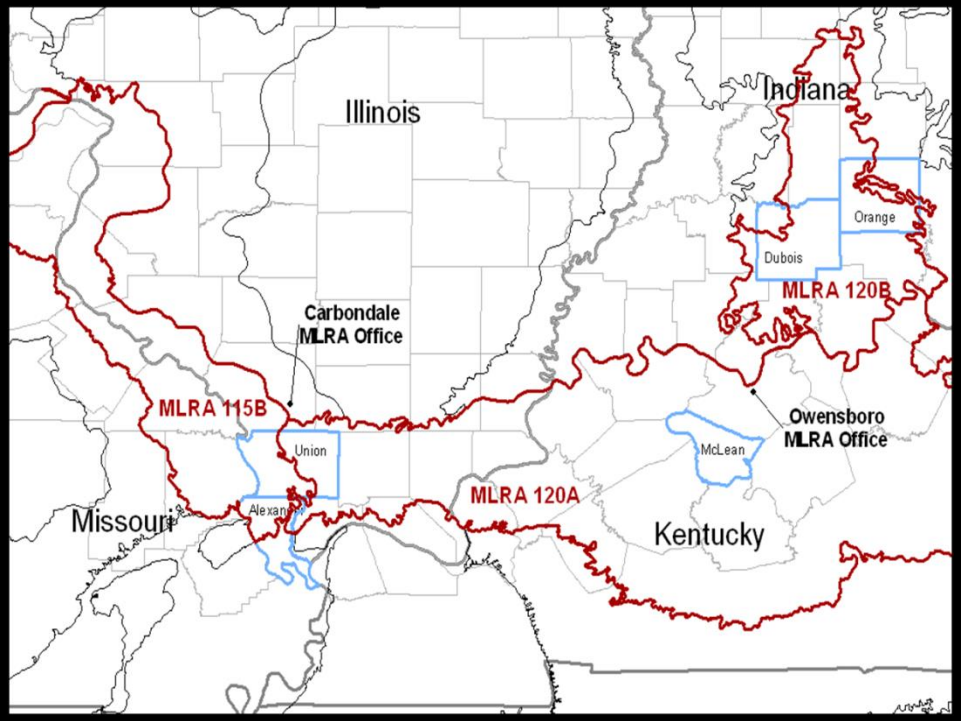
Hydrologic Model



- TOPography-based MODEL
- Beven and Kirkby, 1979
- "Physically-based watershed model that simulates the variable-source-area concept of streamflow generation." (Wolock, 1993)
- Three fundamental assumptions
  - steady-state recharge to the groundwater
  - hydraulic gradient of the water table ≈ the surface slope
  - soil-water movement decreases exponentially with depth

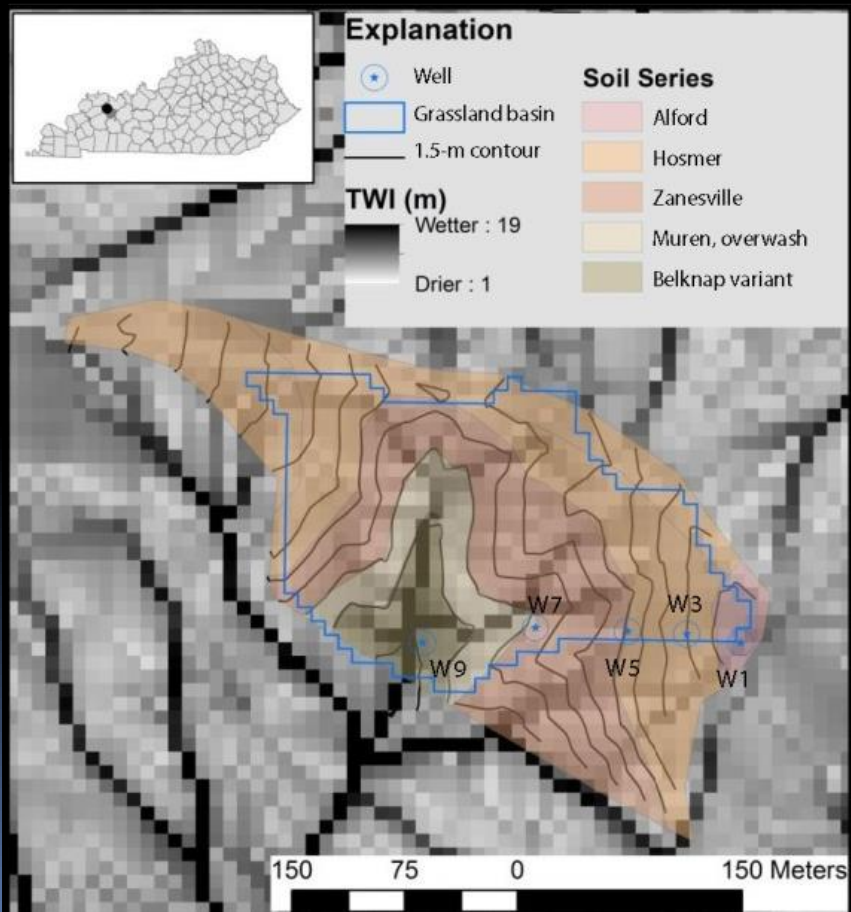
Beven, K.J. and M.J. Kirkby. 1979. A physically based, variable contributing area model of basin hydrology. *Hydrological Sciences Bulletin*, v. 24, pp. 43-69.
Wolock, David M. 1993. Simulating the variable-source-area concept of streamflow generation with the watershed model TOPMODEL. *USGS WRI 93-4124.*



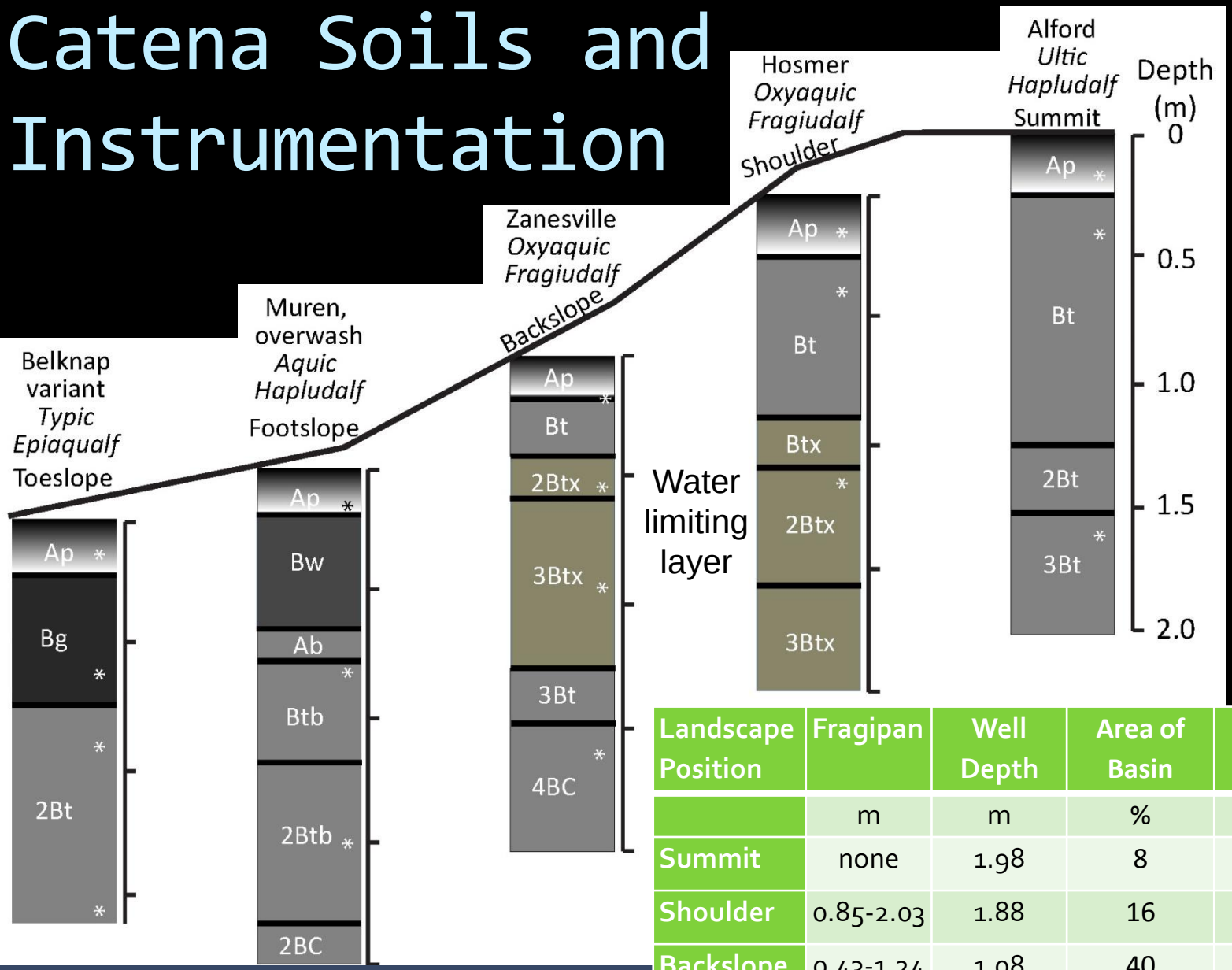
Why Kentucky Shawnee Hills Grassland Site?

Five slope positions

- Soil description & sampling
- K_{sat} field measurement
- Wells and Piezometers



Catena Soils and Instrumentation



Landscape Position	Fragipan	Well Depth	Area of Basin	Topographic Wetness Index	
	m	m	%	m	bin
Summit	none	1.98	8	7.80	12
Shoulder	0.85-2.03	1.88	16	6.23	7
Backslope	0.43-1.24	1.08	40	6.57	8
Footslope	none	1.43	28	5.20	4
Toeslope	none	1.48	8	7.53	11

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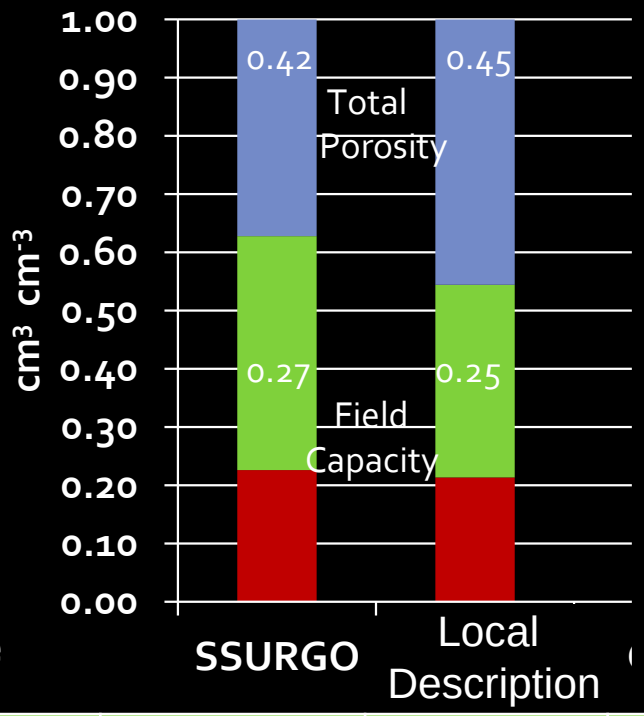
How soil characterization differed among datasets



Soil Dataset	K_{sat}	Soil Thickness	FC storage	Gravity-drained storage
	mm/d	mm	mm	mm
SSURGO	778	979	259.7	153.9
Local Description	792	1161	287.8	240.7

Local description identified landscape positions at which fragipan did not impede water movement.

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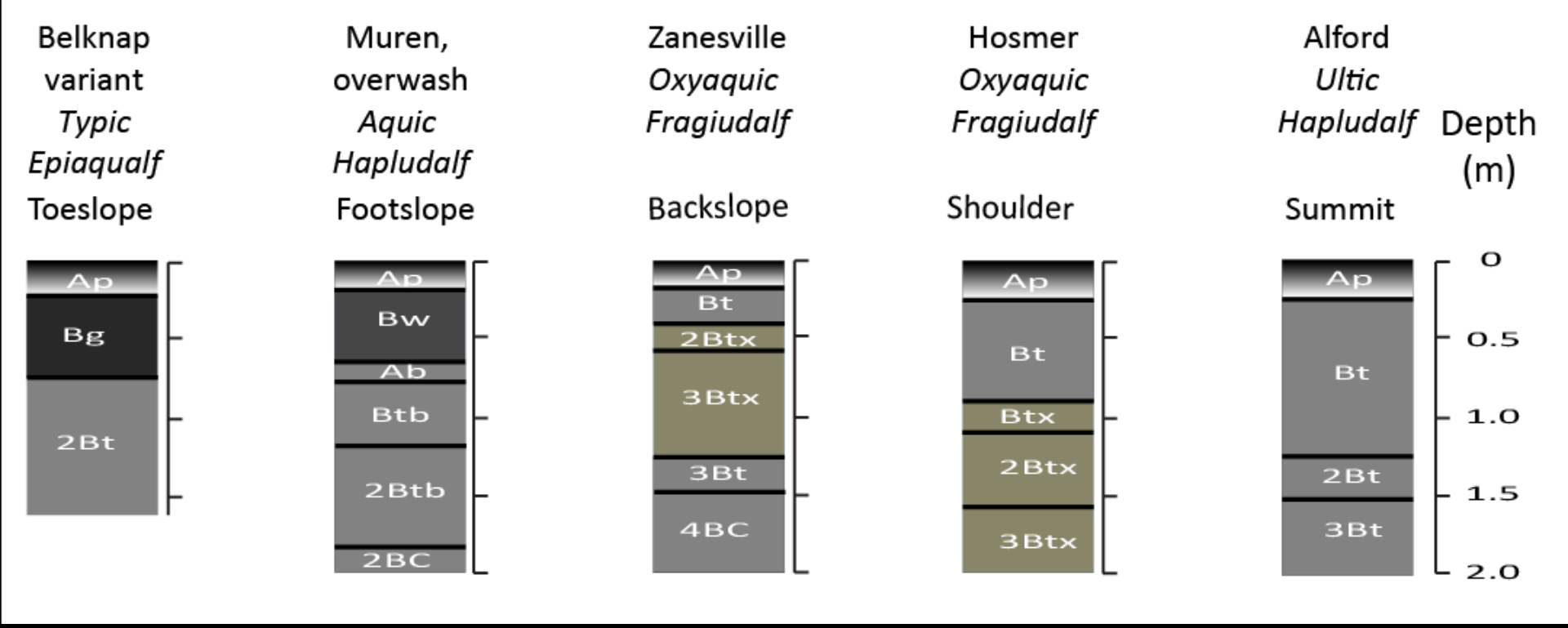
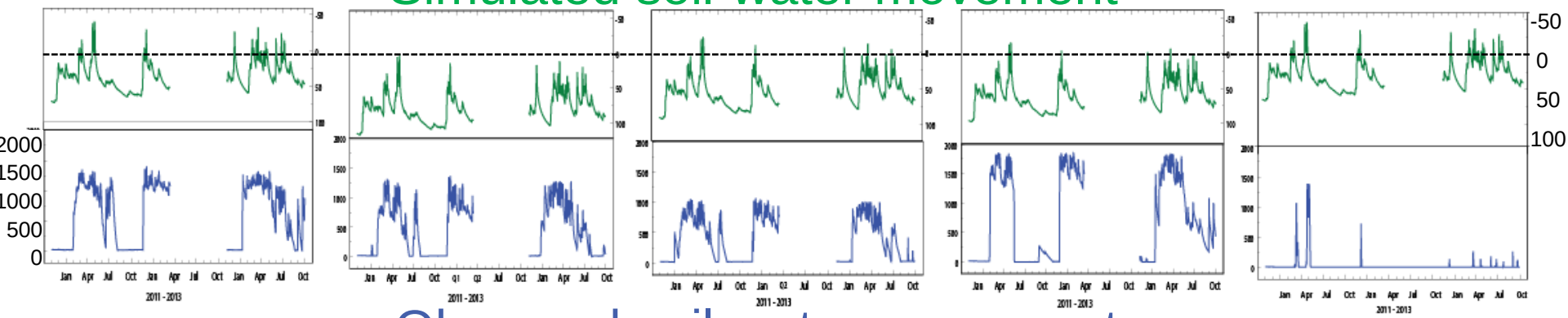


Simulated soil-water movement

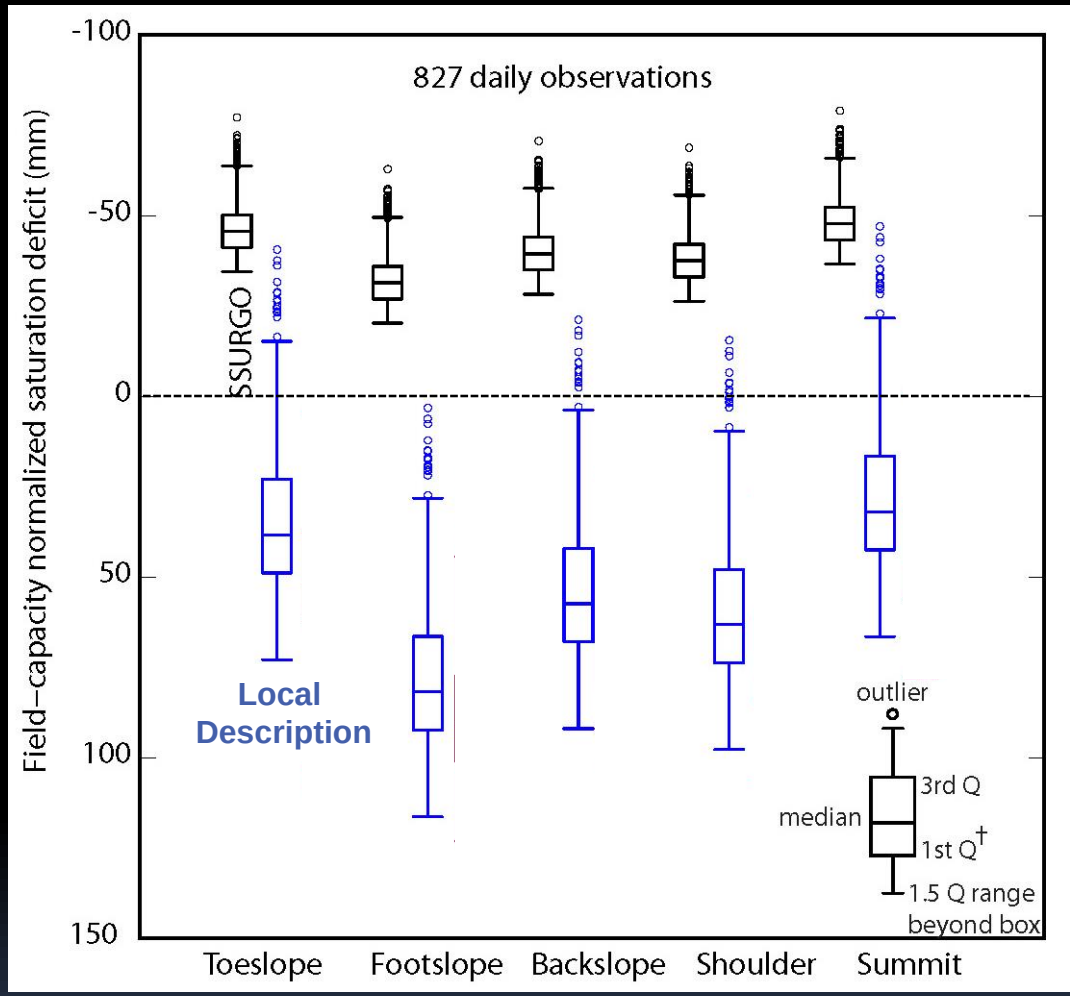


Observed soil-water movement

Differences among simulations

So, local descriptions provide better ability to anticipate water stress, but they show same trends among landscape positions and with time as more generalized soils data.

Significant differences in water storage between each pair of simulations ($p<0.0001$)



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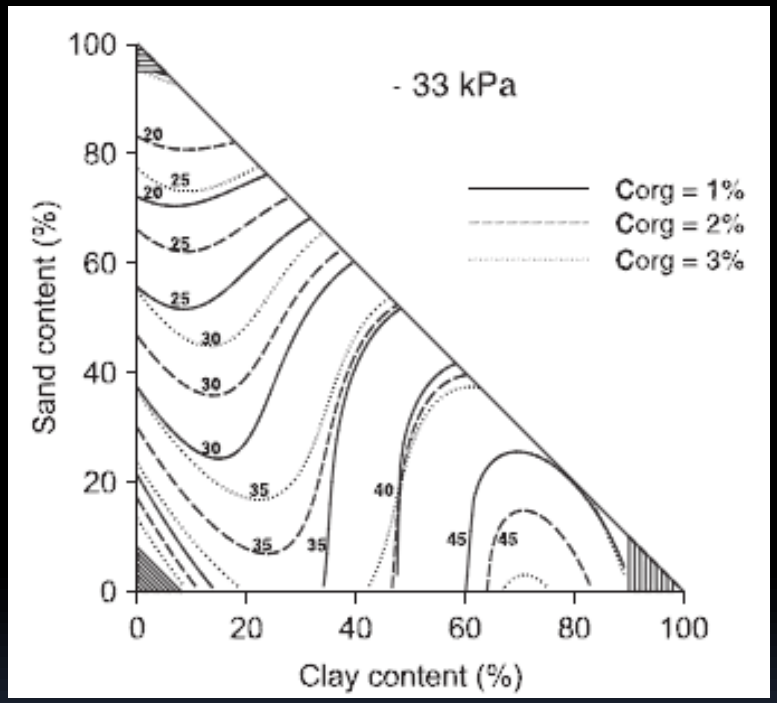
Relation to Soil Health Management



Isolines of soil-water content at field capacity
W. J. Rawls et al. Geoderma 116 (2003)

OC up

Water Content Up

Drought Resilience

Courtesy of NRCS - IN

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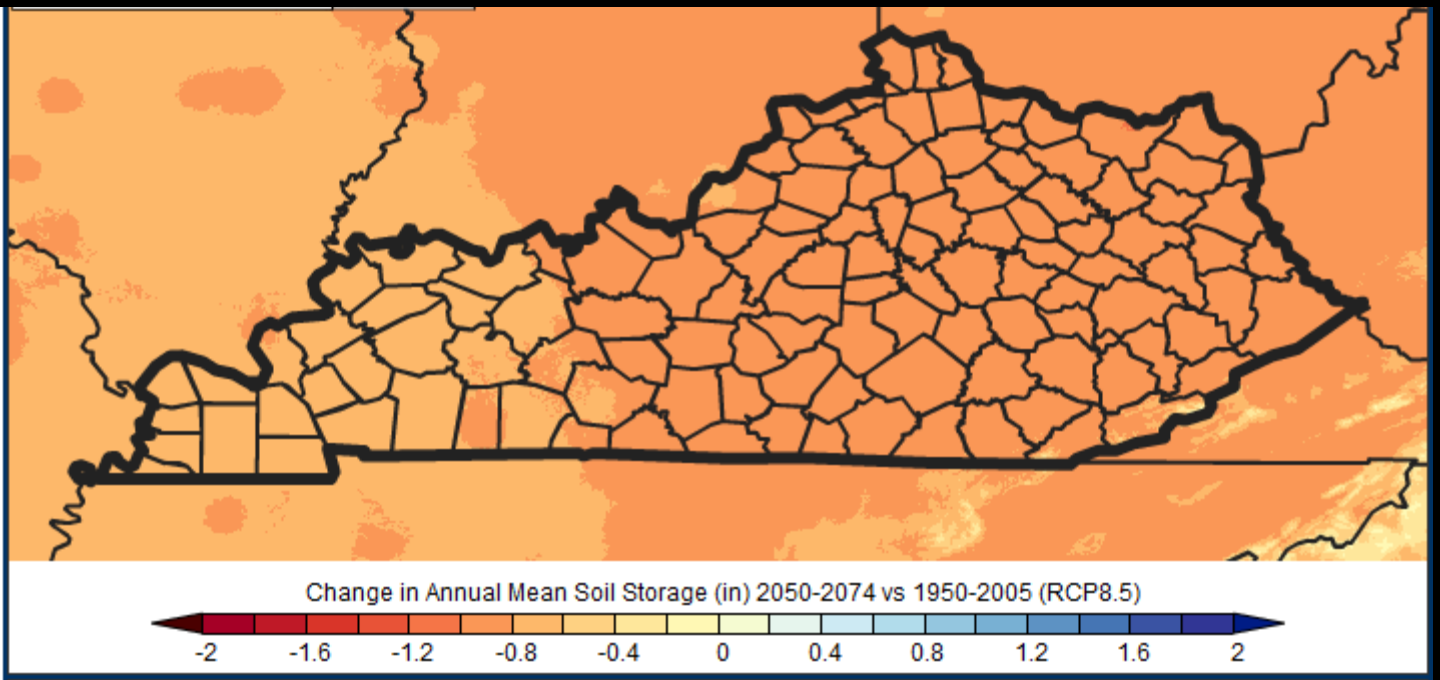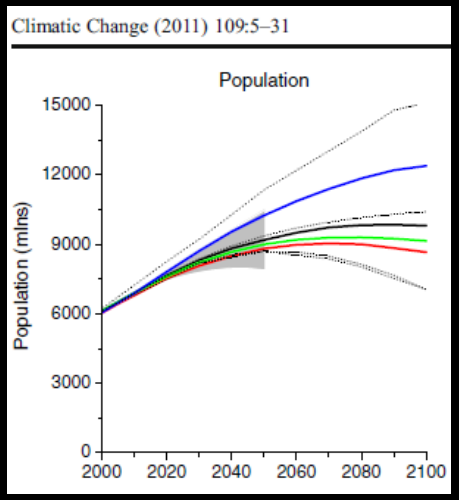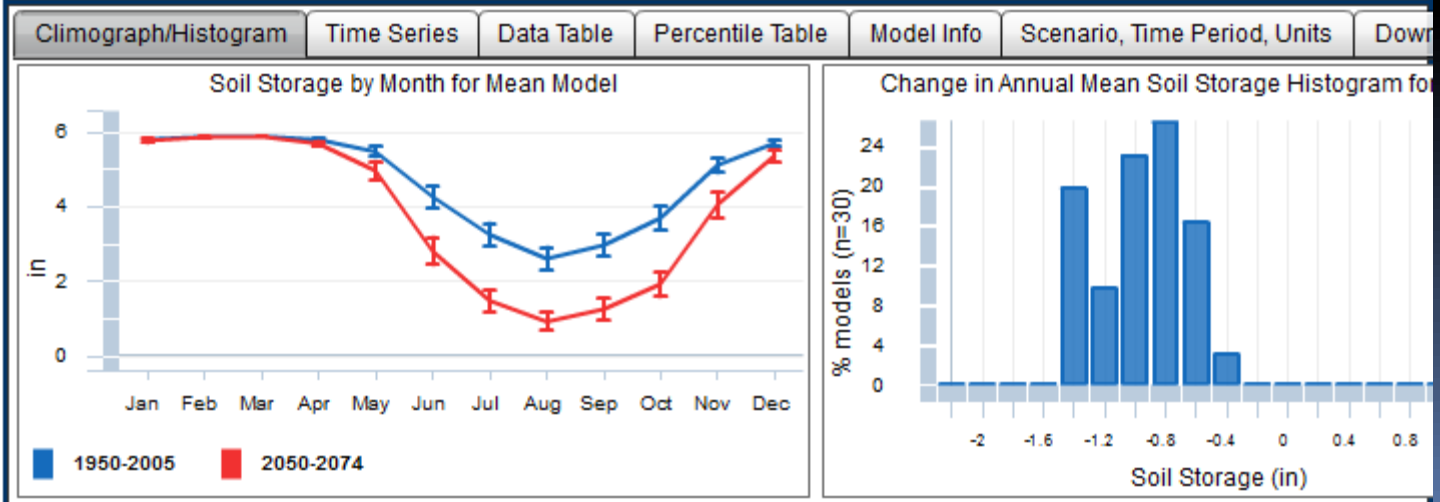
Importance of research to agricultural resilience