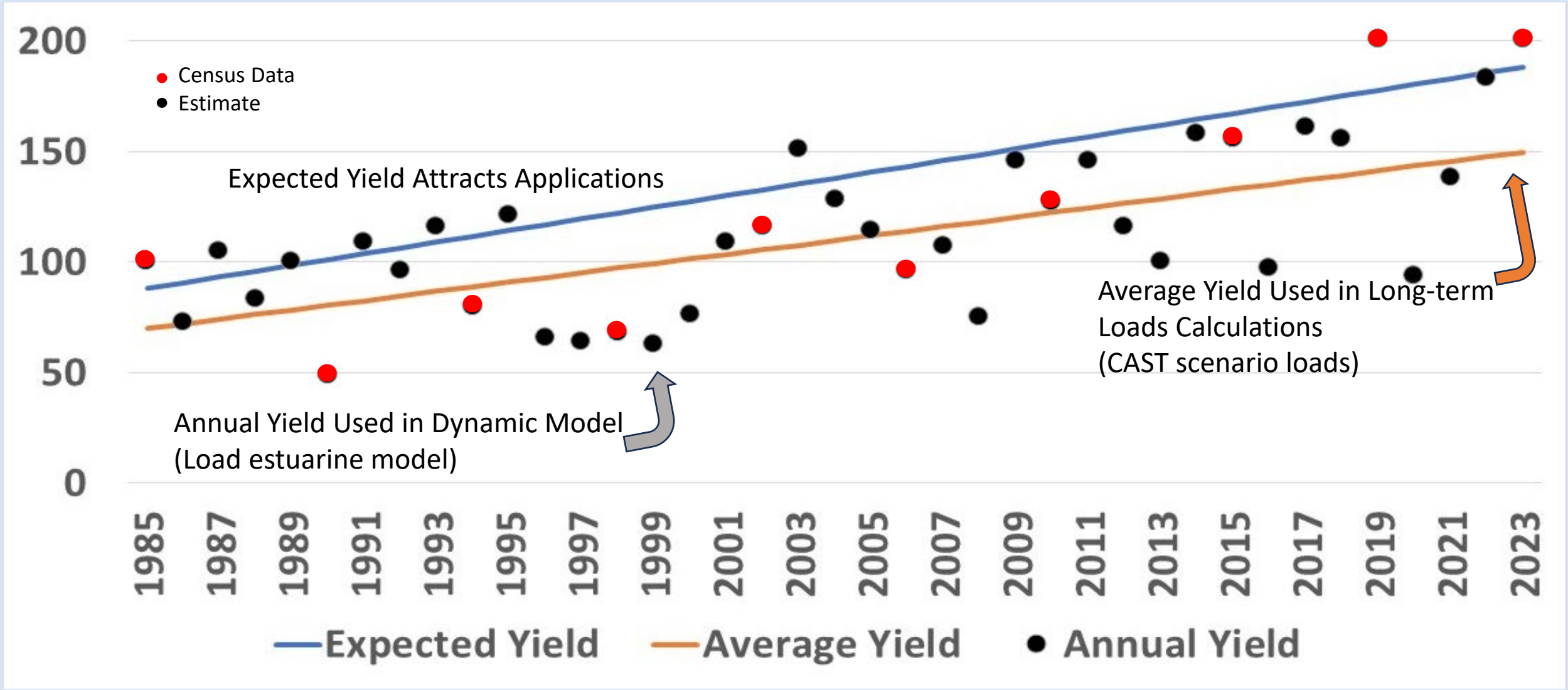
Crop Yields

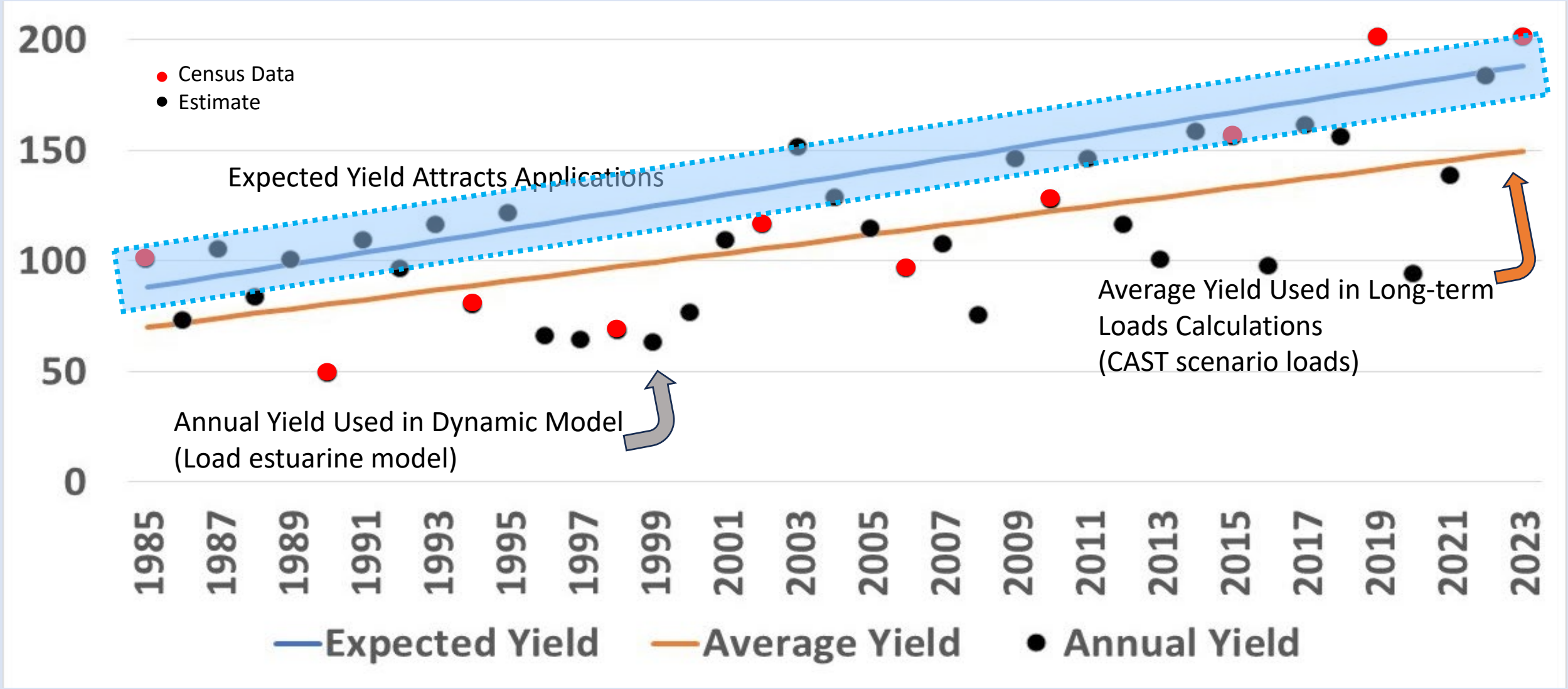
Tom Butler, EPA

10/11/2024

*EXAMPLE
DATA ONLY



*EXAMPLE
DATA ONLY



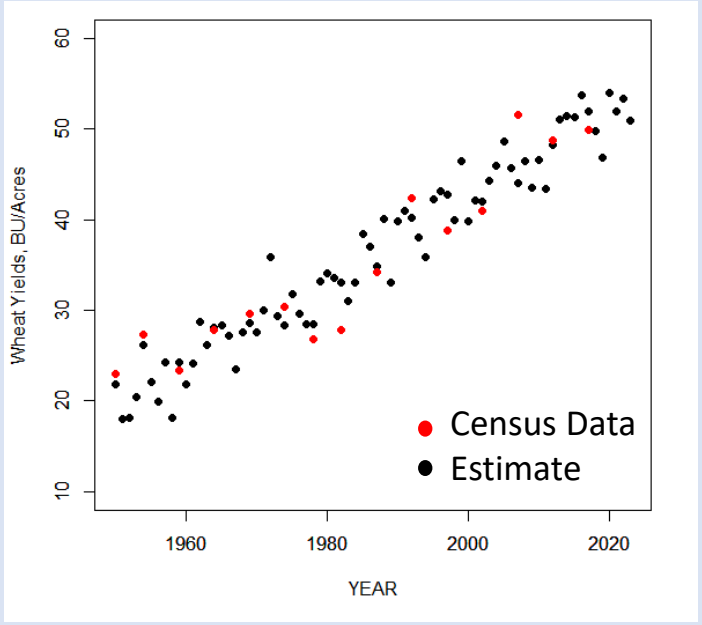
Path of investigation

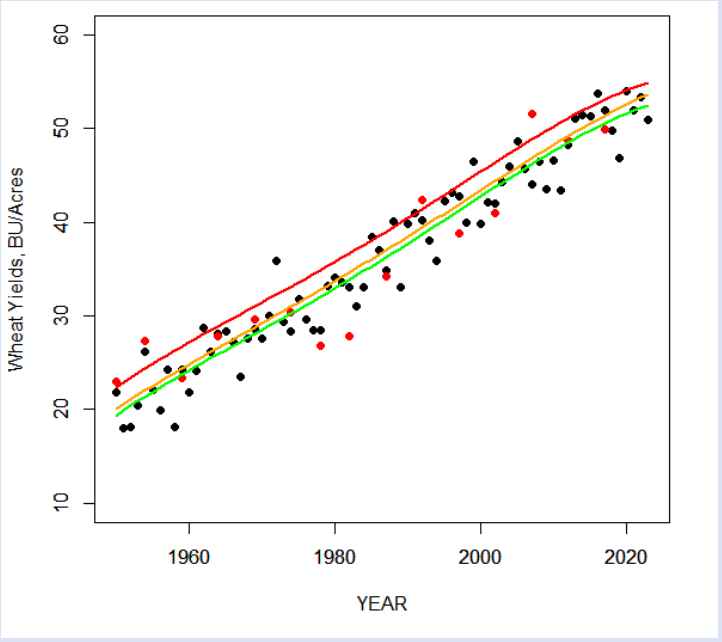
Goals:

- 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

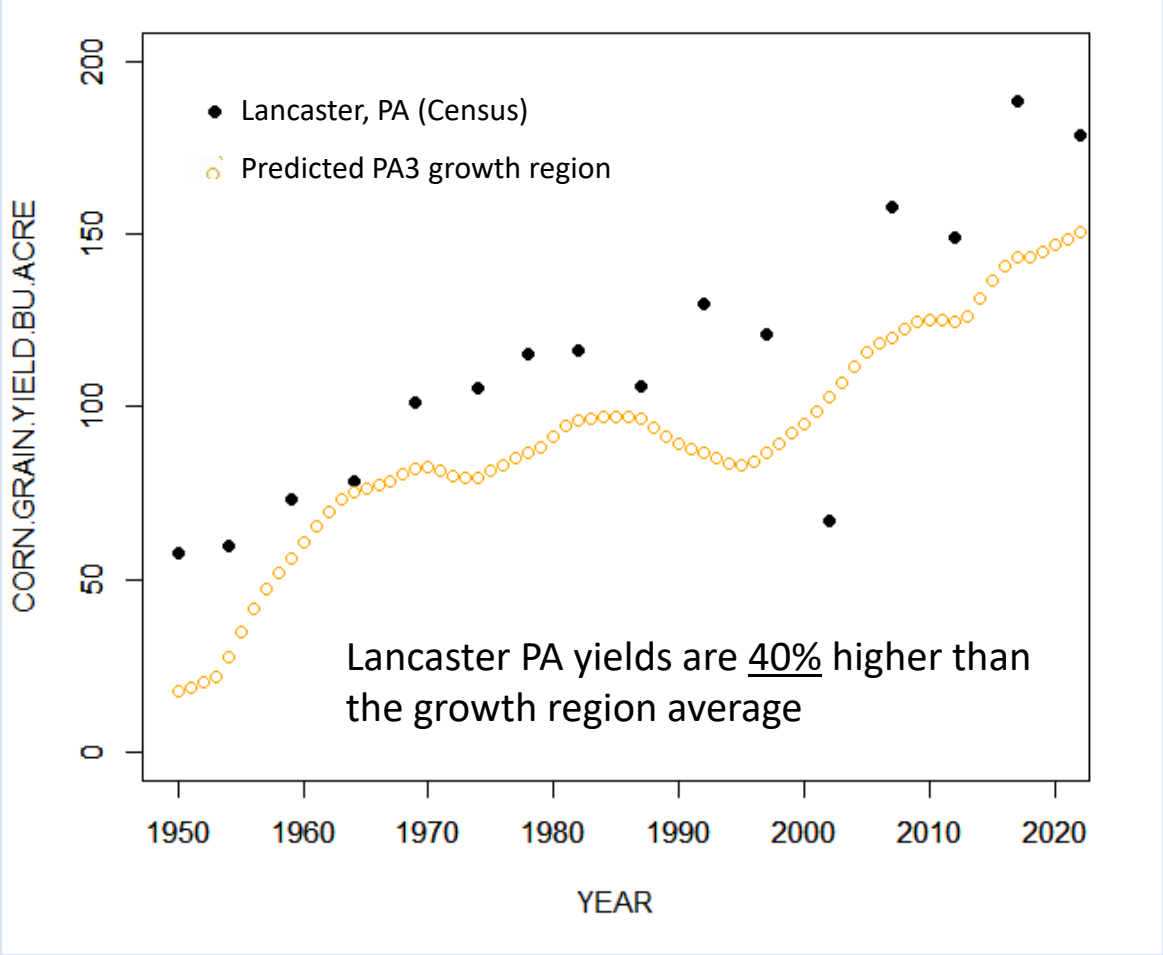
USDA Census and Survey data





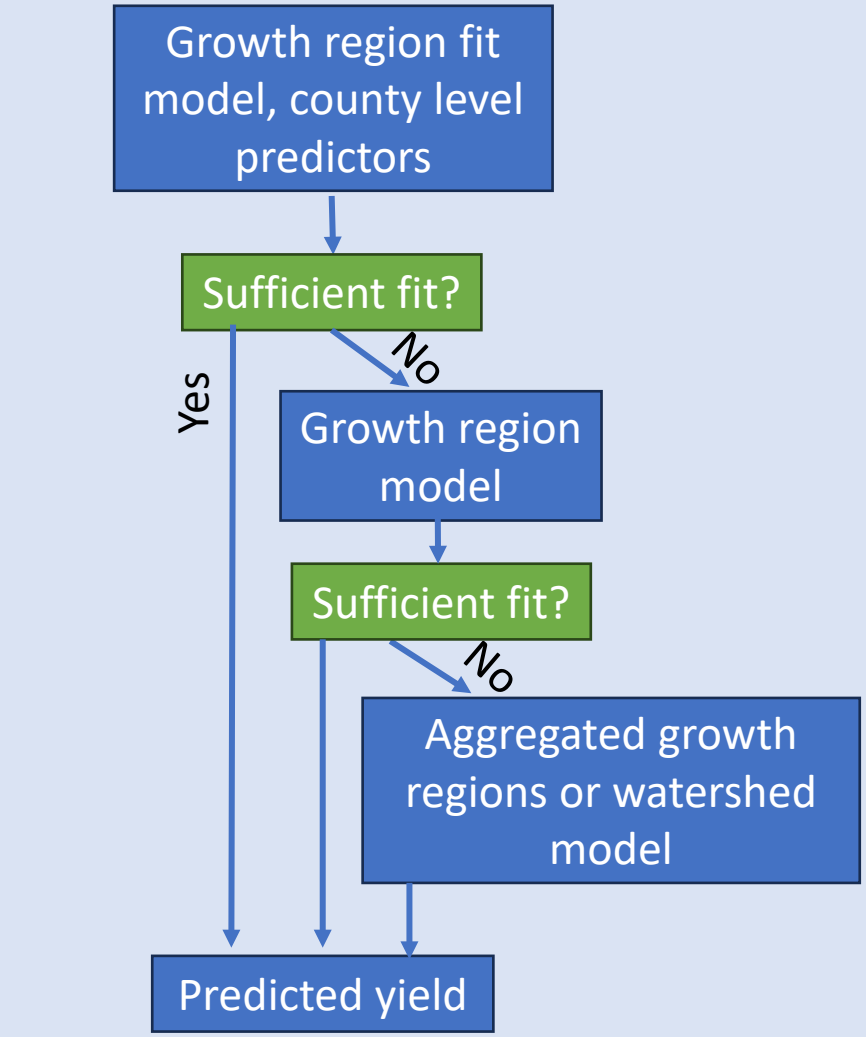
Continued improvements

- 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.

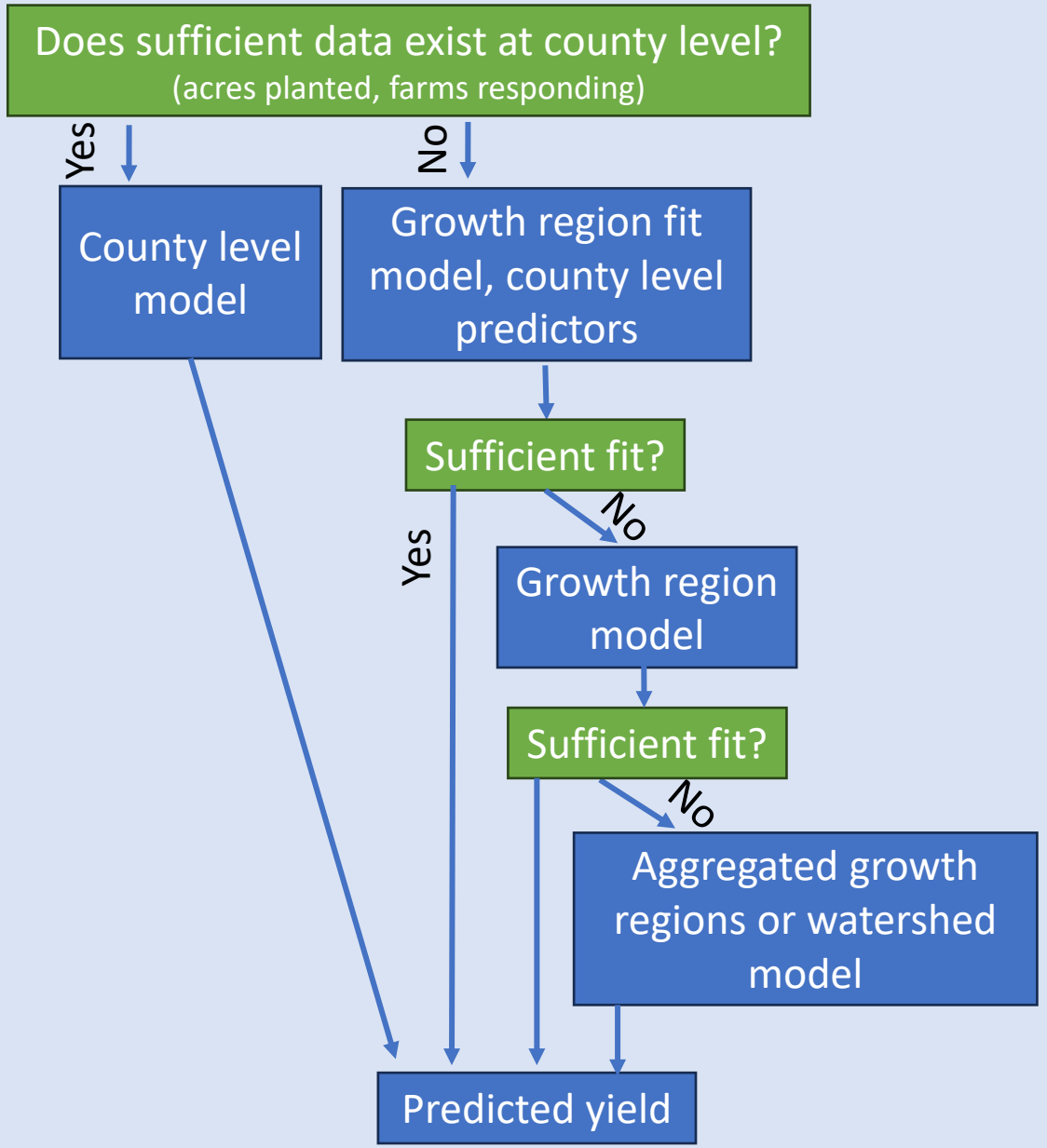


Solution

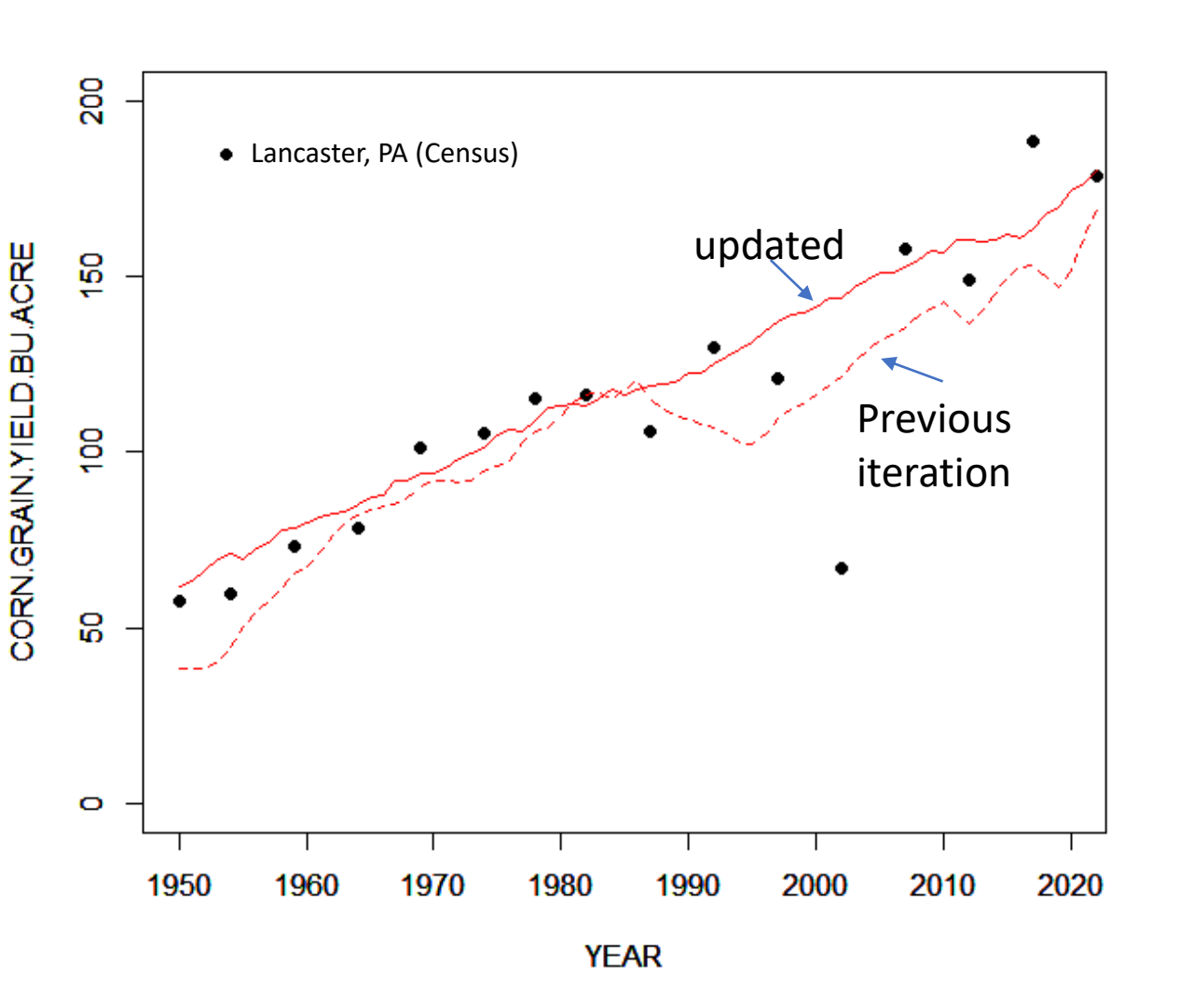
Joseph's current method



Joseph's proposed solution

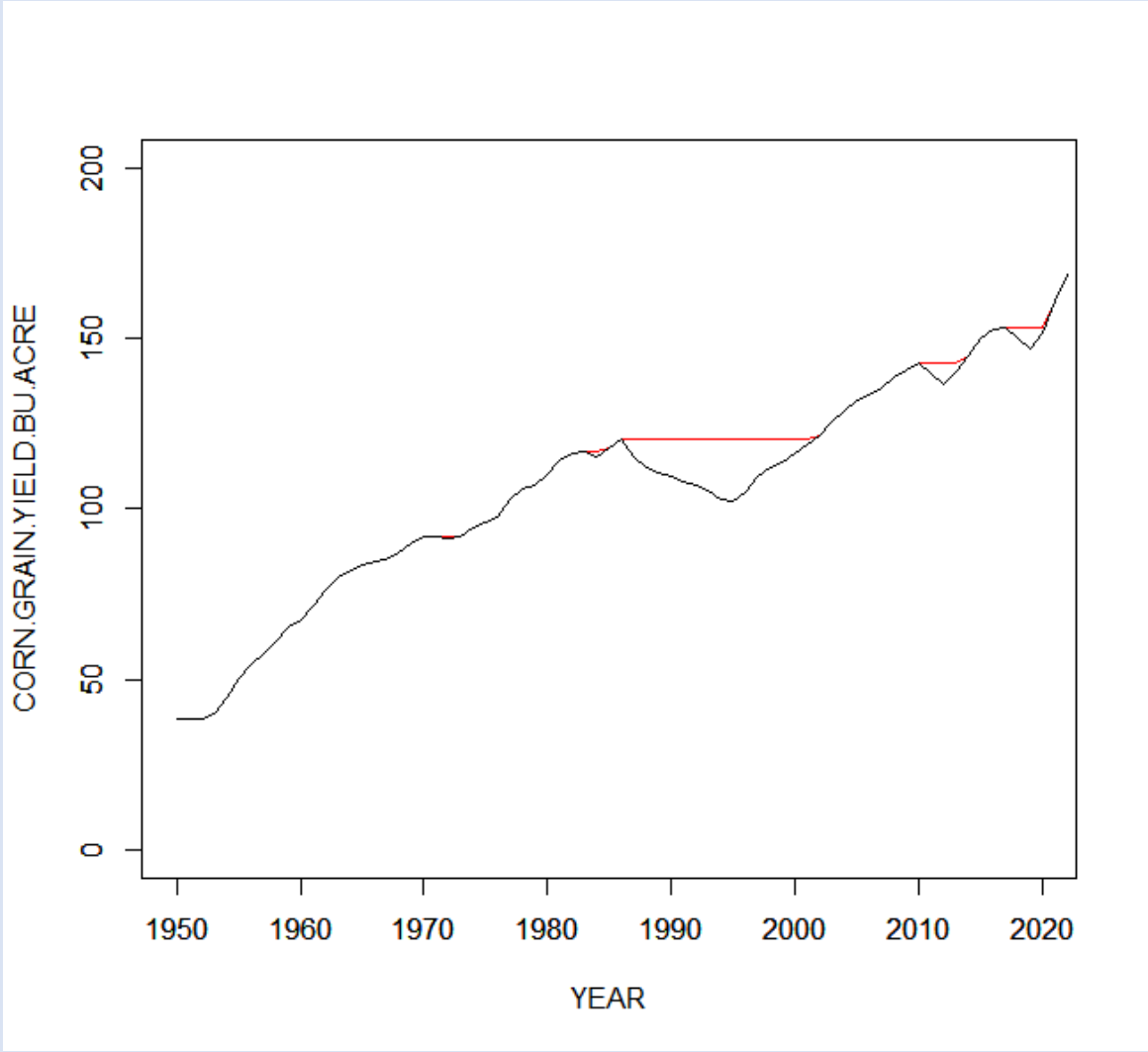


Preliminary results of proposed solution for Lancaster, PA



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:

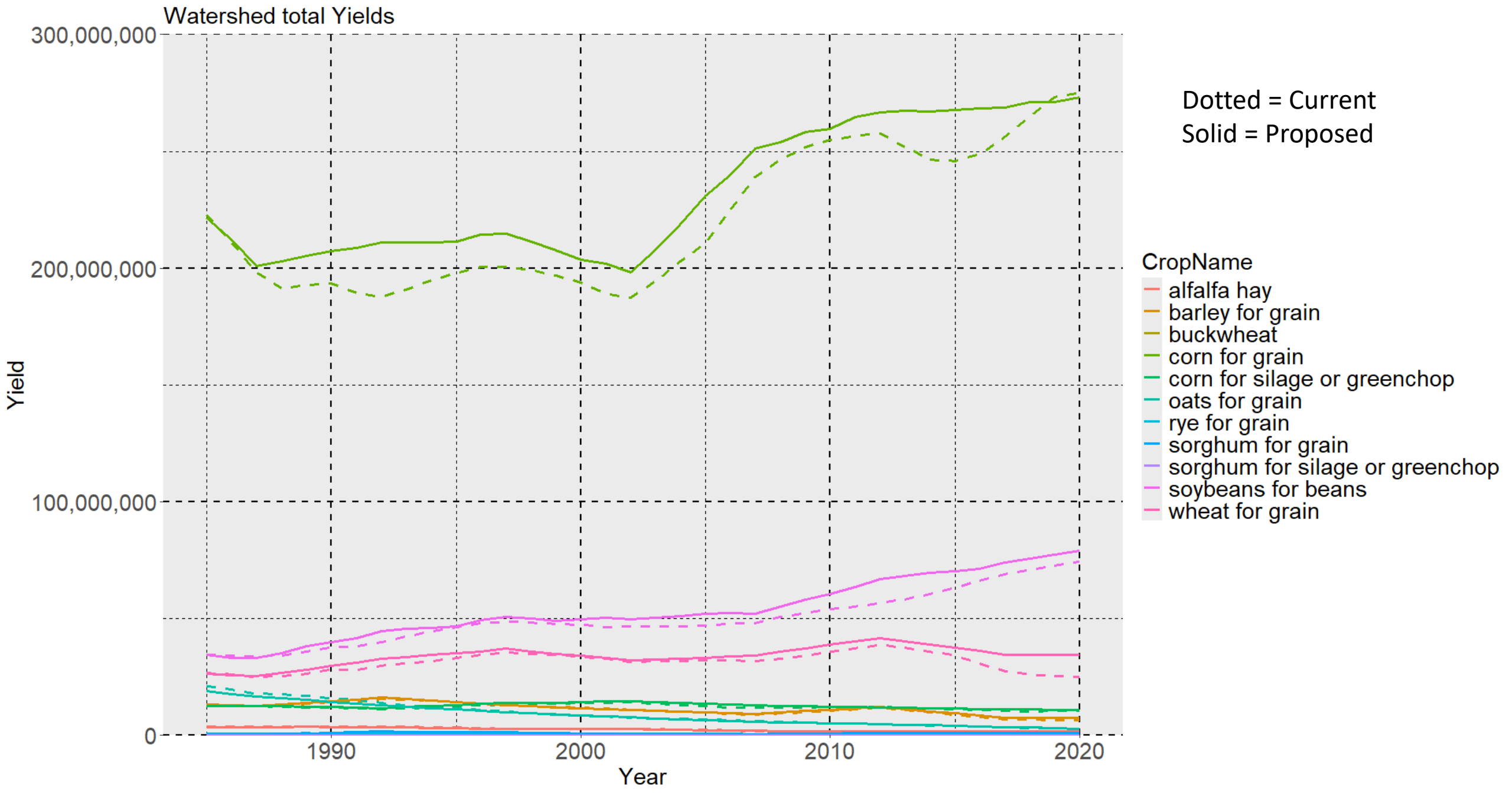
- alfalfa hay
- barley for grain
- corn for silage or greenchop
- sorghum for grain
- soybeans for beans
- wheat for grain
- soybeans for beans
- corn for grain
- sorghum for grain
- corn for grain
- sorghum for grain

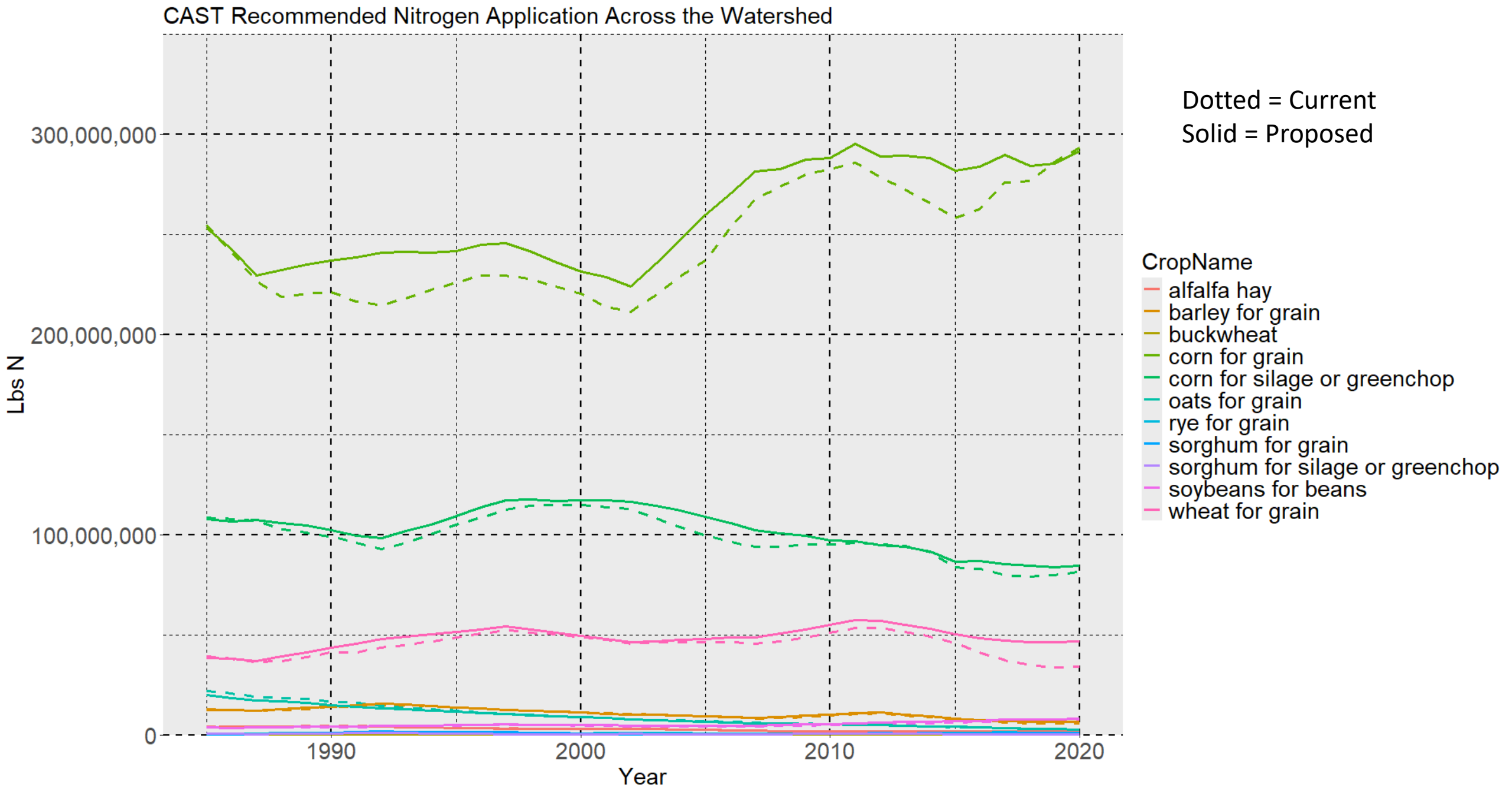
Let’s look at some CAST scenarios:

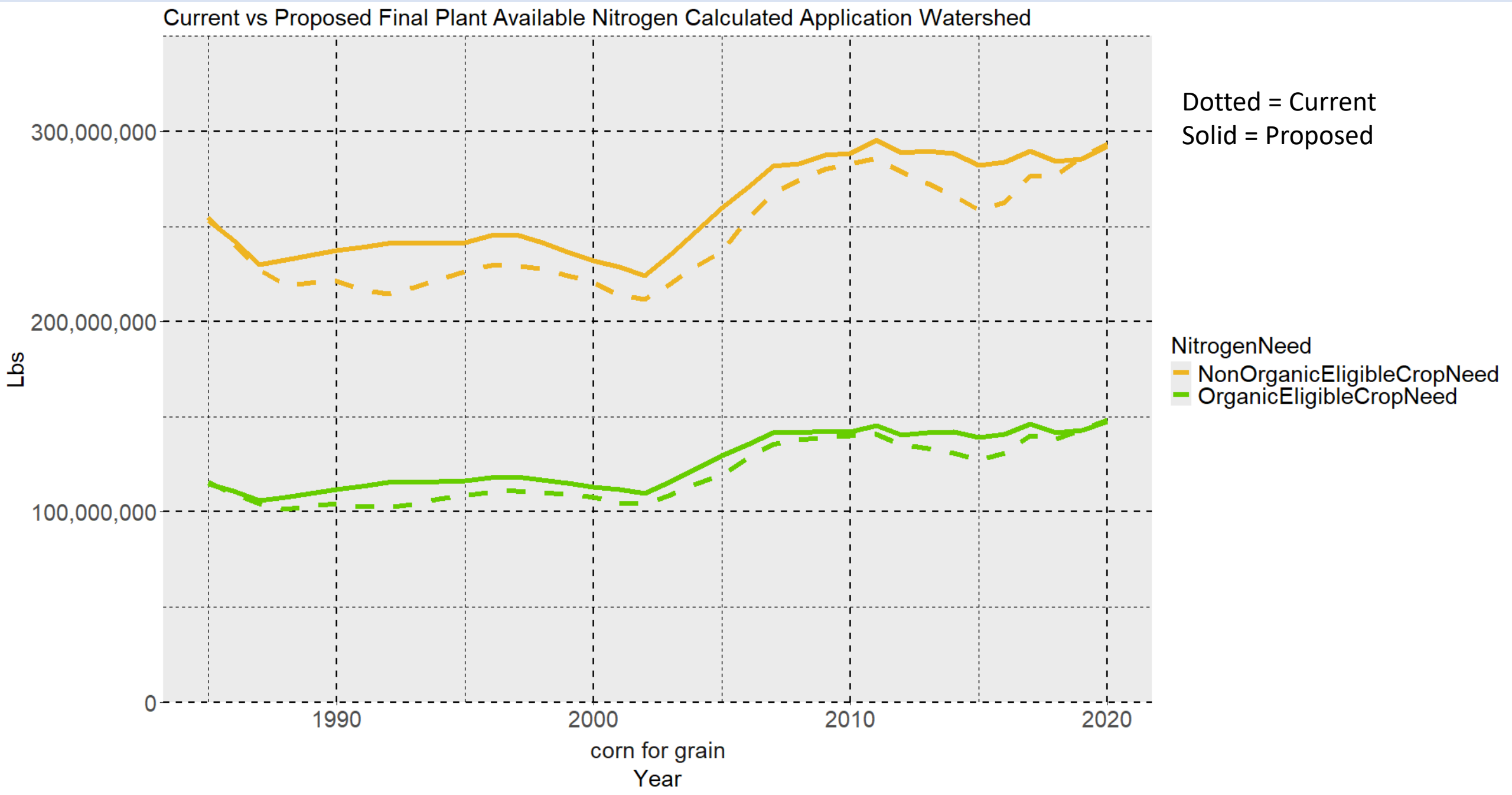
Keeping in mind that continued improvement are expected to increase the yield attracting application by ~5% increasing the recommended application.

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.

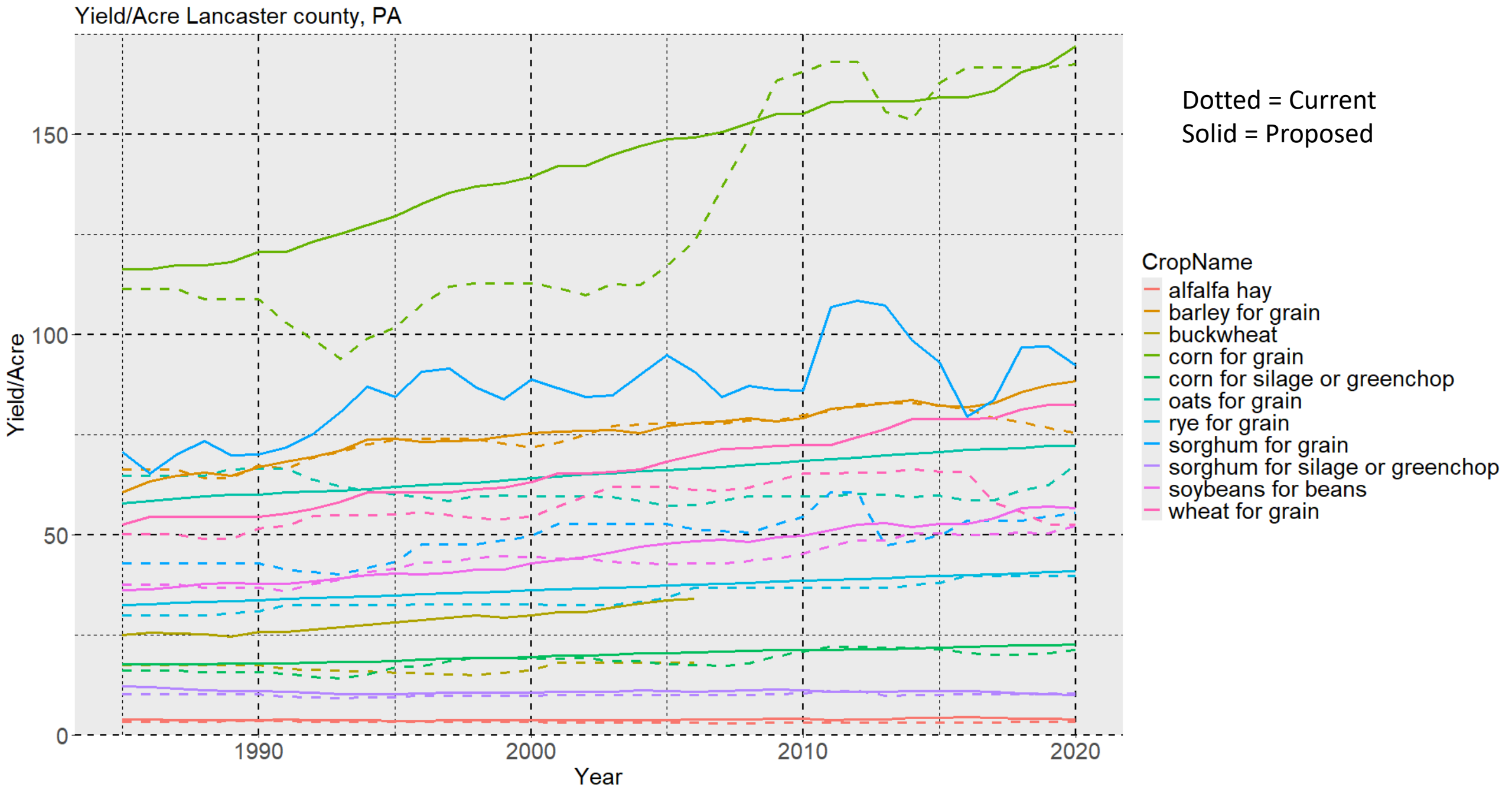
At the watershed level

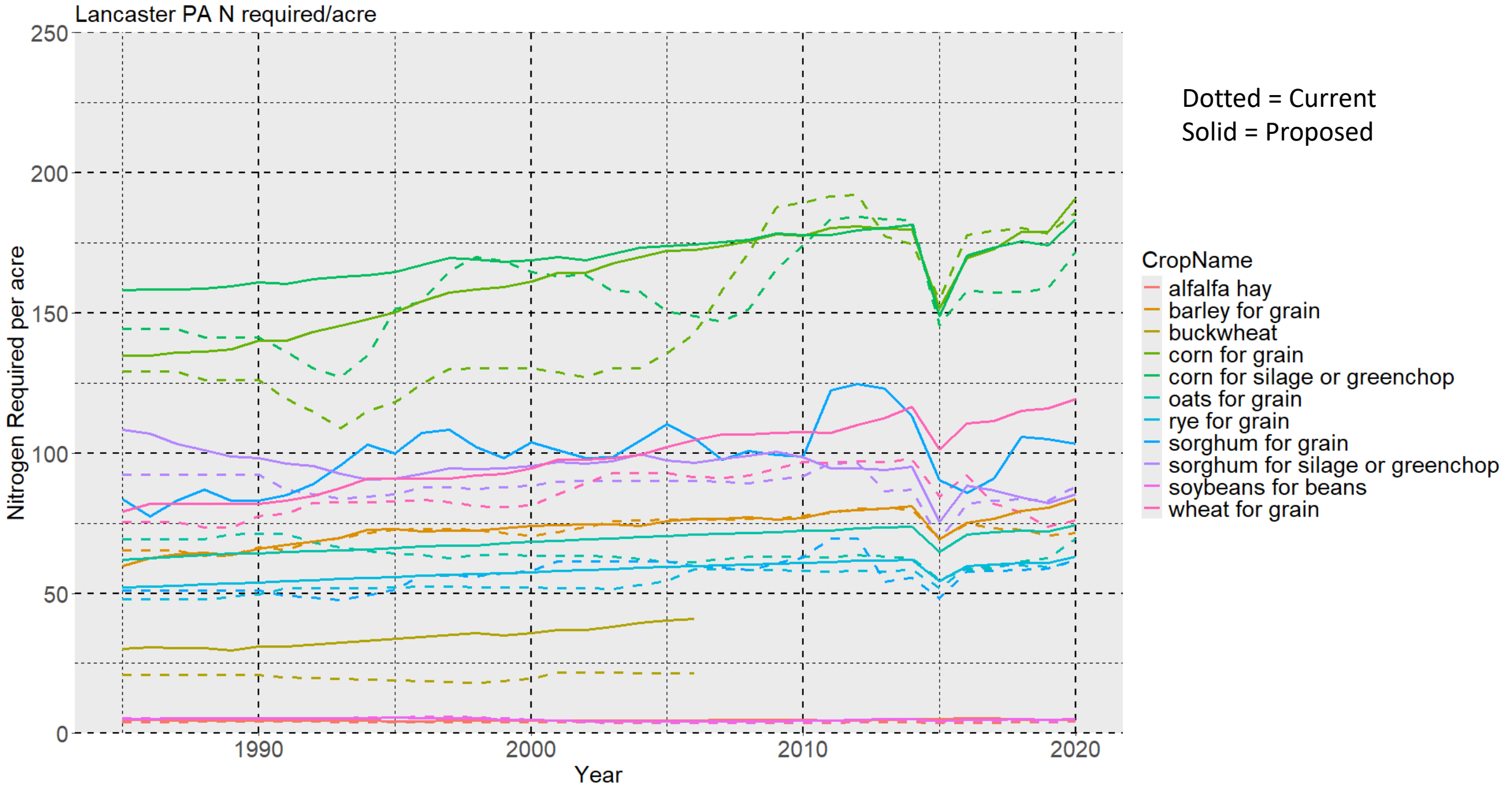

Watershed total Yields
300,000,000
200,000,000
100,000,000
0
Yield
1990
2000
2010
2020
Year
Dotted = Current
Solid = Proposed
CropName
alfalfa hay
barley for grain
buckwheat
corn for grain
corn for silage or greenchop
oats for grain
rye for grain
sorghum for grain
sorghum for silage or greenchop
soybeans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

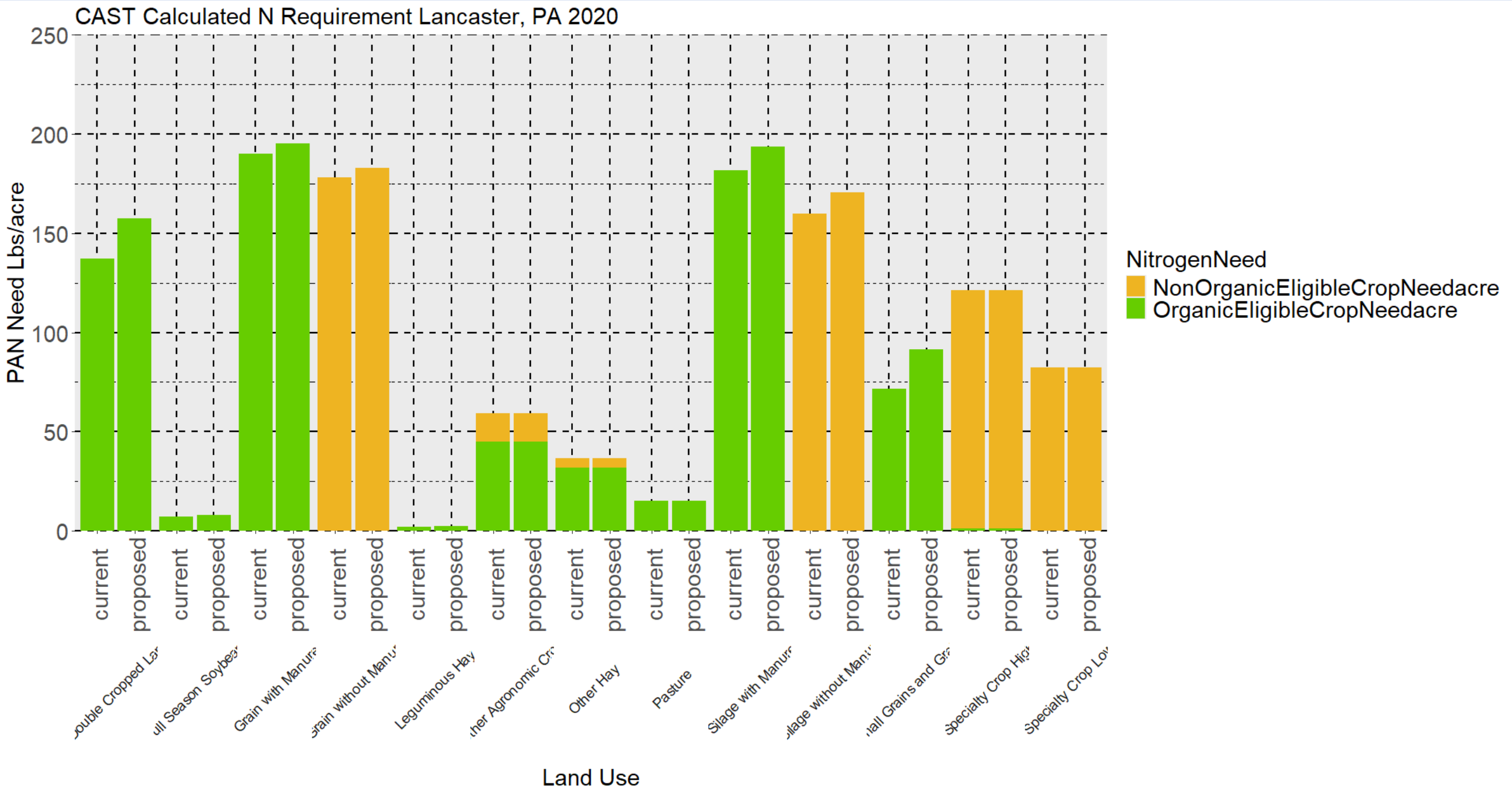

CAST Recommended Nitrogen Application Across the Watershed
300,000,000
200,000,000
100,000,000
0
Lbs N
1990
2000
2010
2020
Year
Dotted = Current
Solid = Proposed
CropName
alfalfa hay
barley for grain
buckwheat
corn for grain
corn for silage or greenchop
oats for grain
rye for grain
sorghum for grain
sorghum for silage or greenchop
soybeans for beans
wheat for grain


Current vs Proposed Final Plant Available Nitrogen Calculated Application Watershed
300,000,000
200,000,000
100,000,000
0
Lbs
1990
2000
2010
2020
corn for grain
Year
Dotted = Current
Solid = Proposed
NitrogenNeed
NonOrganicEligibleCropNeed
OrganicEligibleCropNeed

Lancaster County, PA


Yield/Acre Lancaster county, PA
Yield/Acre
150
100
50
0
1990
2000
2010
2020
Year
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


Lancaster PA N required/acre
Nitrogen Required per acre
250
200
150
100
50
0
1990
2000
2010
2020
Year
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


CAST Calculated N Requirement Lancaster, PA 2020
PAN Need Lbs/acre
250
200
150
100
50
0
current
proposed
Land Use
NitrogenNeed
NonOrganicEligibleCropNeedacre
OrganicEligibleCropNeedacre
Other Hay
Pasture
Specialty Crop Low

Decision:

Proposed decisions:

Should this new statistical framework be used to determine long term crop yield trends?