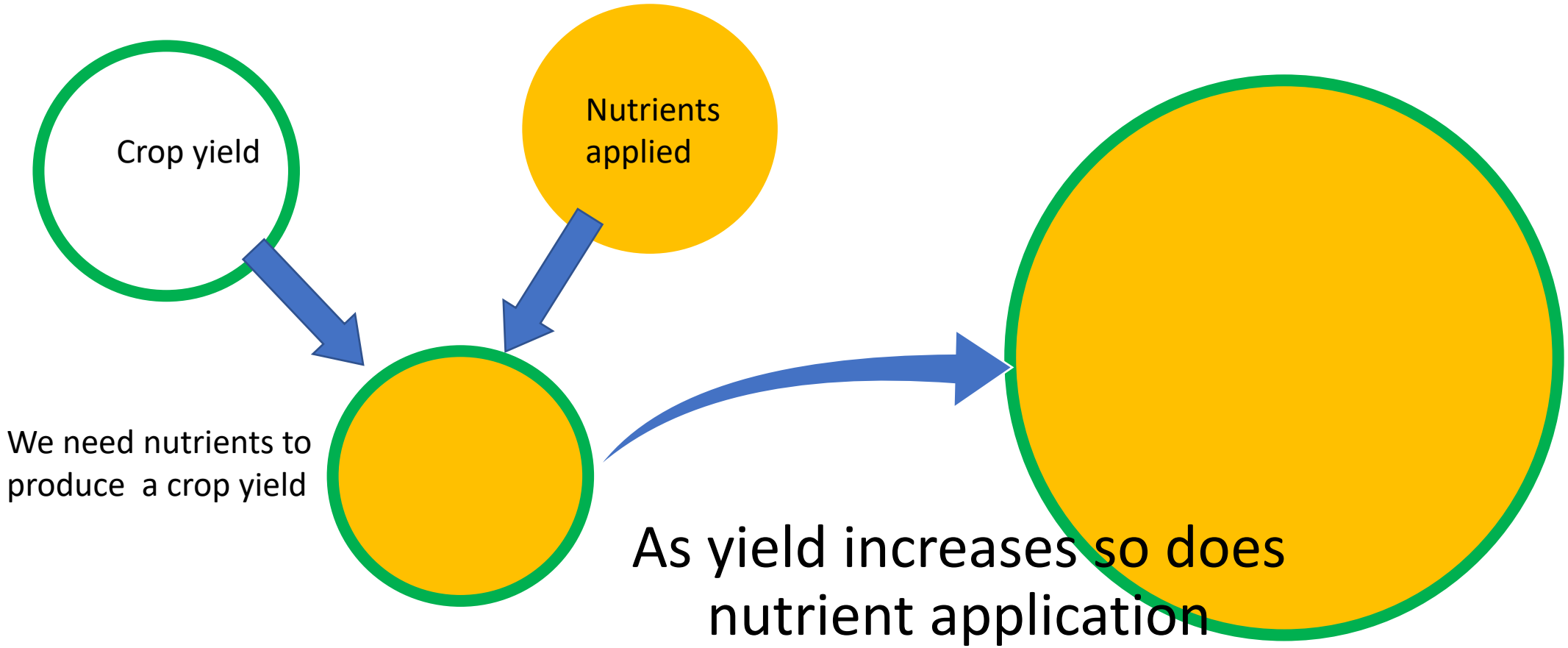
Crop Yields

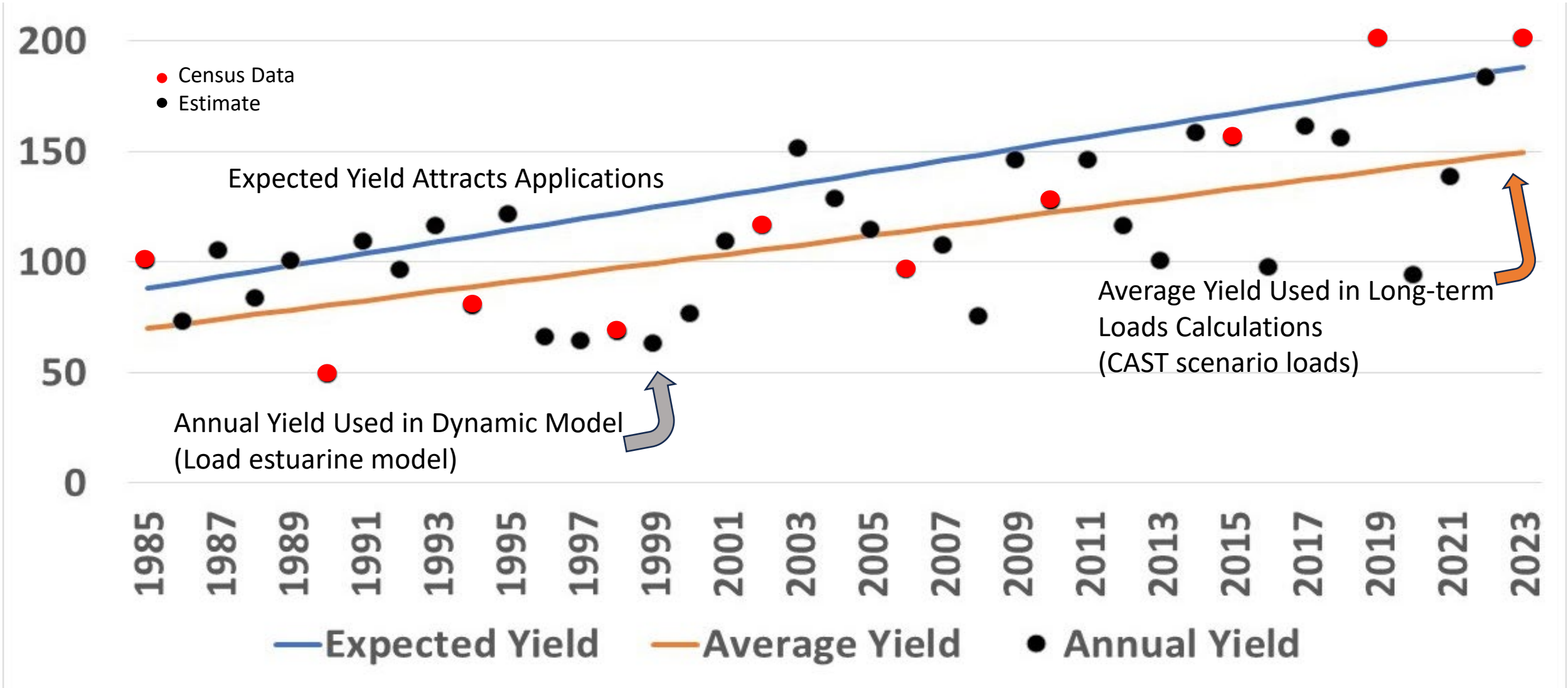
9/13/2024

Why crop yields matter

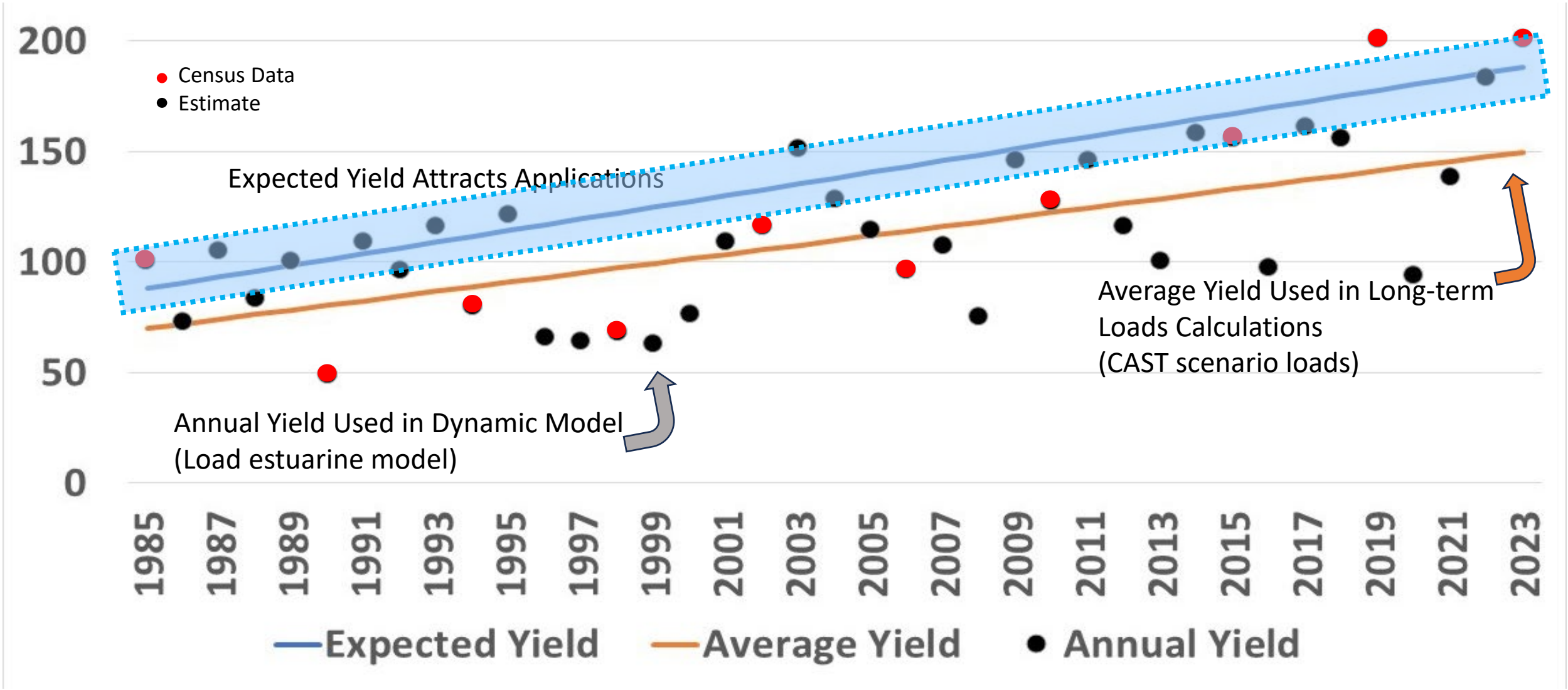
- Yields and nutrient applications are tied together



*EXAMPLE
DATA ONLY



*EXAMPLE
DATA ONLY



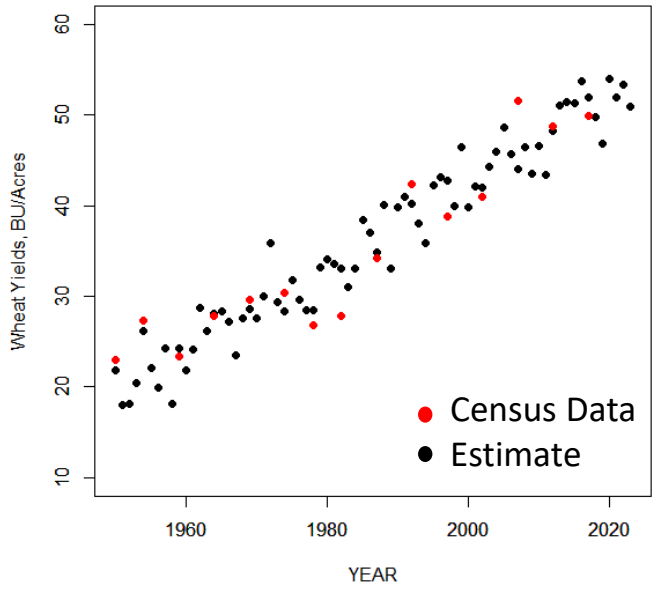
Path of investigation

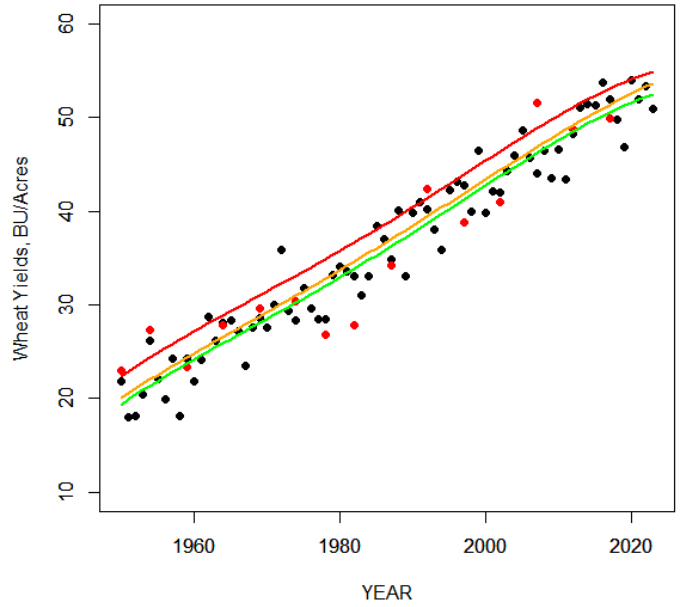
Goals:

- Estimate farmer yield expectations at the county level which drive the application of nutrients.
- Estimate various yield trends to support potential scenarios.

Collect crop yield data from 1950 to present → Estimate annual yields → Apply trend analyses

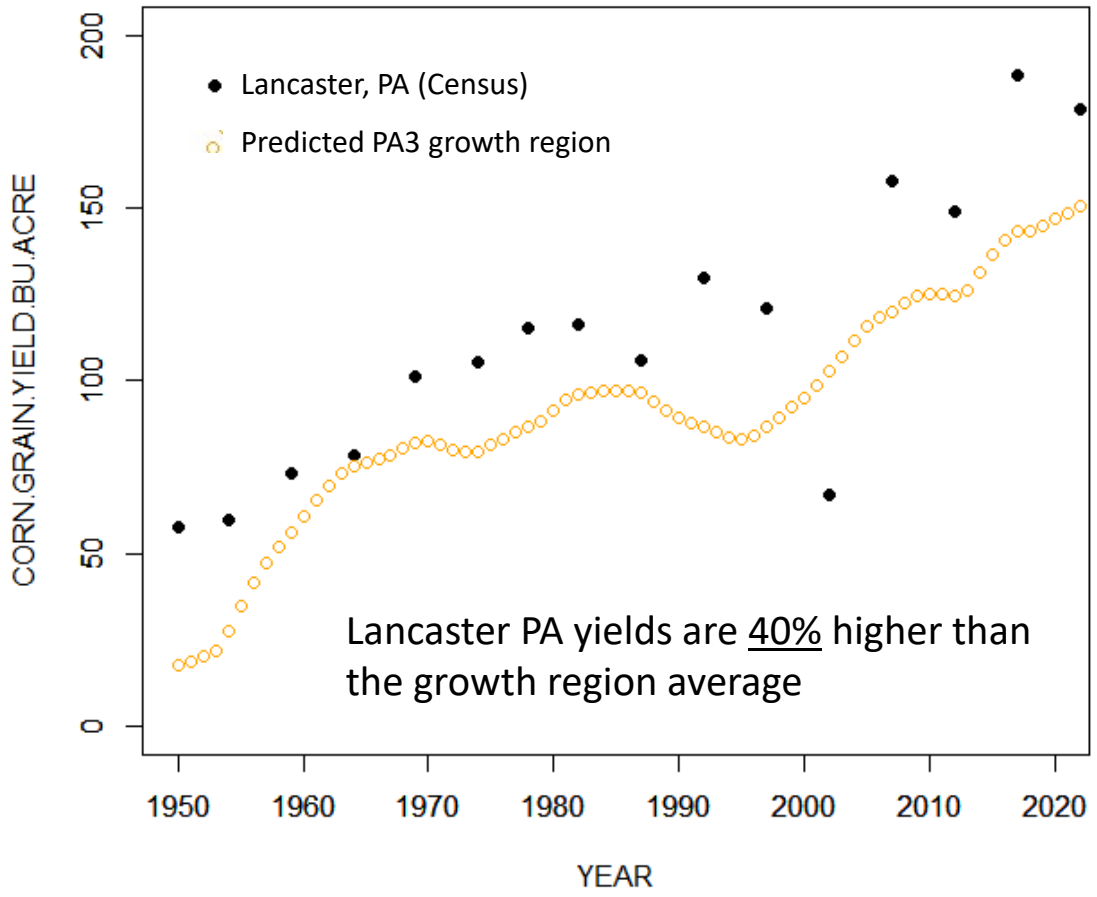
USDA Census and Survey data





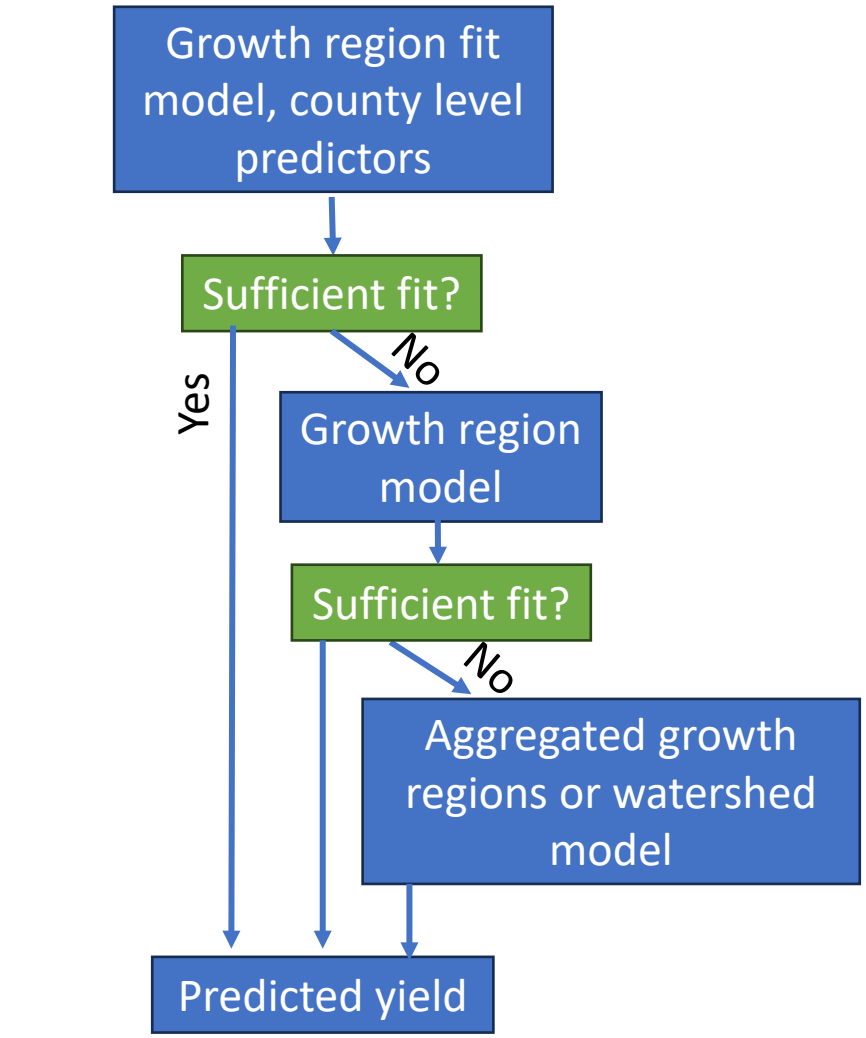
Continued improvements

- Aggregating to the growth region was done to improve data quality over the largest number of counties and crops where data at the individual county can be unreliable.
- HOWEVER, this has resulted in predicted yields which are (much) too low for counties which have high yields relative to their growth region.
- Because counties with high relative yields are also likely to have more acres this issue skews the watershed wide demand for N application down as well.

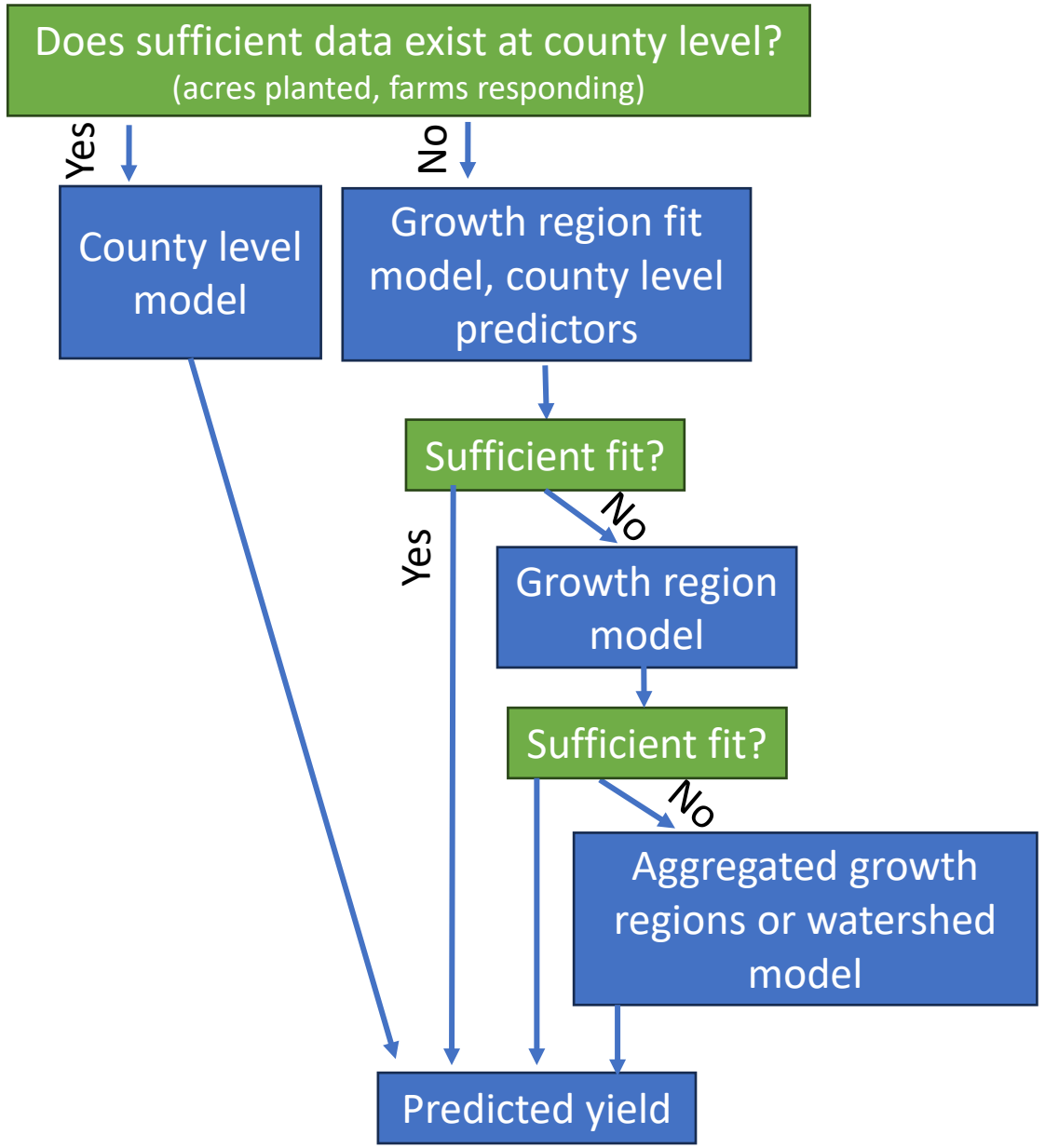


Solution

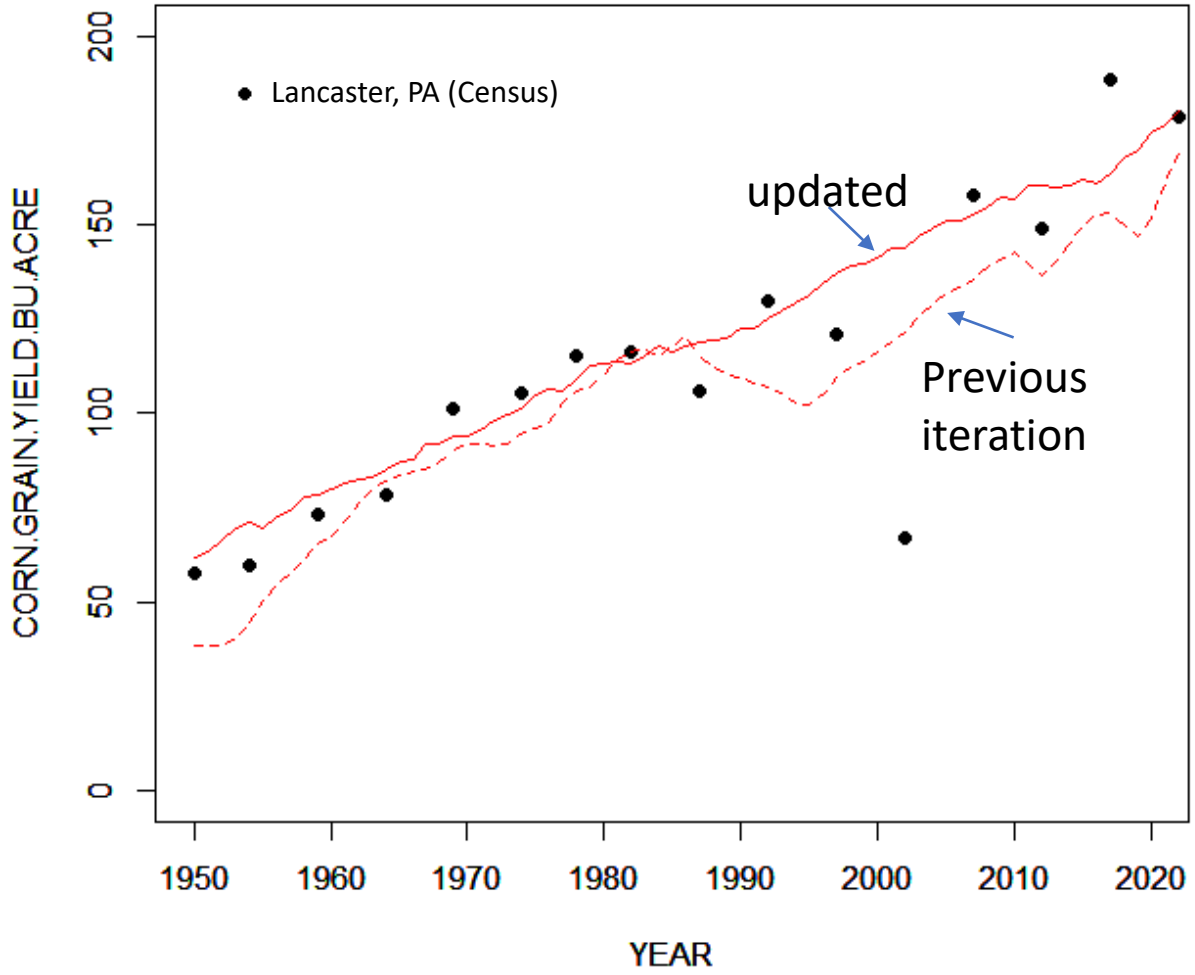
Joseph's current method



Joseph's proposed solution

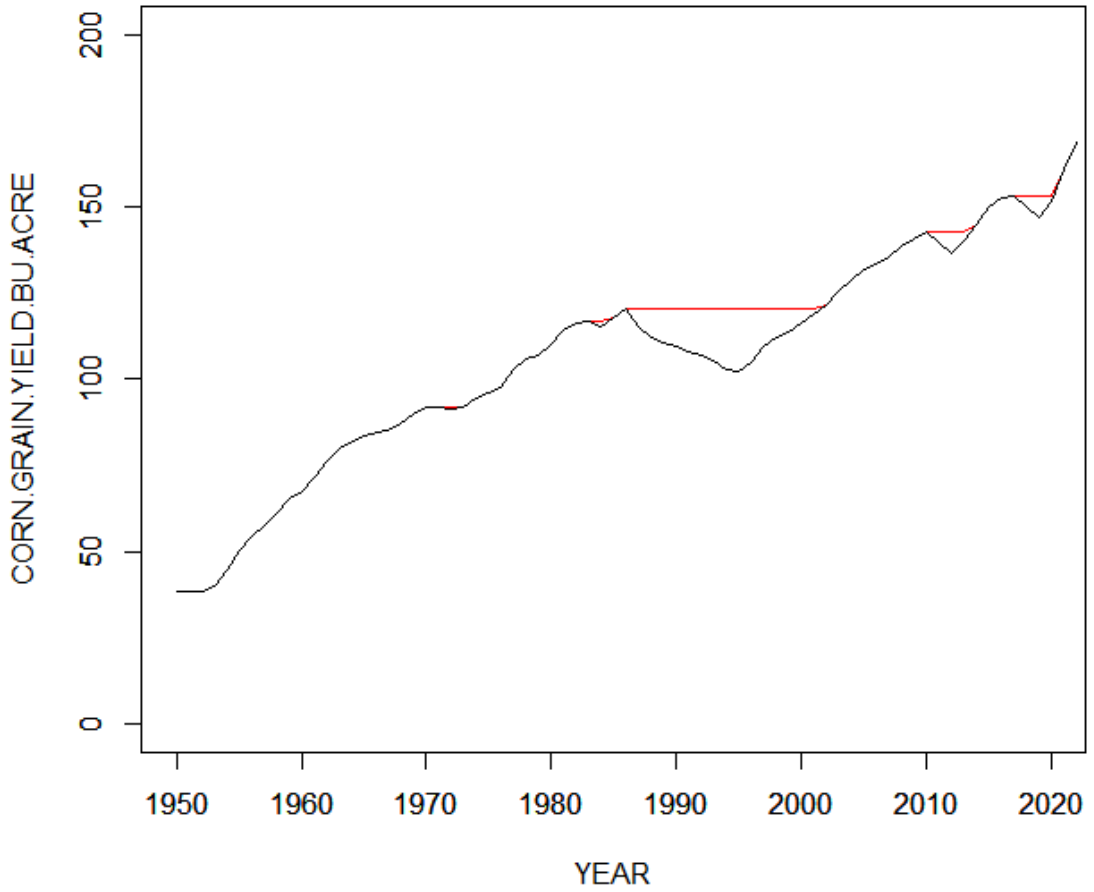


Preliminary results of proposed solution for Lancaster, PA



Expected yields must not go down (for some crops)

- The expected yield for large crops (e.g., Corn, Soybeans) with historically positive trends does not likely decrease
  - This has not been applied in the results shown, but will be applied to select crops based on watershed trend in next revision



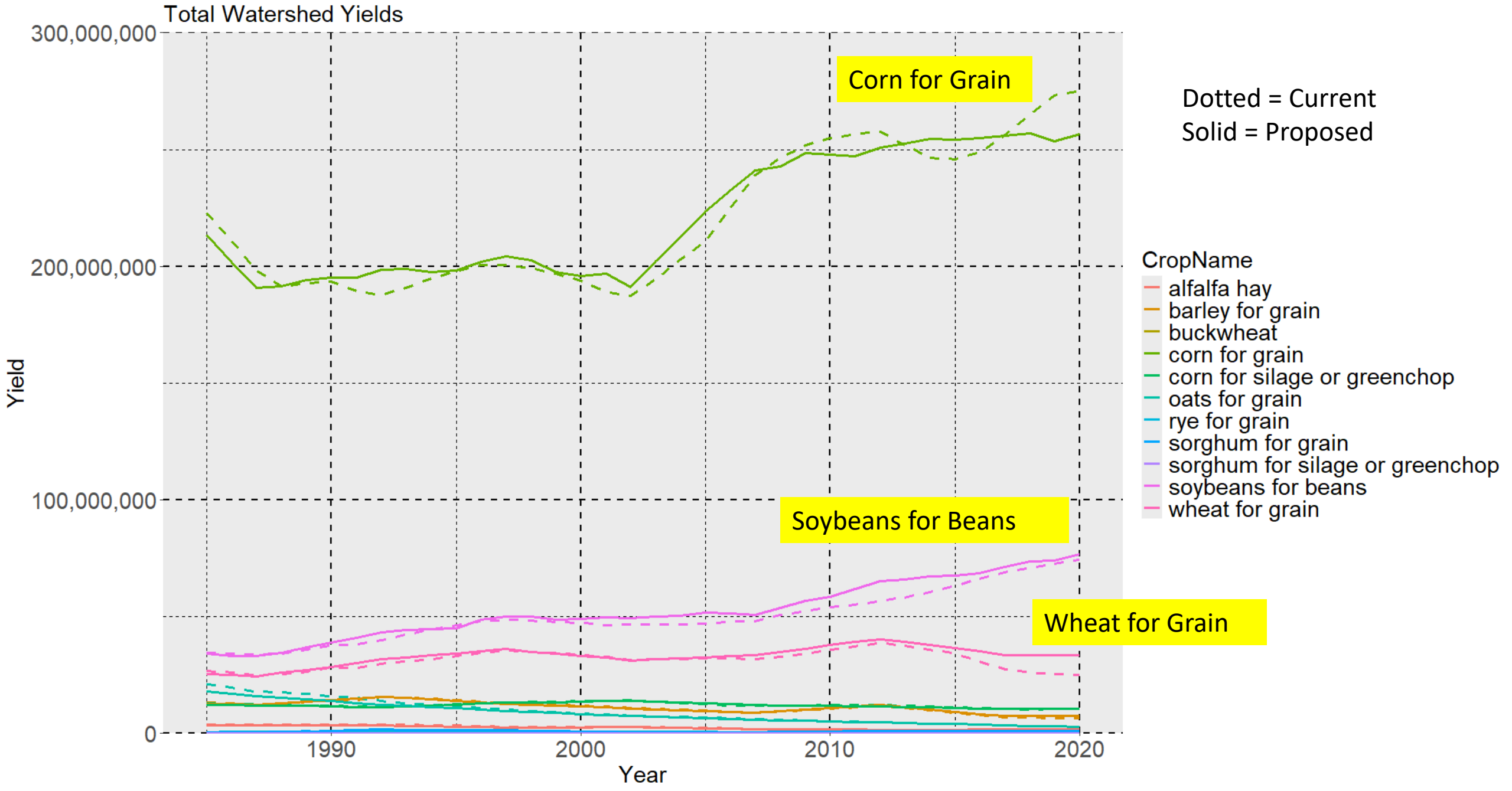
Progress with a subset of crops:

- alfalfa hay
- barley for grain
- corn for silage or greenchop
- sorghum for grain
- soybeans for beans
- wheat for grain
- soybeans for beans
- corn for grain
- sorghum for grain
- corn for grain
- sorghum for grain

Let’s look at some CAST scenarios:

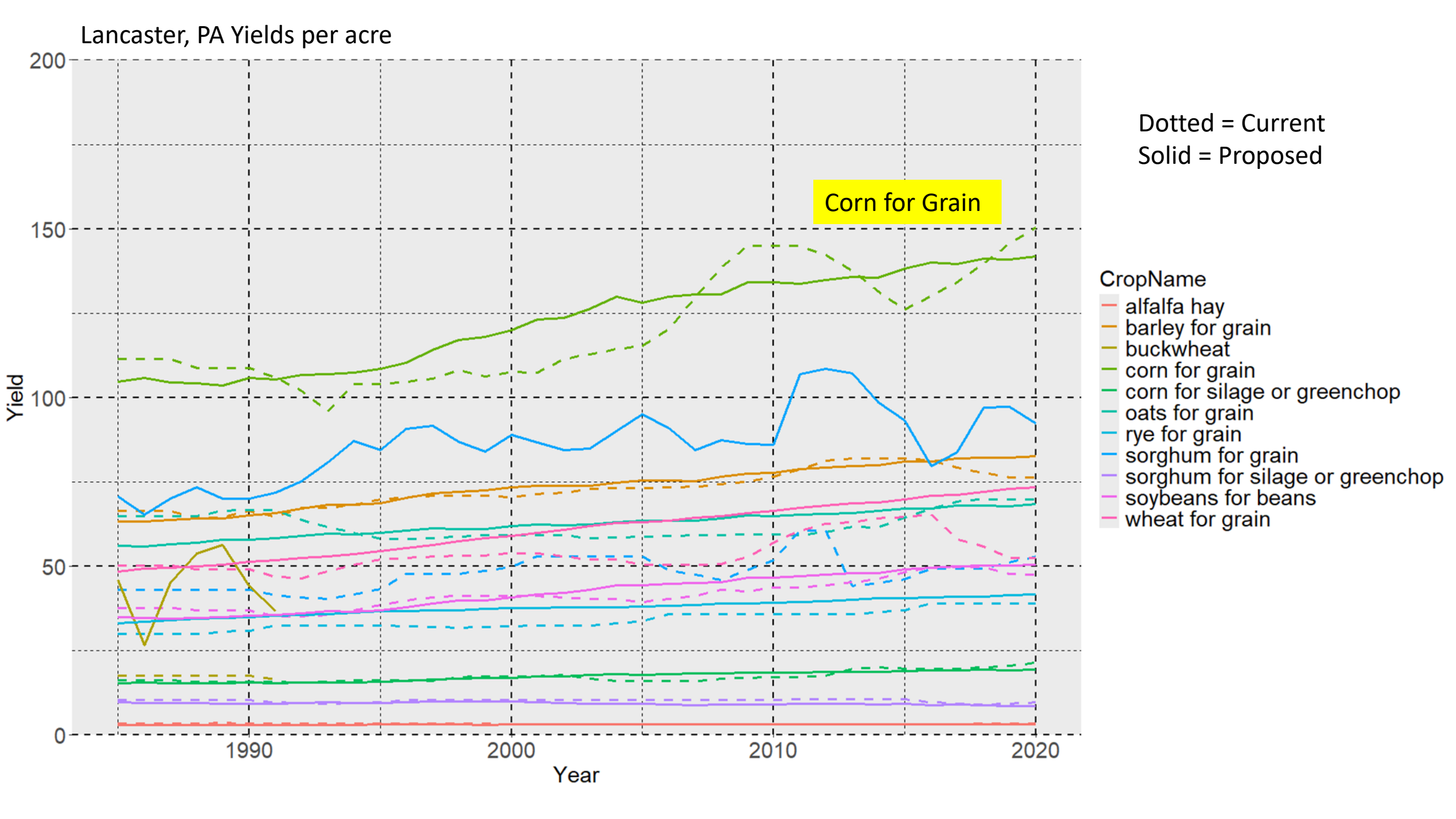
Keeping in mind that continued improvement are expected to increase the yield attracting application by ~5% increasing the recommended application.

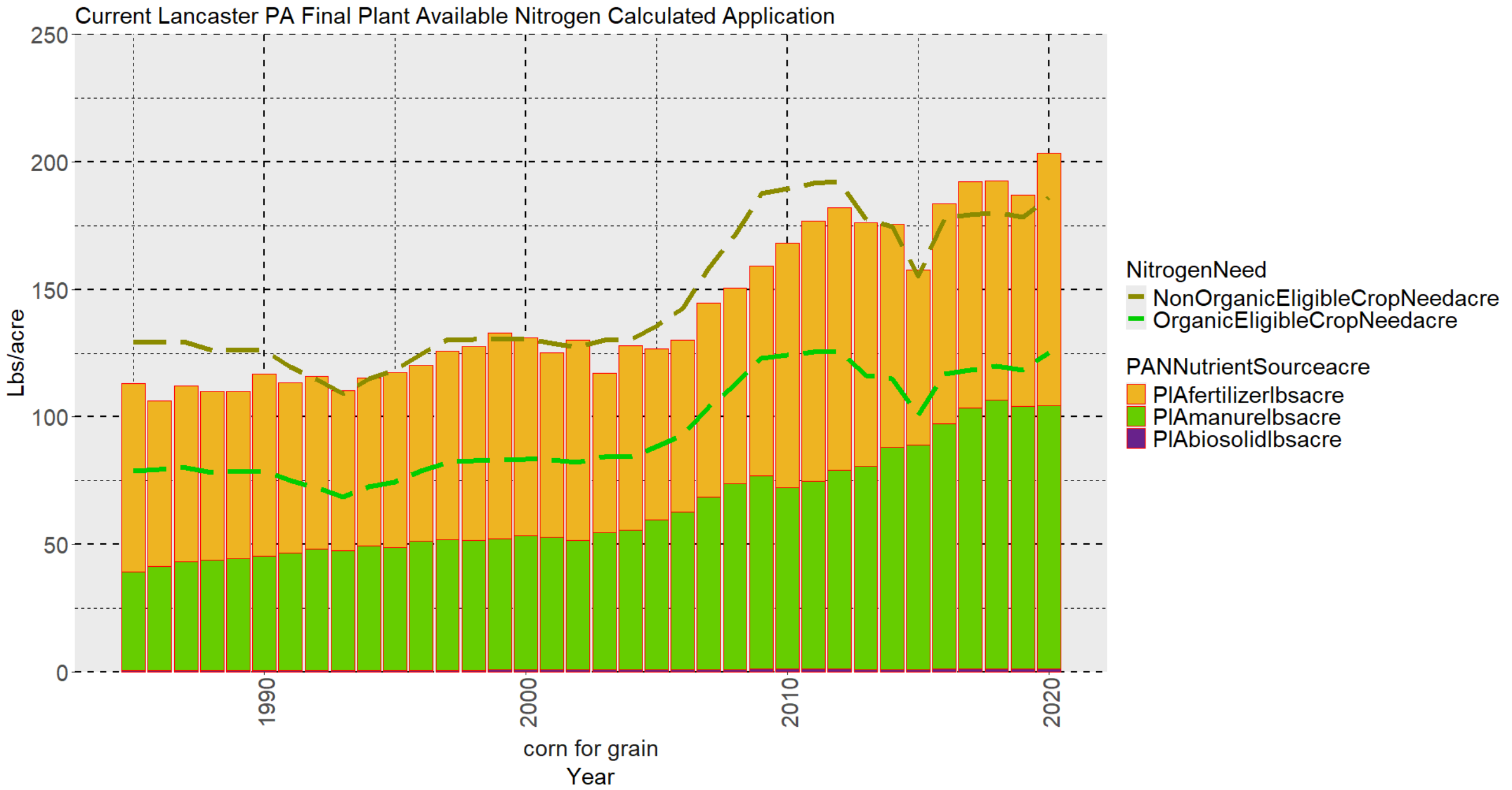
Current – The current Phase 6 CAST method	***Proposed*** – Proposed updated Phase 7 method
• Yields are unchanged from P6.	• Yields are updated with Joseph’s work.

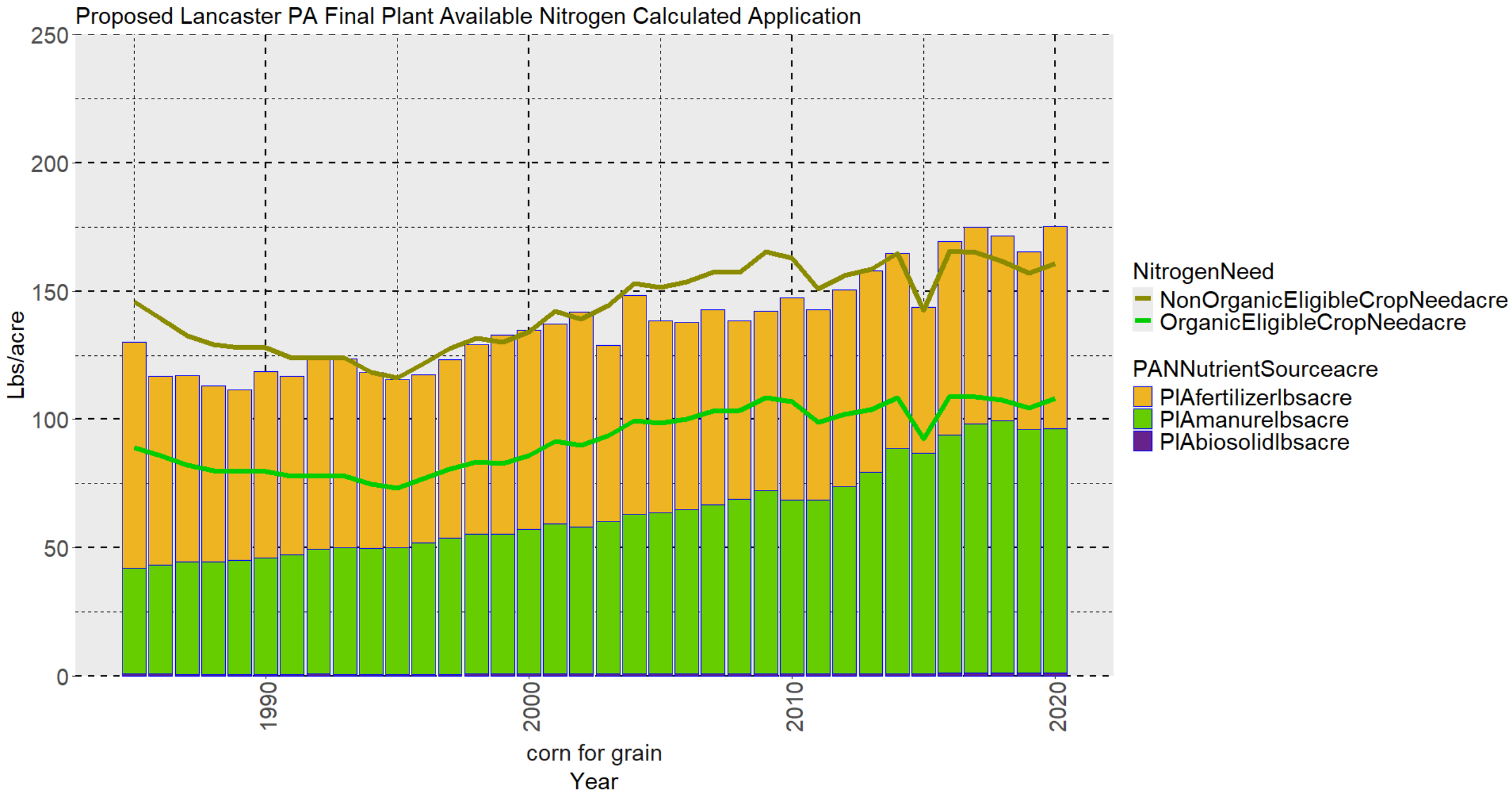

Total Watershed Yields
300,000,000
200,000,000
100,000,000
0
Yield
1990
2000
2010
2020
Year
Corn for Grain
Soybeans for Beans
Wheat for Grain
Dotted = Current
Solid = Proposed
CropName
alfalfa hay
barley for grain
buckwheat
corn for grain
corn for silage or greenchop
oats for grain
rye for grain
sorghum for grain
sorghum for silage or greenchop
soybeans for beans
wheat for grain

What about a county?

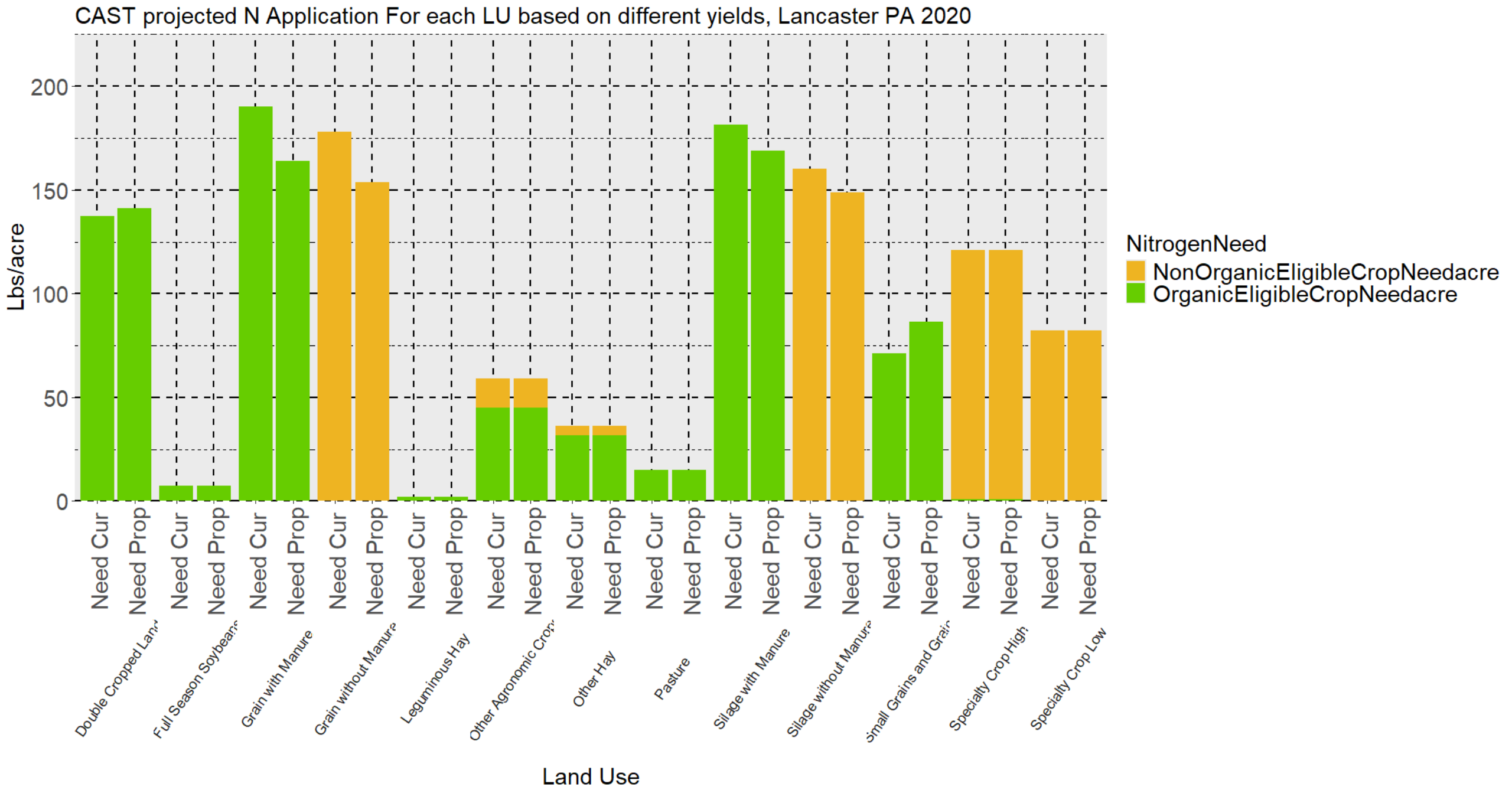
- Let’s try Lancaster:

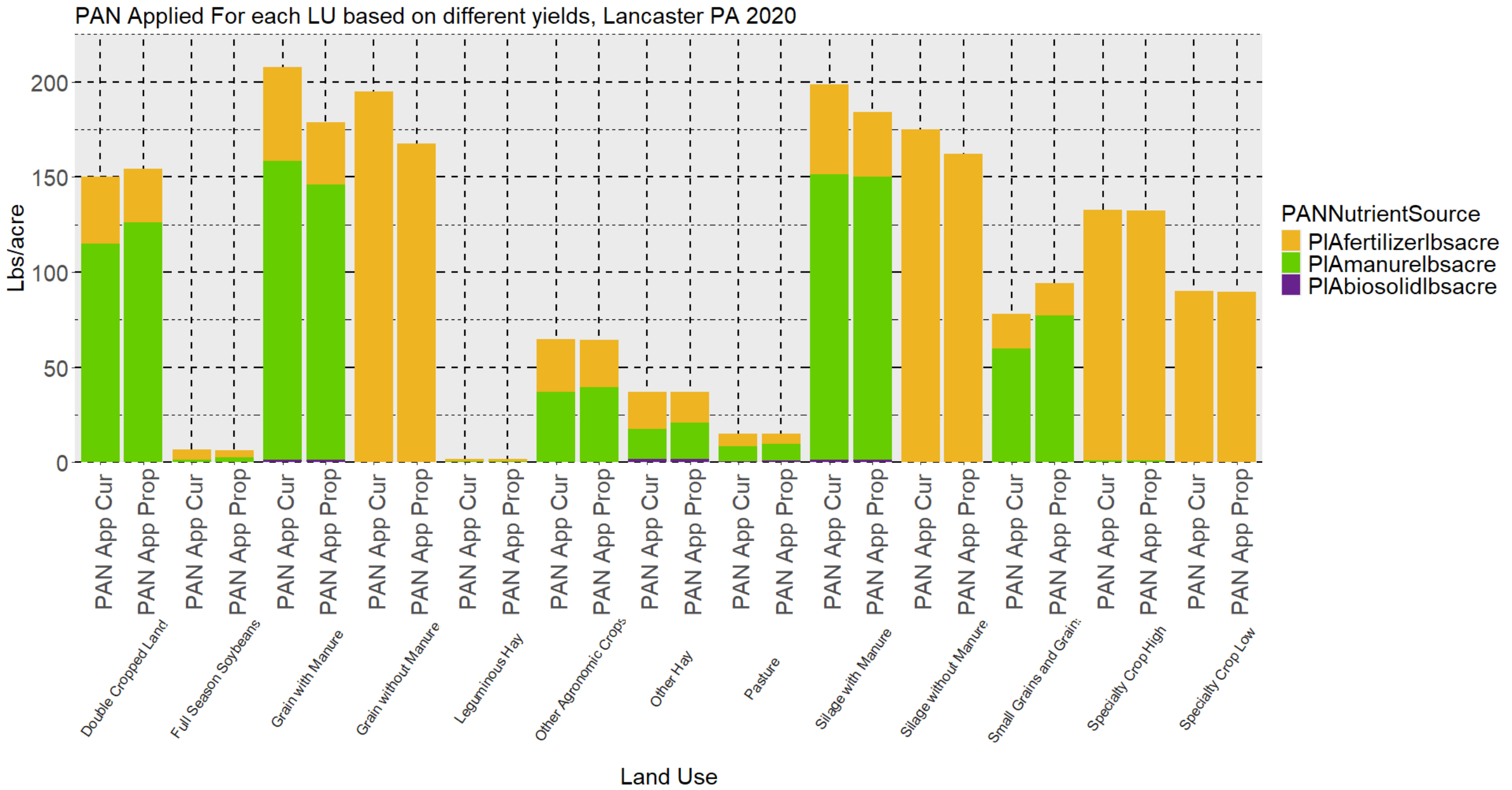

Lancaster, PA Yields per acre
Corn for Grain
Dotted = Current
Solid = Proposed
CropName
alfalfa hay
barley for grain
buckwheat
corn for grain
corn for silage or greenchop
oats for grain
rye for grain
sorghum for grain
sorghum for silage or greenchop
soybeans for beans
wheat for grain
Yield
Year
200
150
100
50
0
1990
2000
2010
2020


Current Lancaster PA Final Plant Available Nitrogen Calculated Application
250
200
150
100
50
0
Lbs/acre
1990
2000
2010
2020
corn for grain
Year
NitrogenNeed
NonOrganicEligibleCropNeedacre
OrganicEligibleCropNeedacre
PANNutrientSourceacre
PlAfertilizerlbsacre
PlAmanurelbsacre
PlAbiosolidlbsacre


Proposed Lancaster PA Final Plant Available Nitrogen Calculated Application
250
200
150
100
50
0
Lbs/acre
1990
2000
2010
2020
corn for grain
Year
NitrogenNeed
NonOrganicEligibleCropNeedacre
OrganicEligibleCropNeedacre
PANNutrientSourceacre
PlAfertilizerlbsacre
PlAmanurelbsacre
PlAbiosolidlbsacre

What about some Land Uses?


CAST projected N Application For each LU based on different yields, Lancaster PA 2020
Lbs/acre
200
150
100
50
0
Need Cur
Need Prop
Double Cropped Land
Full Season Soybeans
Grain with Manure
Grain without Manure
Leguminous Hay
Other Agronomic Crop
Other Hay
Pasture
Silage with Manure
Silage without Manure
Small Grains and Grain
Specialty Crop High
Specialty Crop Low
Land Use
NitrogenNeed
NonOrganicEligibleCropNeedacre
OrganicEligibleCropNeedacre


PAN Applied For each LU based on different yields, Lancaster PA 2020
Lbs/acre
200
150
100
50
0
PAN App Cur
PAN App Prop
Double Cropped Land
Full Season Soybeans
Grain with Manure
Grain without Manure
Leguminous Hay
Other Agronomic Crops
Other Hay
Pasture
Silage with Manure
Silage without Manure
Small Grains and Grain
Specialty Crop High
Specialty Crop Low
Land Use
PANNutrientSource
PlAfertilizerlbsacre
PlAmanurelbsacre
PlAbiosolidlbsacre

Summary

- Variation in each county
- Driven by several factors
  - Yield
  - Acres
  - Nutrient Management
- Nutrients are applied in excess (generally)
  - Fertilizer

Questions?

Let’s discuss

- Is crop yield looking better?
- Do these applications look reasonable?
- Is an appropriate amount of nutrient used?