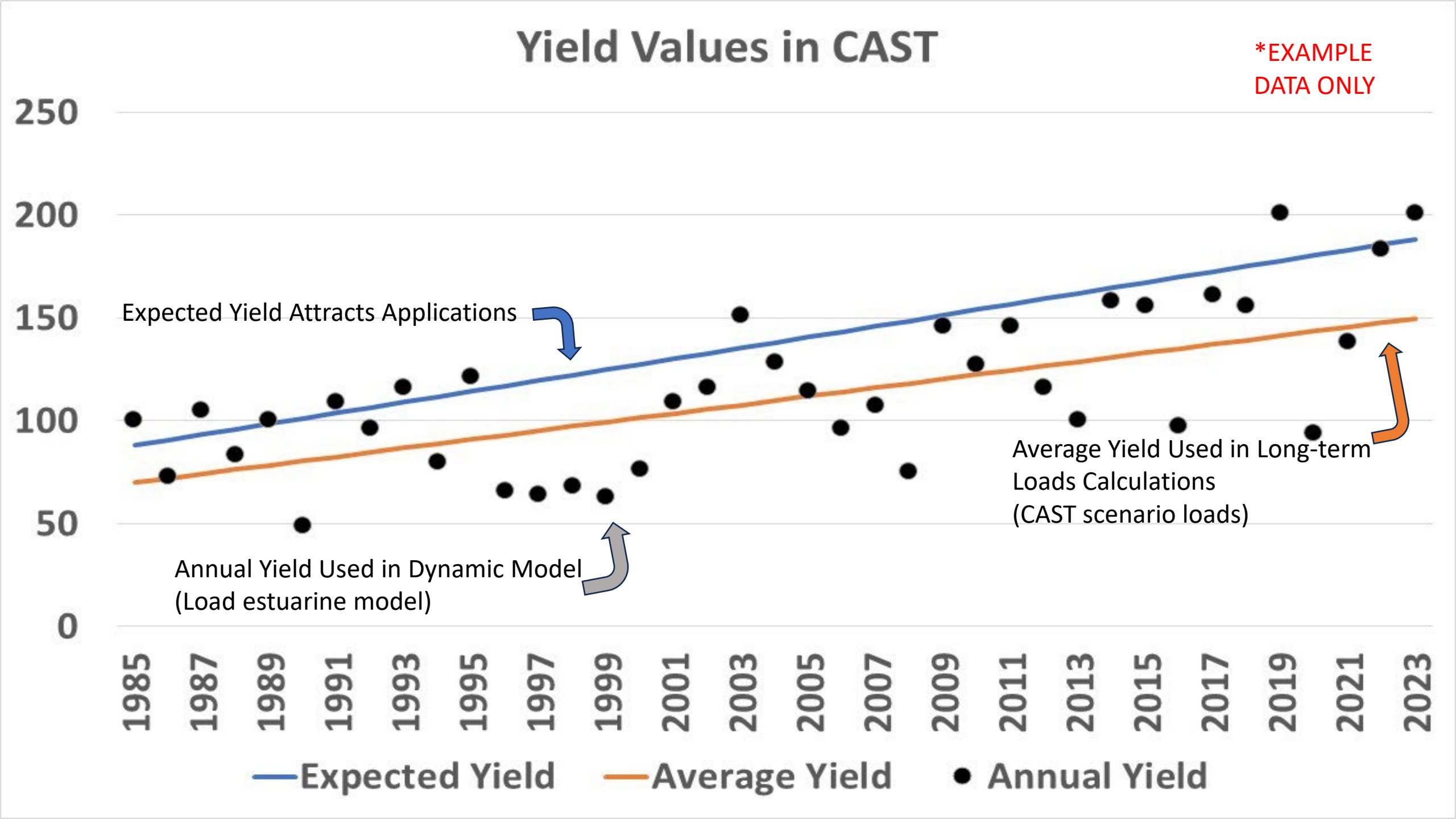
Crop Yield Progress

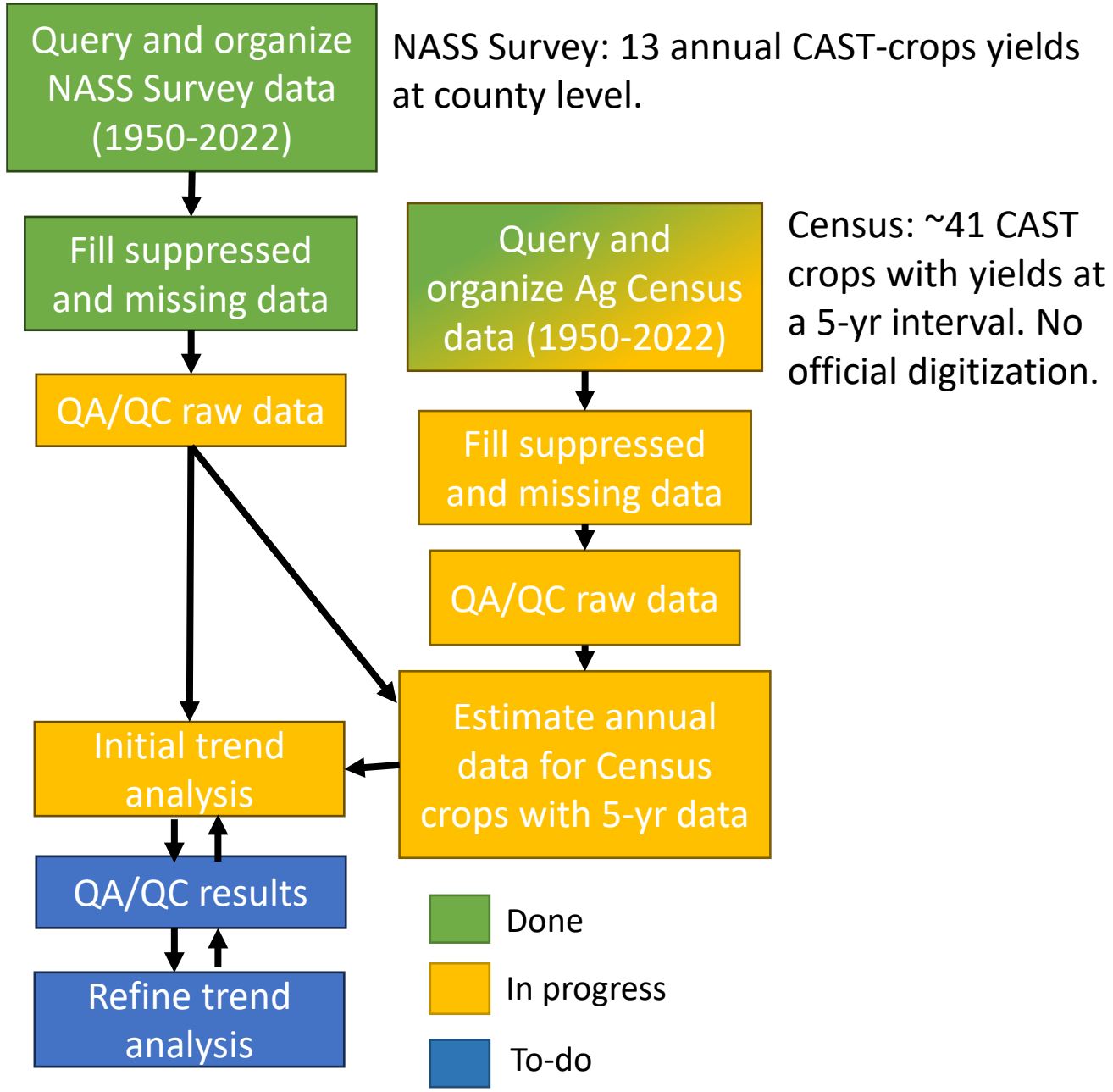
11/9/2023


Yield Values in CAST
*EXAMPLE DATA ONLY
250
200
150
100
50
0
Expected Yield Attracts Applications
Annual Yield Used in Dynamic Model
(Load estuarine model)
Average Yield Used in Long-term Loads Calculations
(CAST scenario loads)
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
Expected Yield
Average Yield
Annual Yield

Planned Path for investigation

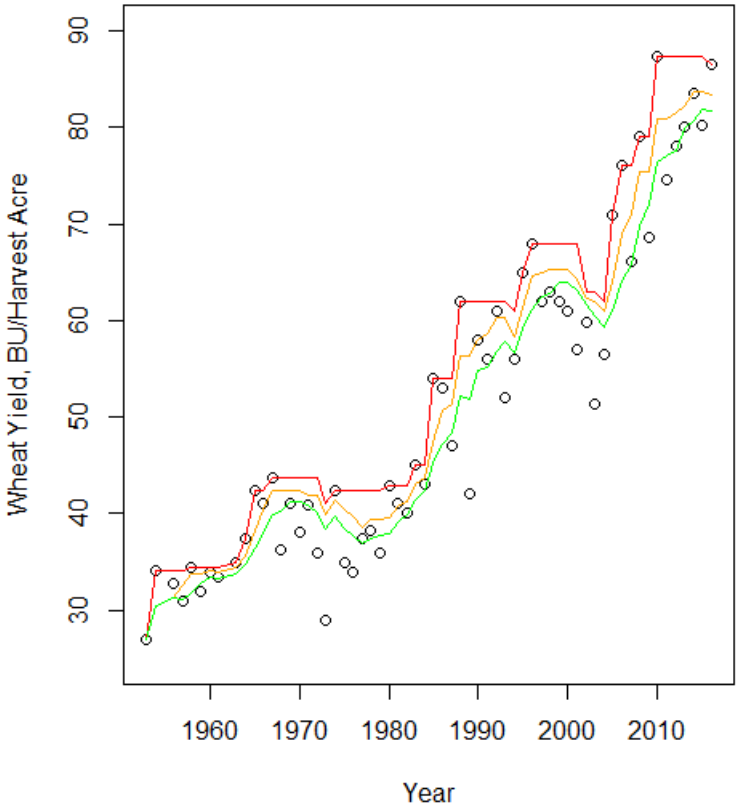
Goals: Estimate farmer yield expectations at the county level which drive the application of nutrients.

Approach: Use trend analysis of long-term annual crop yields to develop several potential scenarios of yield expectation at the county level.

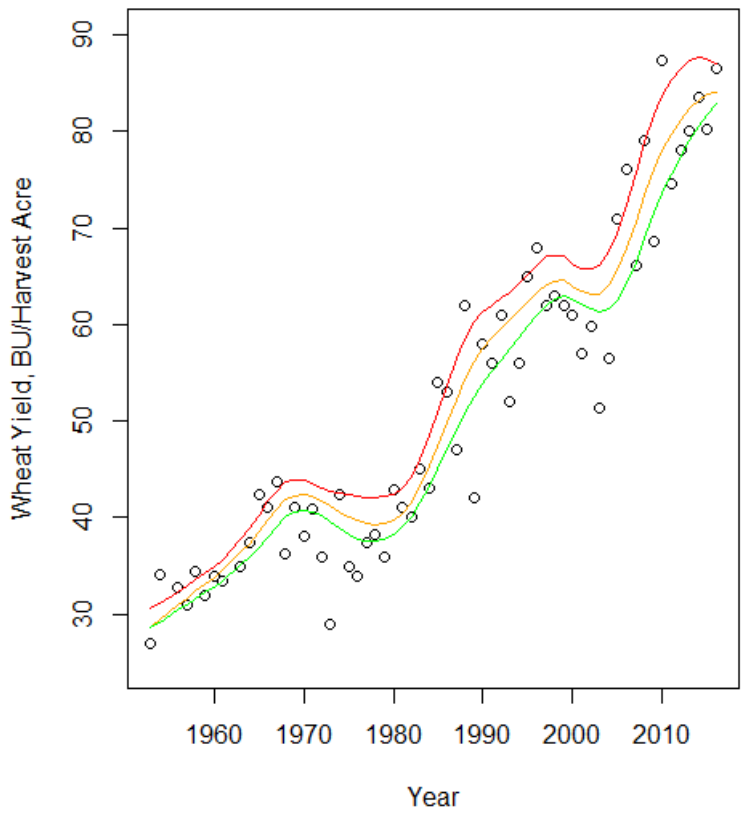


Example trend analyses of NASS survey yields

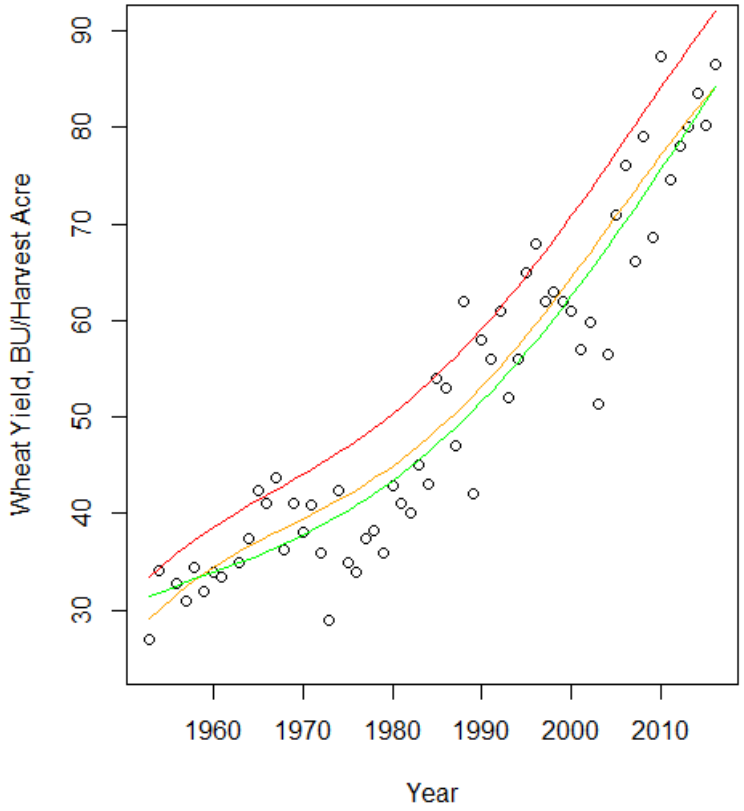
Moving window



Moving window smoothing



Regression, weighted residuals



- Max yield expectation (5-year max)
- Weather independent yield expectation (Average of best 3 of past 5 years
- 5-yr mean yield

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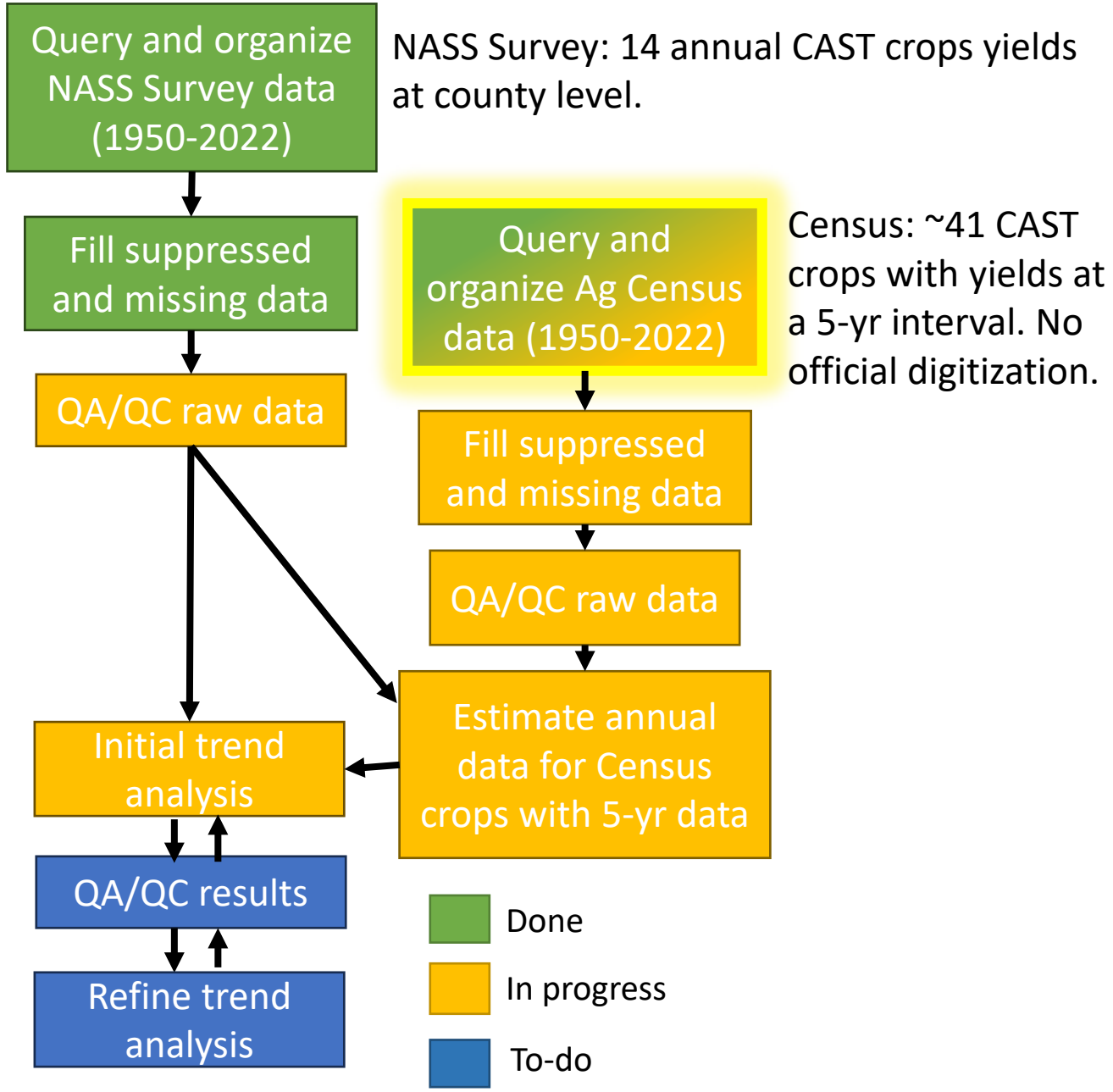

Crop yield data collection status

- 94 CAST-crops with both a potential yield and N-application
  - Excludes pasture, fallow, unmanaged or wild covers

- “Complete” data for 23 of these CAST-crops
  - Complete = county level, 12+ data points spanning >85% of period 1950-present
  - **91% of crop land area, 95% of N applied to crop land**

- Partial data for an additional 40 crops
  - Partial = partial spatial range, partial time range, state-level only
  - 2.2% of crop land area, 3% of N applied to crop land

- No yield data for 31 crops
  - 6% of crop land area, 2% of N applied to crop land

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Proposed solution:

- Do you have or know of yield data for these crops?
- Identify potential surrogate crops
  - With expert input
  - Where extensive partial data is available, by comparison to overlapping data

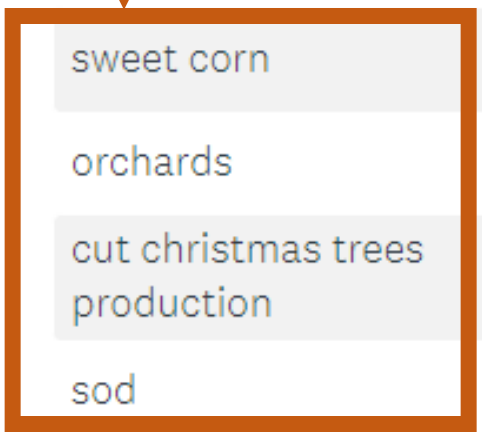
"Complete"	Partial	None
alfalfa hay	alfalfa seed	aquatic plants
barley for grain	asparagus	broccoli
buckwheat	bedding/garden plants	brussels sprouts
corn for grain	beets	celery
corn for silage or greenchop	berries - all	chinese cabbage
cotton	birdsfoot trefoil seed	collards
dry beans	bulbs; corms; rhizomes; and tubers – dry	cut christmas trees production
haylage or greenchop from alfalfa or alfalfa mixtures	canola	garlic
oats for grain	cantaloupe	green onions
other haylage; grass silage and greenchop	carrots	greenhouse vegetables
other managed hay	cauliflower	herbs - fresh cut
peanuts for nuts	cucumbers and pickles	honeydew melons
popcorn	cut flowers and cut florist greens	kale
potatoes	dry edible beans excluding limas	mustard greens
rye for grain	dry onions	nursery stock
small grain hay	eggplant	okra
sorghum for grain	emmer and spelt	orchardgrass seed
sorghum for silage or greenchop	escarole and endive	other field and grass seed crops
soybeans for beans	fescue seed	other nursery and greenhouse crops
sunflower seed - non-oil varieties	foliage plants	parsley
sunflower seed - oil varieties	green lima beans	peas - chinese (sugar and snow)
tobacco	head cabbage	peppers - chile (all peppers – excluding bell)
wheat for grain	land in orchards	radishes
wild hay	lettuce	rhubarb
	mushrooms	ryegrass seed
	peas - green (excluding southern)	short-rotation woody crops
	peas - green southern (cowpeas)	sod
	peppers - bell	turnip greens
	potted flowering plants	turnips
	pumpkins	vegetable & flower seeds
	red clover seed	vegetables - mixed
	snap beans	
	spinach	
	squash	
	sweet corn	
	sweet potatoes	
	timothy seed	
	tomatoes	
	triticale	
	vetch seed	
	watermelons	

Action Items:

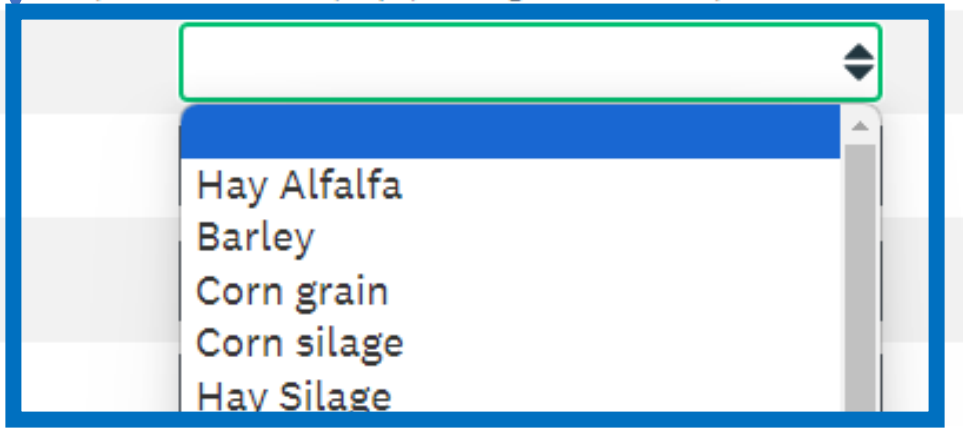
- Data call
  - Any additional information on crop yields
- Relating crops
  - Voting member survey (~5 minutes)
    - Select the crop with data that you feel shares yield trends with the crop lacking yield data

Ag Modeling Team Voting members	
Affiliation	Primary
Chair	Zach Easton, VT
Delaware	Chris Brosch (DDA)
Maryland	Alisha Mulkey (MDA)
New York	Cassie Davis (NYS DEC)
Pennsylvania	Scott Heidel (PA DEP)
Virginia	Tim Larson (VA DCR)
West Virginia	Dave Montali (Tetratech)
U.S. Environmental Protection Agency	Jeff Sweeney (EPA)
At Large	Ken Staver, UMD
At Large	Tamie Veith, USDA-ARS
At Large	Candiss Williams, USDA-NRCS
At Large	Alex Soroka, USGS

Crops with no or incomplete data



Crops with 12 + data points spanning 85% of the period 1950 – Present



Progress on estimating annual yields for crops with 5-yr data (COA)

List of potential predictors of crop yields

- CBP Growth regions
- Hardiness zones
- EPA Eco-regions
- Cropland as perc. of county area
- Total rainfall
- Temp., mean
- Temp., 90th pct.
- Temp., 10th pct.
- Wind speed, mean
- Wind speed, 90th perc.
- Humidity, mean
- GDD
- FFD
- PAR, total
- GDD mean photoperiod
- Soil drought sensitivity index (PDSI)
- Soil “droughty”
- Soil organic carbon
- Soil root zone available water storage
- Bulk Density
- Perc. Sand
- Perc. Silt
- Perc. Clay
- Perc. OM
- Soil EC or CEC
- Slope, mean
- Topographic Wetness Index
- Perc. convergent landform
- Perc. divergent landform
- Mean yield of crops with annual data
- Perc. Deviation from previous year yields from crops with annual data