

Improving Cover Crop Management in Illinois with Subseasonal Climate Prediction

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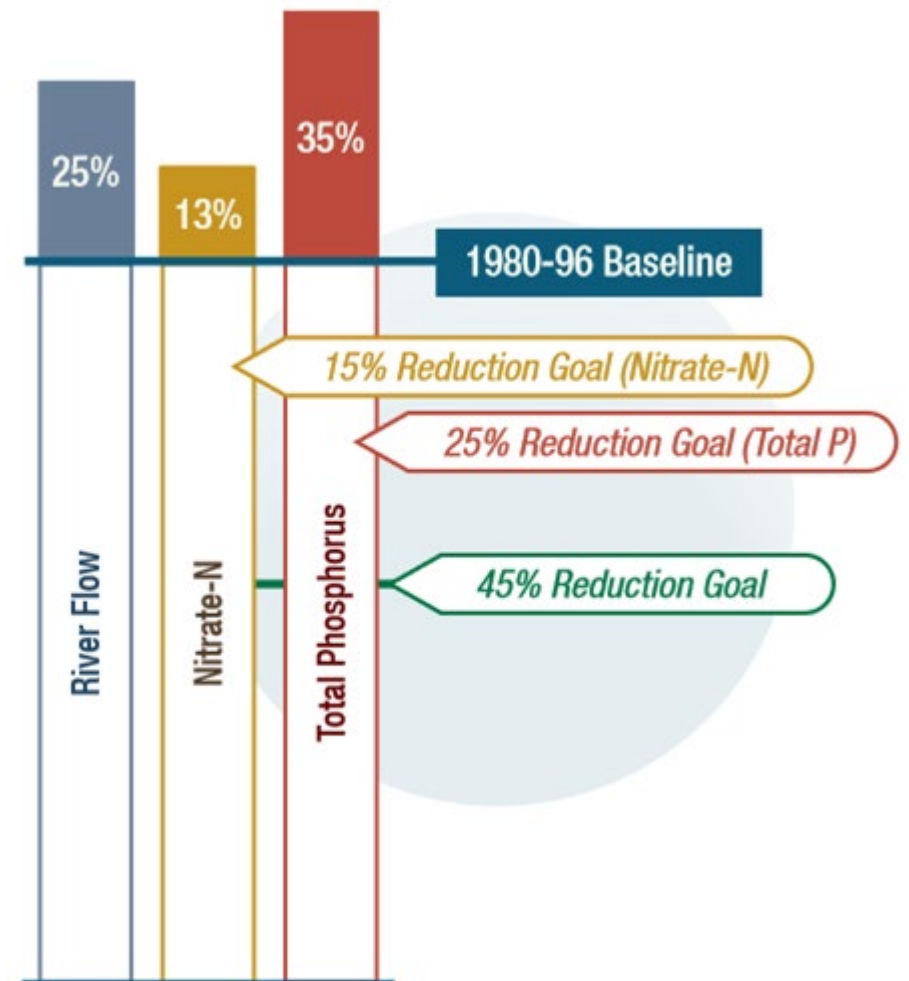
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Agricultural Runoff & Erosion Issues

- Nutrient runoff – increased nitrate and total phosphorous loads in Midwest streams
- Soil erosion – estimated average \$10k to \$40k annual loss in productivity in Illinois (Thaler, 2021 PNAS)
- Exacerbated by increasing heavy rainfall frequency, especially in spring and summer



2015-19 nitrate load in Illinois was **13% greater** than 1980-96 baseline loads, despite nutrient loss reduction efforts. Figure from Illinois Nutrient Loss Reduction Strategy 2021 Biennial Report

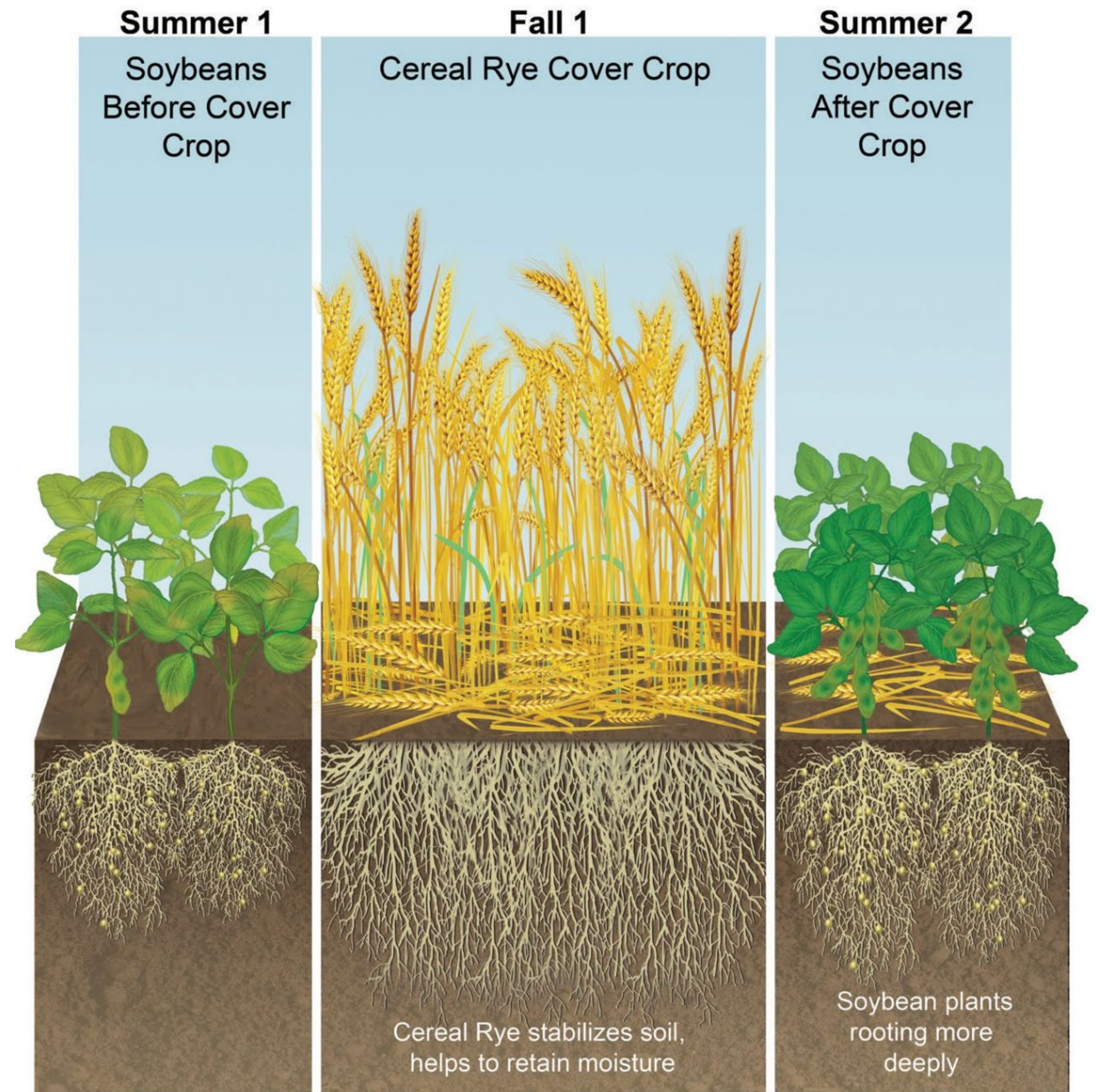
Cover Crops – Cereal Rye

- Nitrogen producer & scavenger
- Building soil health
- Preventing erosion
- Suppressing weeds
- Grazing & forage value

COVER CROPPING TO IMPROVE CLIMATE RESILIENCE



<https://www.climatehubs.usda.gov>



Cover Crop Decisions

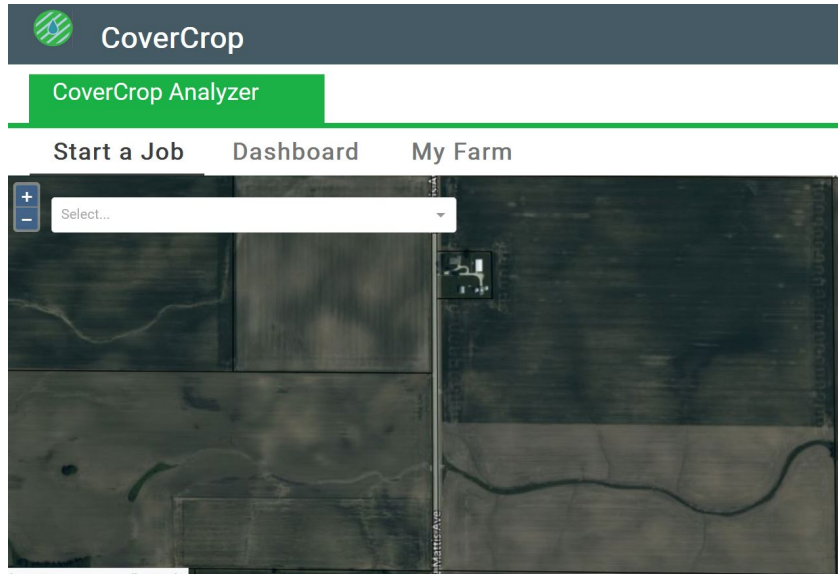
- Optimum cereal rye termination is at the end of stem elongation growth stage
- Growth stage depends on planting date, N application, and *spring weather*
- Accurate estimates of current & near-future cover crop growth can help best time termination for maximum benefits

Objective: provide accurate, timely weather information to support producers' goal of optimizing cover crop benefits

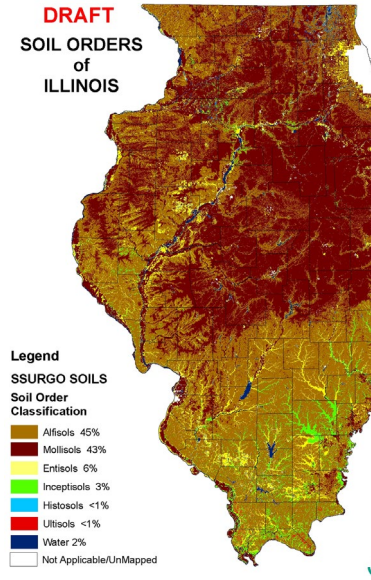
Cereal Rye Growth Stages (Zadoks' Scale)

	First-digit	Description of growth stage	
Vegetation Stage	0	Germination	
	1	Seedling growth	Too
	2	Tillering	Early
	3	Stem elongation	Ideal
Reproductive Stage	4	Booting	Termination
	5	Inflorescence emergence	n
	6	Anthesis	Too
	7	Milk development	Late
	8	Dough development	
	9	Ripening	

The CoverCrop Analyzer



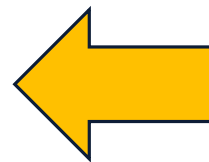
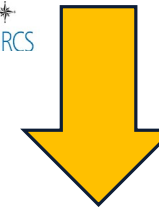
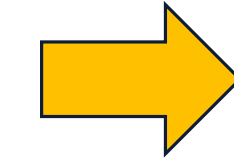
SSURGO



Mesonet Recent & Historical Weather



Biomass **C:N Ratio** **N Loss Reduction**

Three images illustrating the concepts: 1. Biomass: A field of tall green grass. 2. C:N Ratio: A diagram showing a corn plant with its roots in the soil, with two yellow circles labeled 'C' representing carbon in the soil. 3. N Loss Reduction: A pipe discharging water into a field, with a yellow circle labeled 'C' representing carbon in the soil.

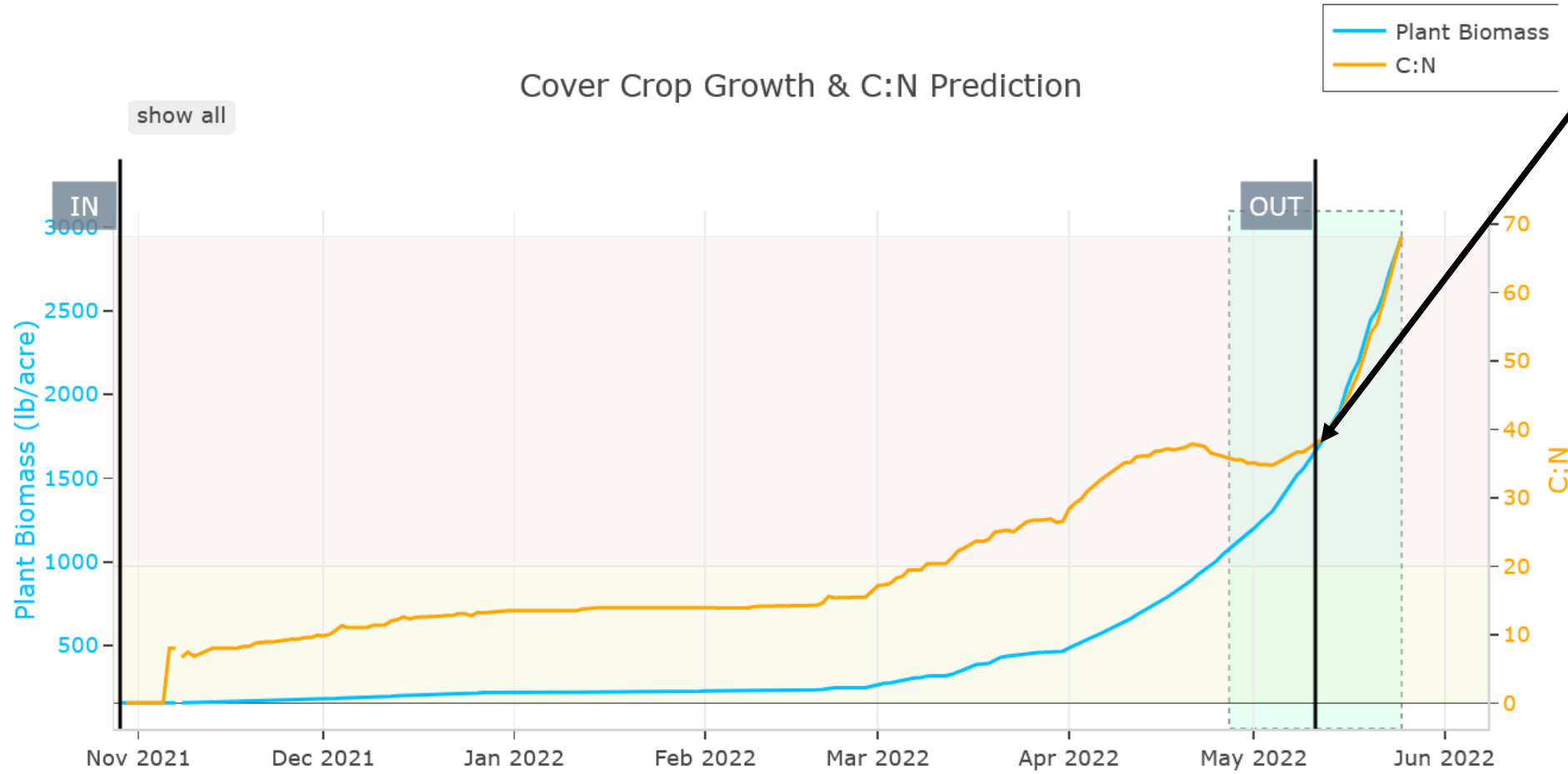
DSSAT

<https://covercrop.ncsa.illinois.edu/analysis>

The CoverCrop Analyzer

Cereal Rye Planting Date: October 15, 2021
 Hypothetical Termination Date: May 14, 2022

DSSAT simulation of biomass and C:N ratio under "average" hypothetical weather conditions

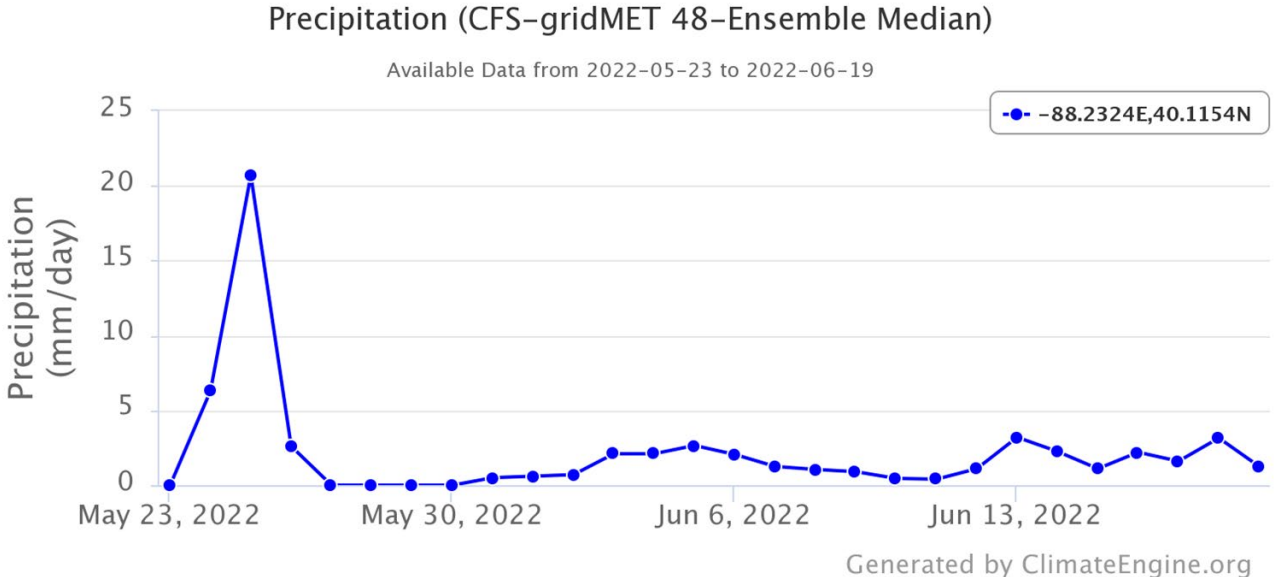


Results with Cover Crop	
Plant Biomass (lb/acre)	1657.67
C:N	37.83
Nitrogen Uptake (lb/acre)	16.33

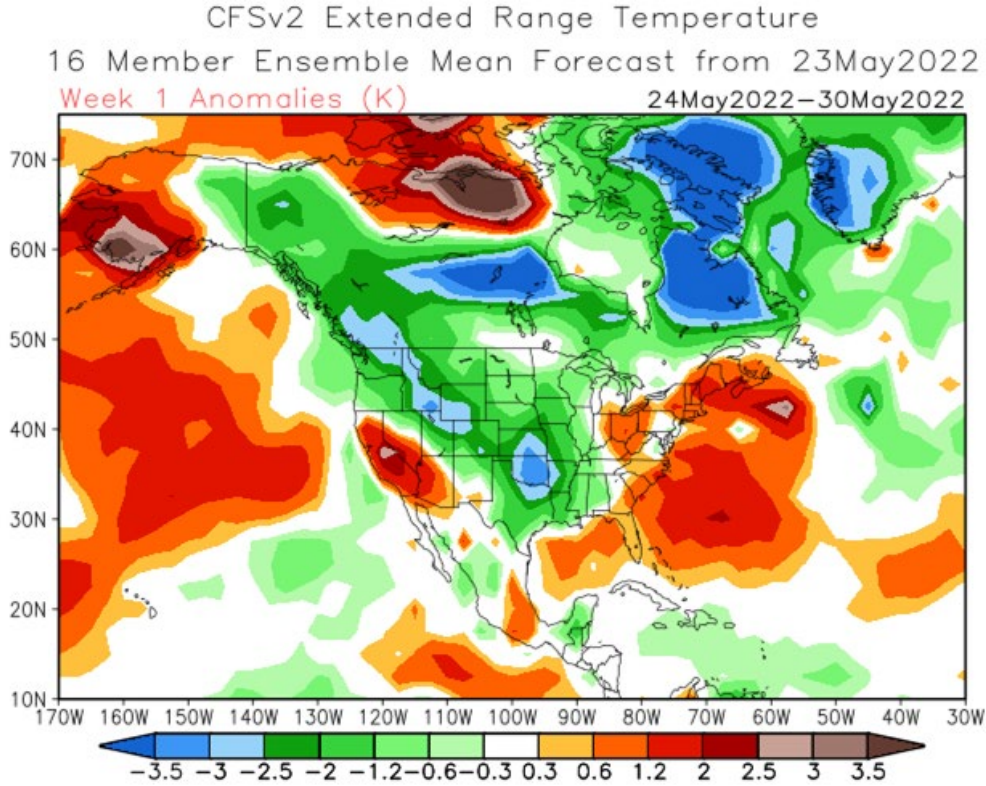


Improving Weather Information

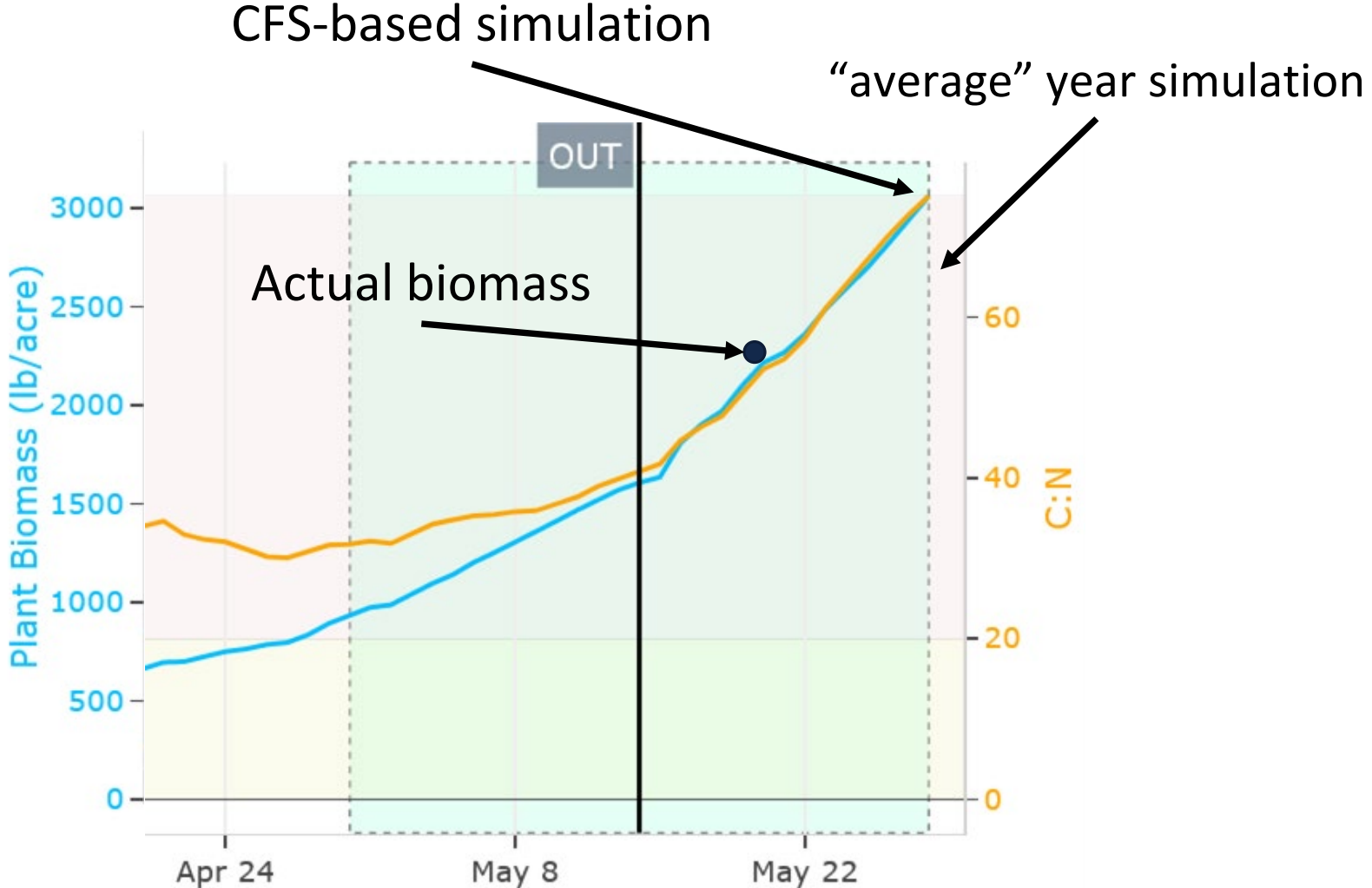
- Added option to include DSSAT simulations using CFSv2 forecasts for weeks 1-4 to supplement hypothetical conditions: “average”, “hot”, etc.
- Producers can use CFS forecasts to project biomass, C:N ratio, etc. up to 30-days prior to planned termination



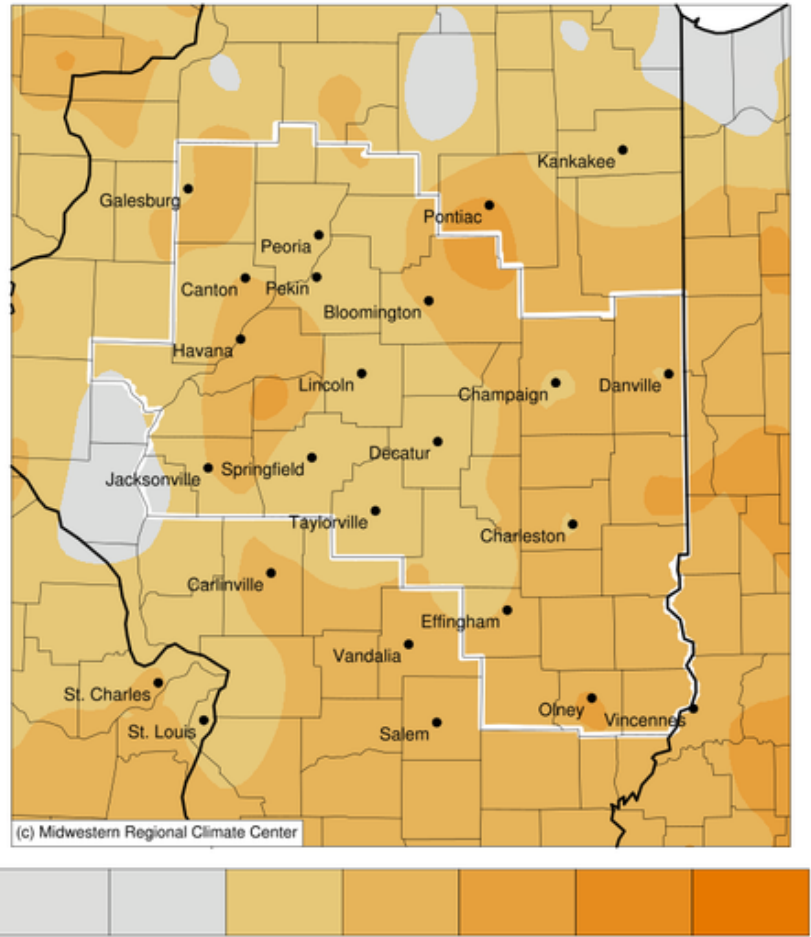
CFS weeks 1-4 precipitation forecast for Champaign County, IL



Improving Weather Information for Cover Crop Termination Decisions



Average Temperature (°F): Departure from 1991-2020 Normals
 April 24, 2022 to May 23, 2022



0 1 2 3 4 5

Stations from the following networks used: WBAN, COOP, FAA, GHCN, ThreadEx, CoCoRaHS, WMO, ICAO, NWSLI, Missouri FSA, Missouri Mesonet, Midwestern Regional Climate Center
 cli-MATE: MRCC Application Tools Environment
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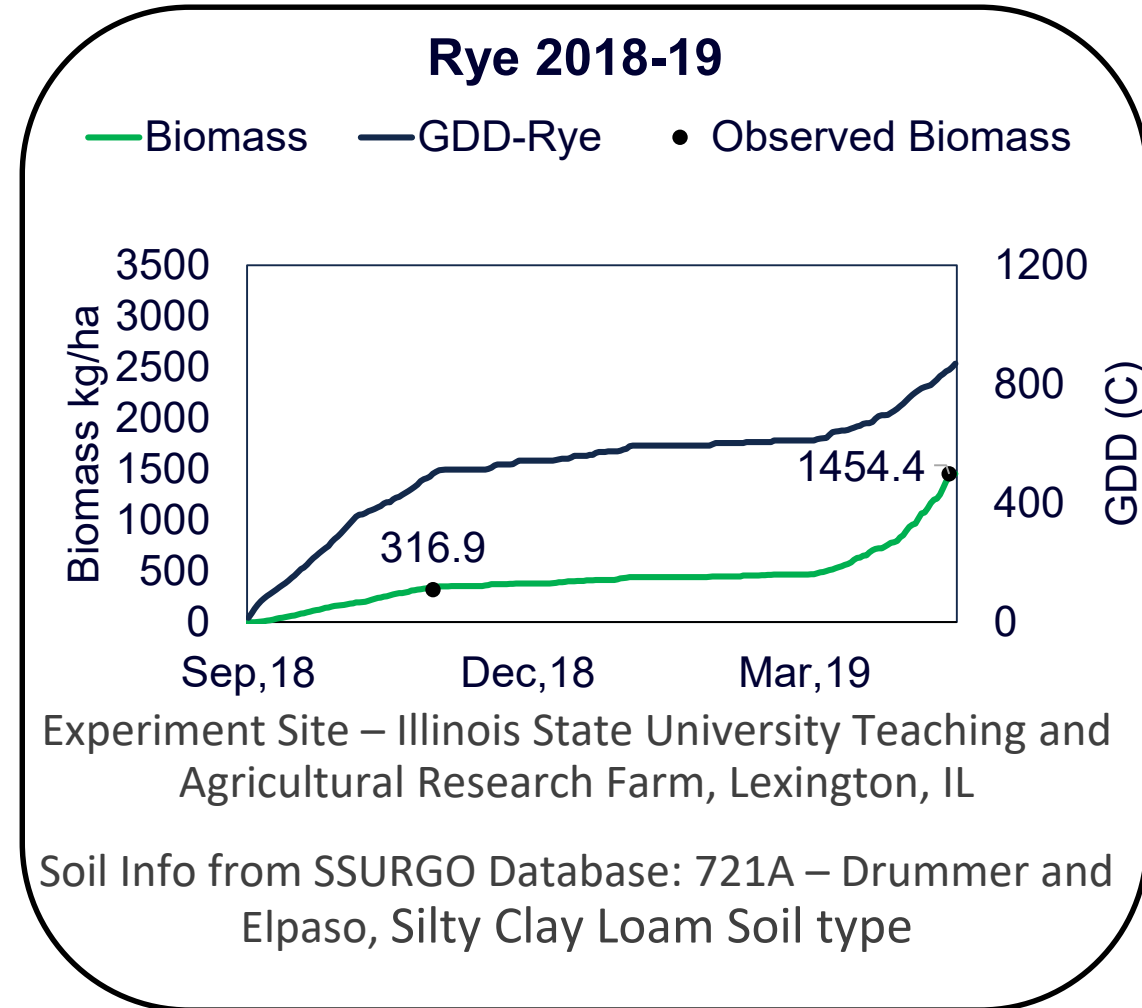
Summary & Next Steps

Summary

- Building a value-added cover crop decision support tool using sophisticated climate forecast systems
- Adding to toolbox of decision support services to facilitate wider, more effective adoption of climate-resilient Ag practices in the Midwest

Next Steps

- Further DSSAT validation – comparison between weather information
- Probabilistic forecasts better utilizing ensemble spread and uncertainty information
- More cover crops – working with hairy vetch & winter wheat
- Expansion beyond Illinois



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