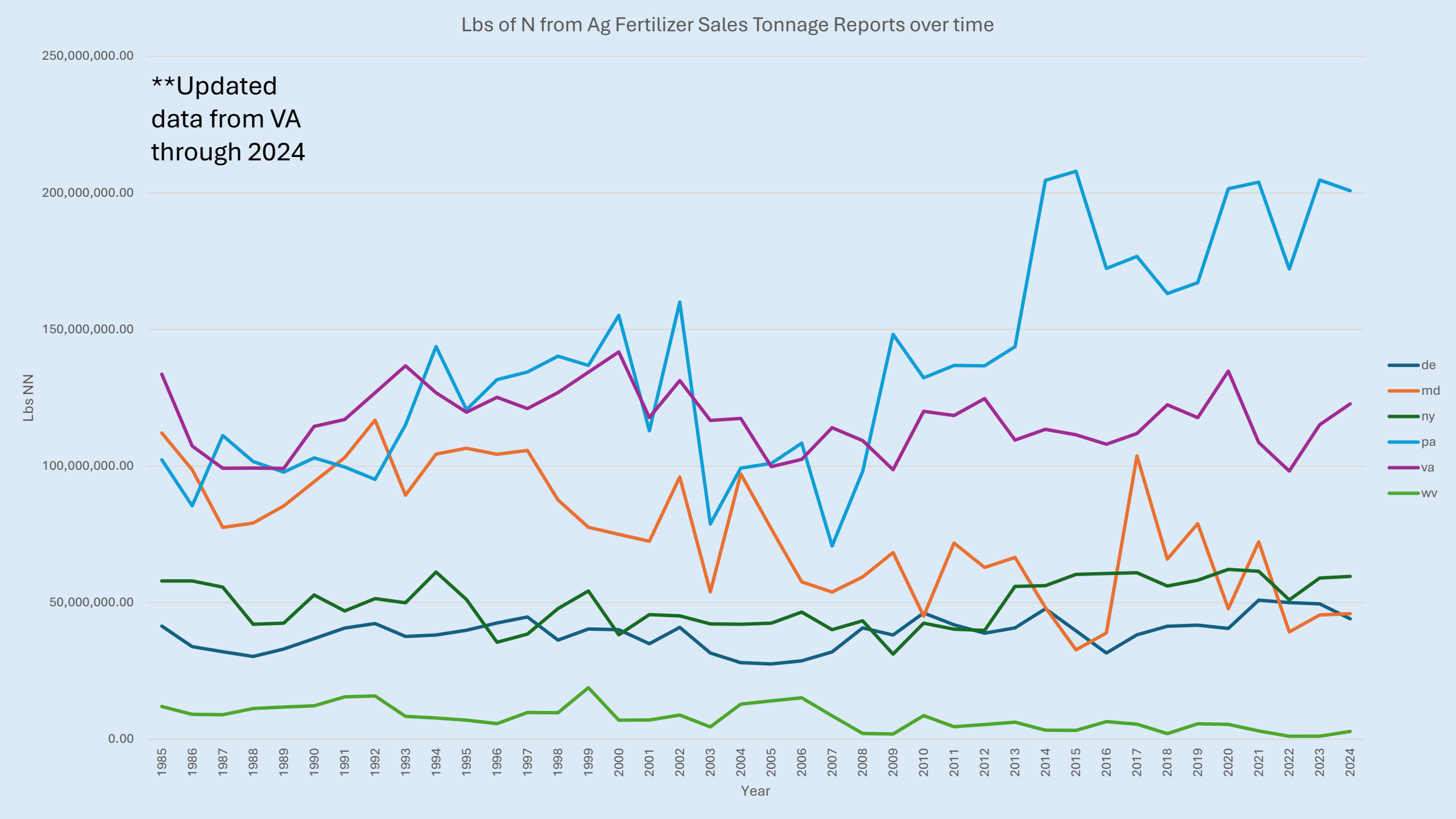
Inorganic Fertilizer November AMT

11/14/2025

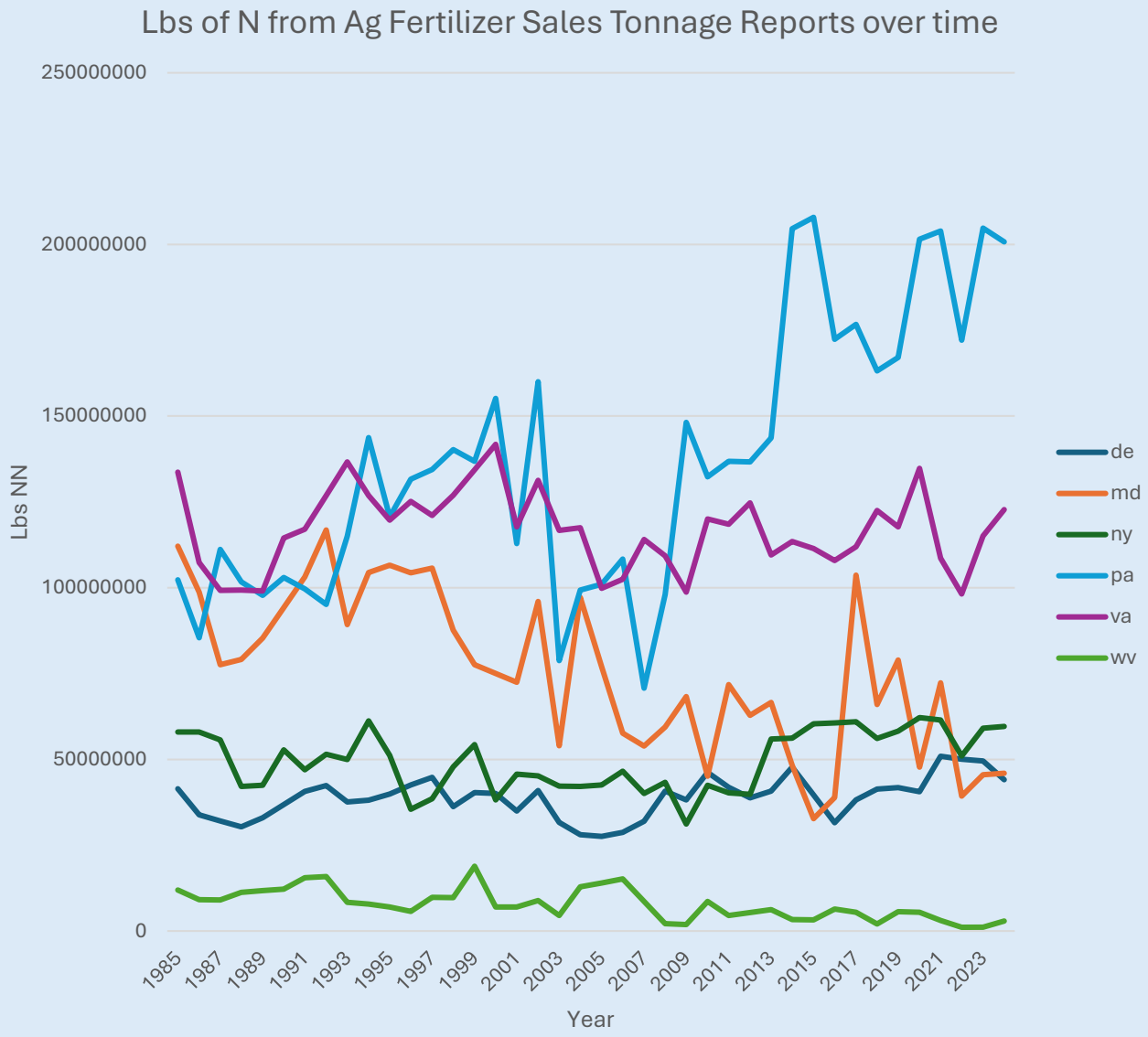
Inorganic Fertilizer Progress to date

- June 2025
  1. Fertilizer Data Trend walkthrough
  2. Requested update to state supplied data
  3. State Scale fertilizer stock investigation
- July 2025
  - State Scale fertilizer stock analysis
  - Decision to move to state scale
- August 2025
  - Alternative fertilizer modeling presentation
- October 2025
  - 1) Filling data gaps
  - 1) How to smooth


Lbs of N from Ag Fertilizer Sales Tonnage Reports over time
**Updated data from VA through 2024
250,000,000.00
200,000,000.00
150,000,000.00
100,000,000.00
50,000,000.00
0.00
Lbs NN
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
de
md
ny
pa
va
wv

How to smooth:

- High variability in sales
- Hard to plan for this
- Try to create a smooth long term trend
  - Greater confidence that real behaviors are being captured



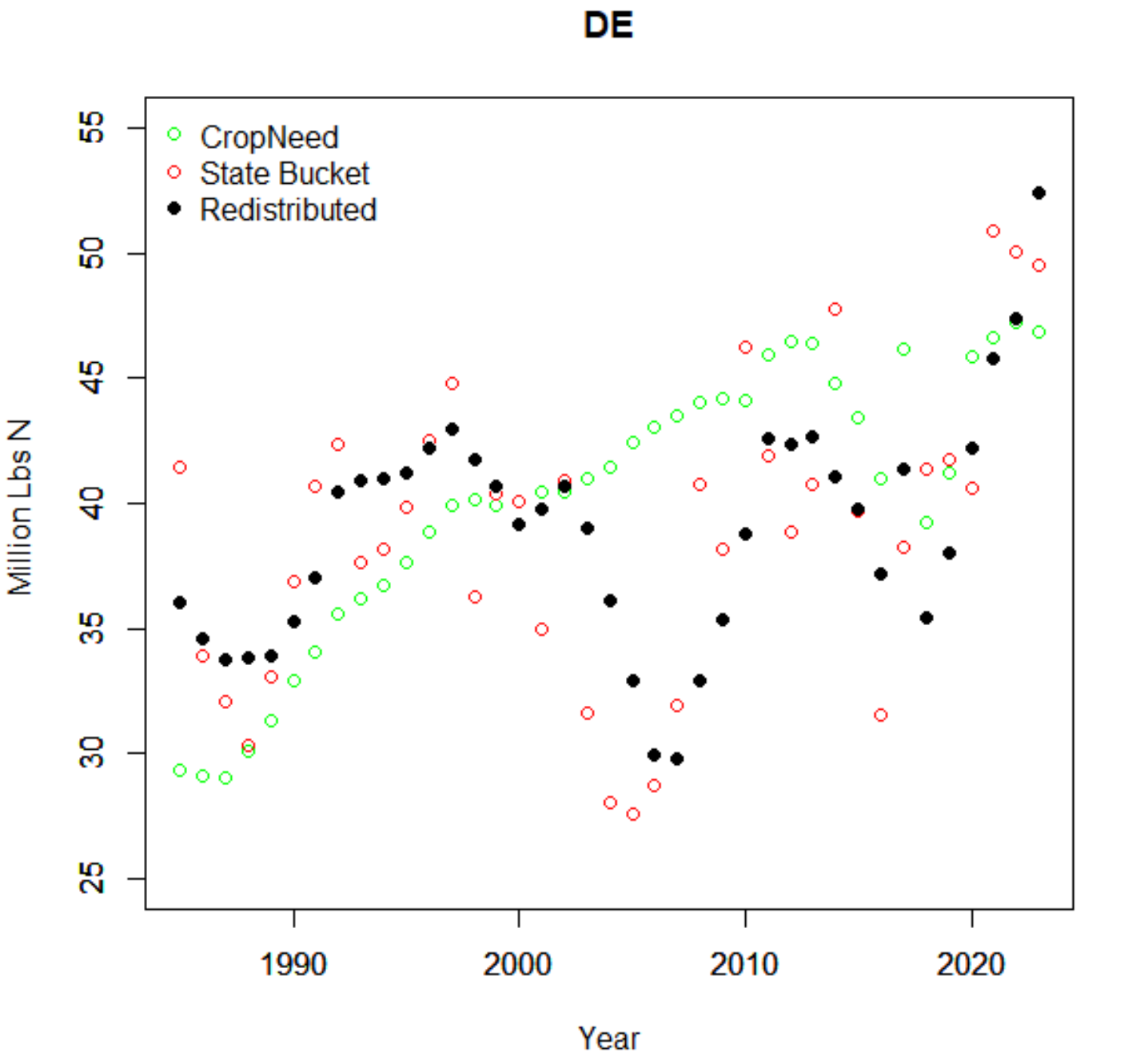
State fertilizer sales temporal redistribution to estimate applications

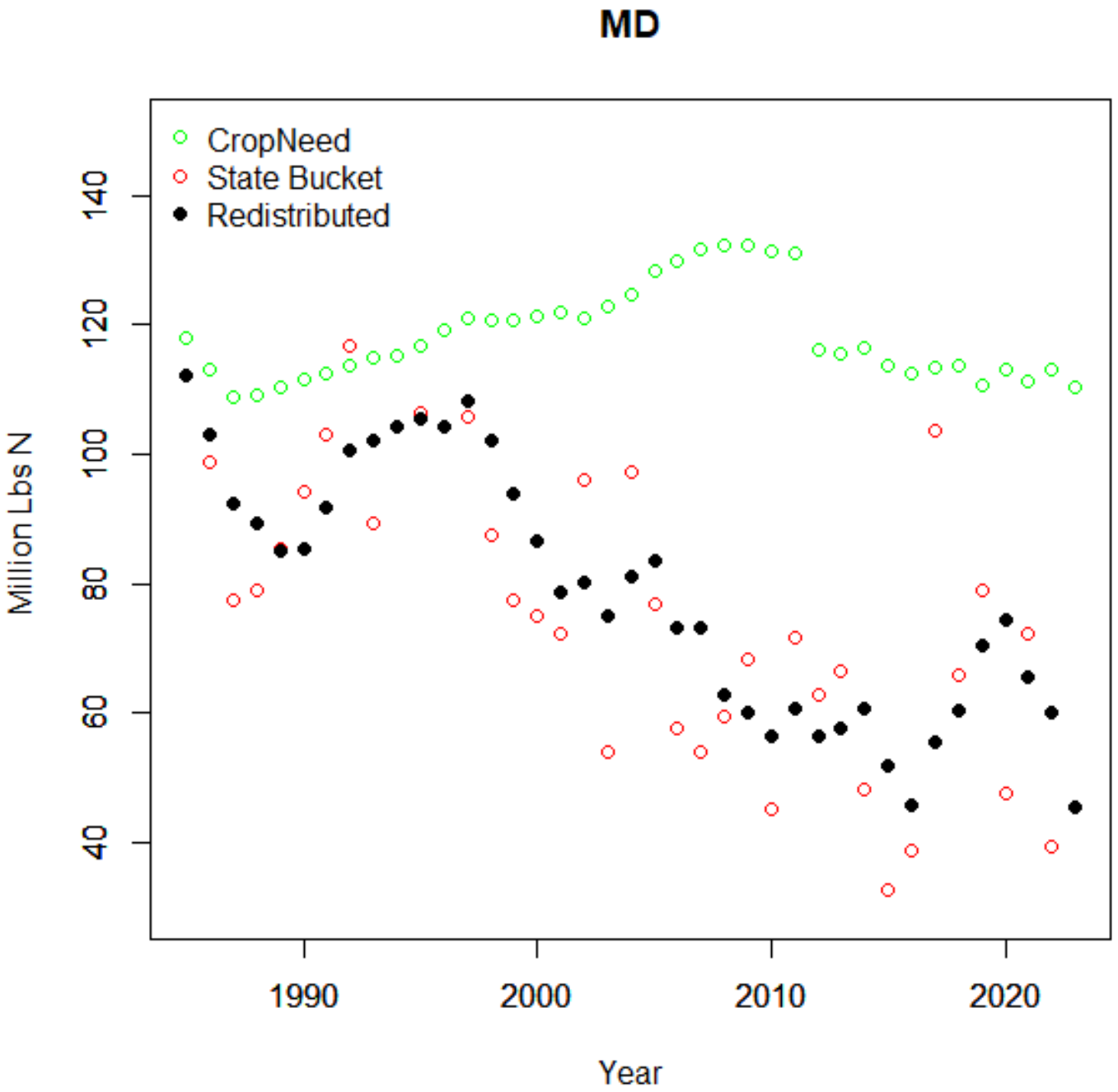
Stage one: Allocate surplus at time t to t, t+1, t+2, t+3 to meet need (or proportional to the deficit if need can't be met). Applies only to years t with a surplus, defined as sales exceeding estimated crop need.

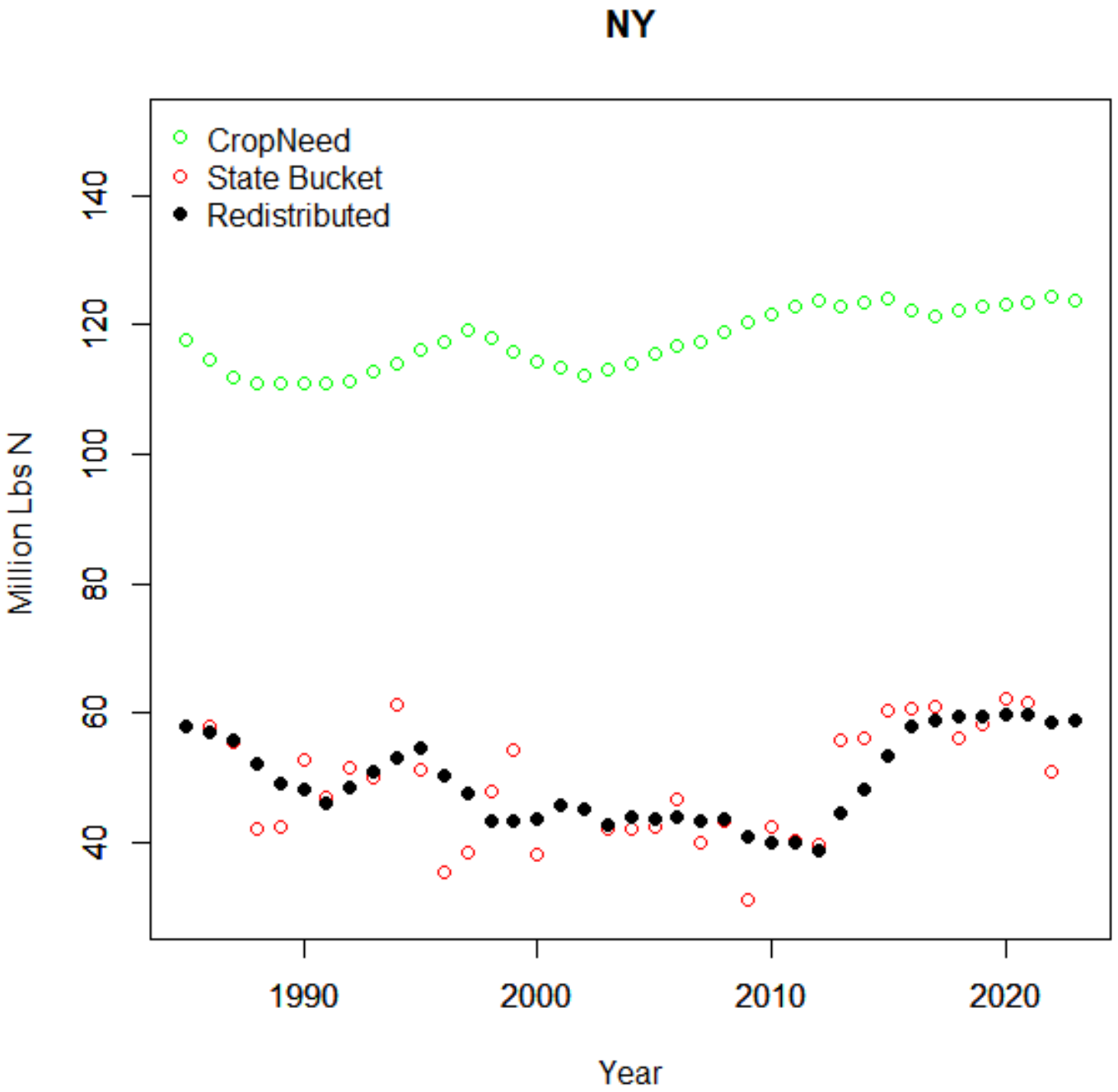
Stage two: Redistribute sale at times t:t+3 to t, t+1, t+2, t+3 proportional to crop need (right aligned crop need weighted moving window average). Applies to all years t.

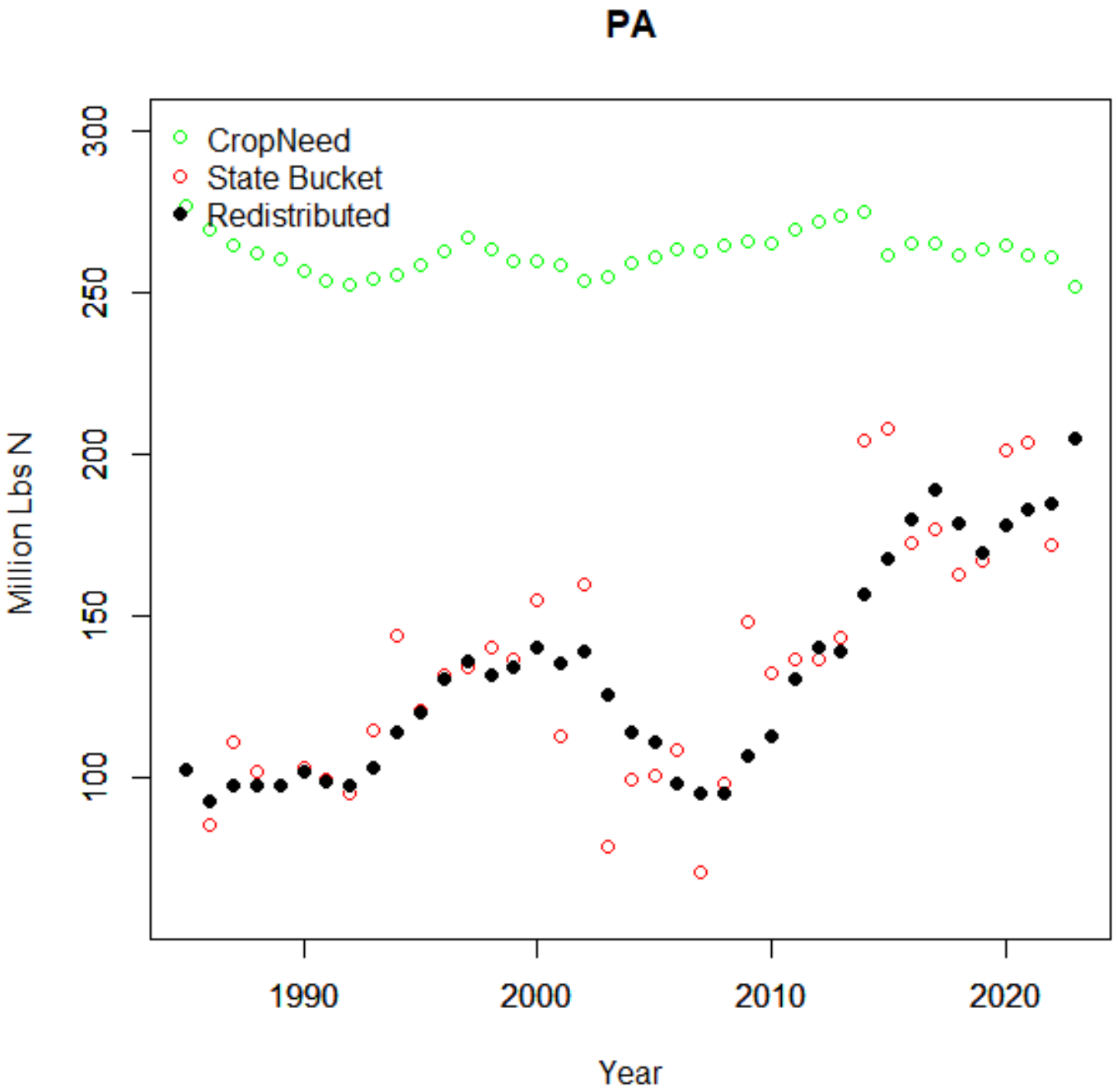
Notes:

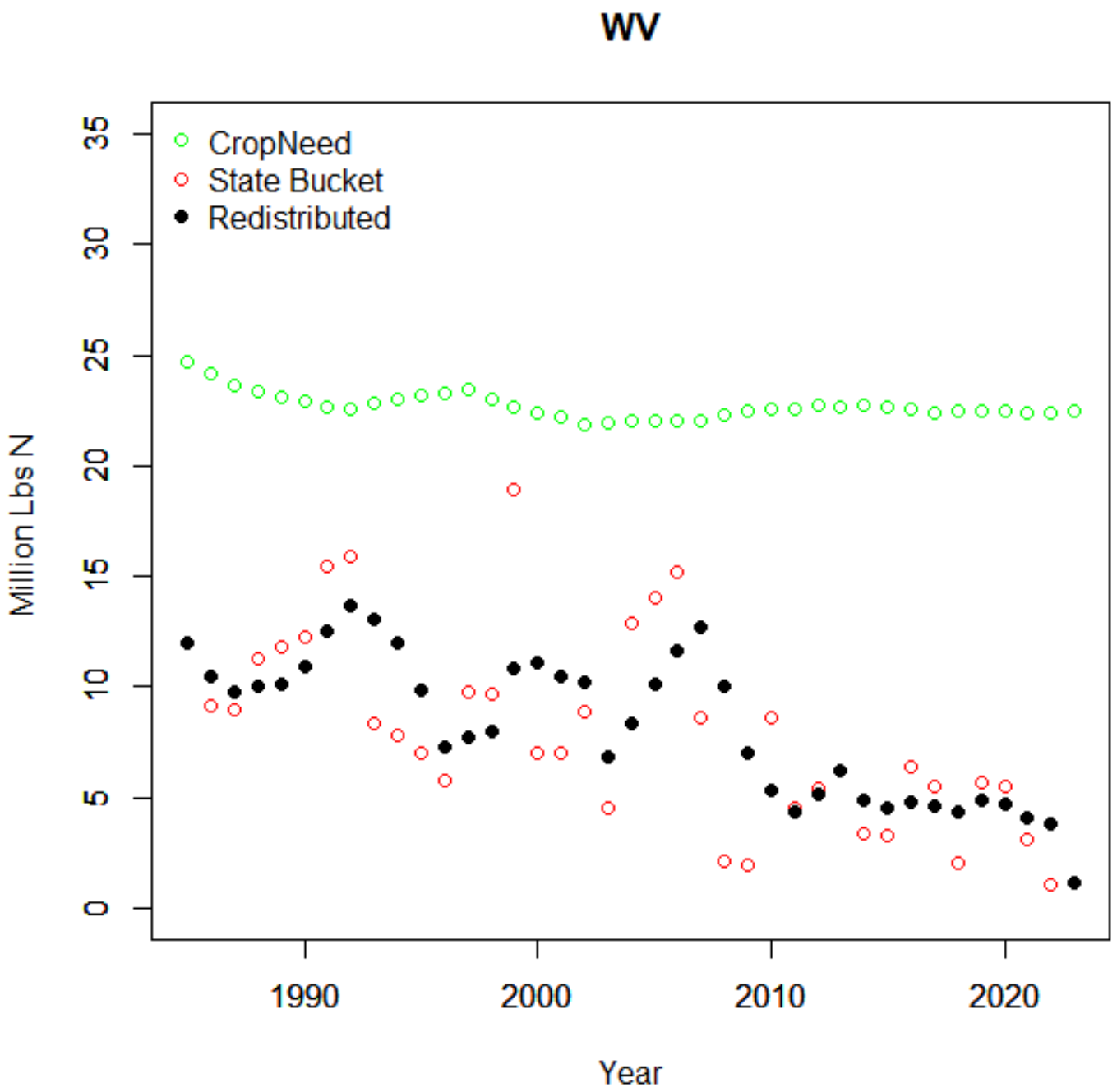
- Stage two final year application = sales. I.e., if there is no surplus in the final 4 years, application = sales. A "final year" rule can be added.

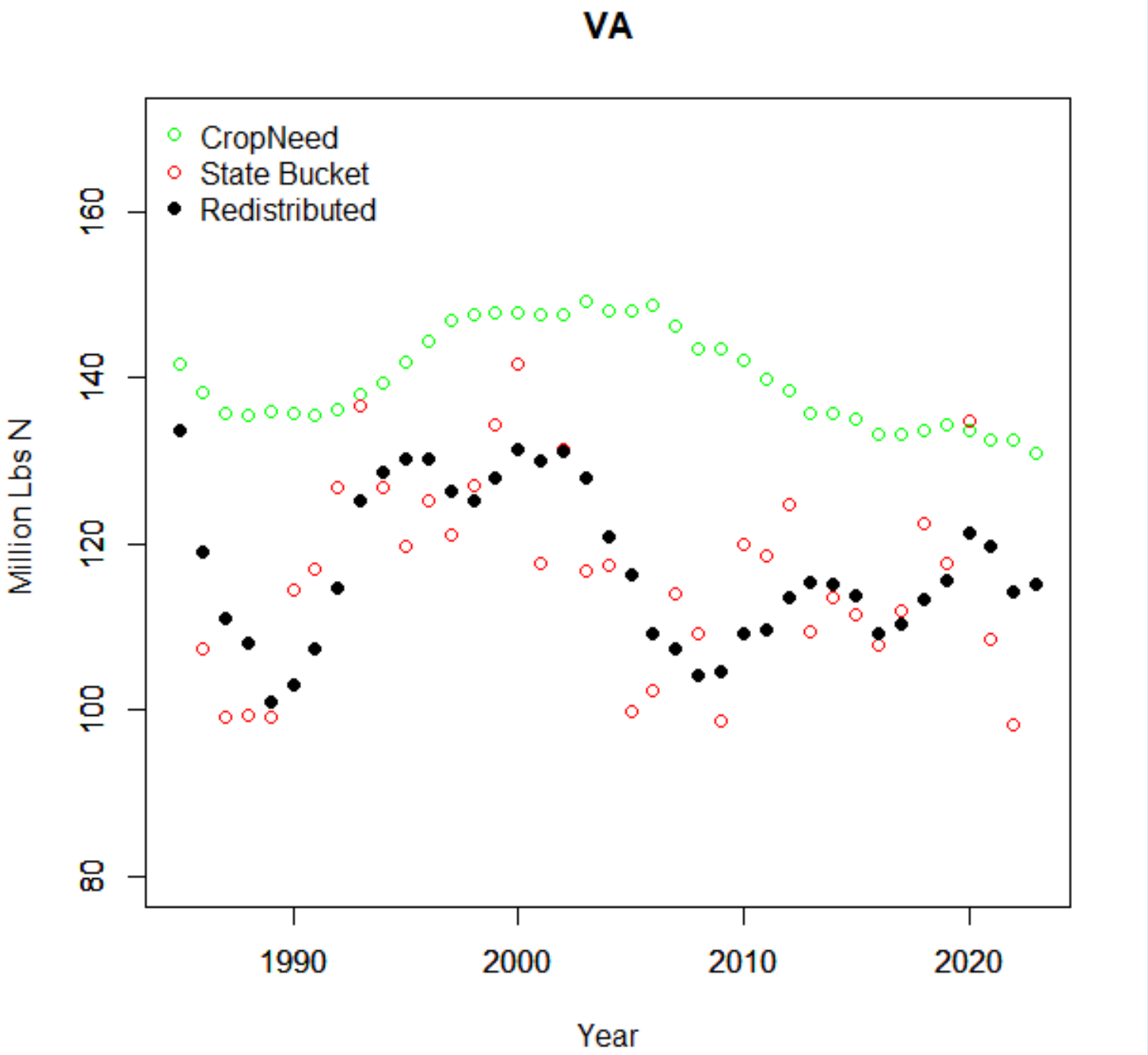

DE
CropNeed
State Bucket
Redistributed
Million Lbs N
25
30
35
40
45
50
55
1990
2000
2010
2020
Year


MD
CropNeed
State Bucket
Redistributed
Million Lbs N
40
60
80
100
120
140
1990
2000
2010
2020
Year


NY
CropNeed
State Bucket
Redistributed
Million Lbs N
40
60
80
100
120
140
1990
2000
2010
2020
Year


PA
CropNeed
State Bucket
Redistributed
Million Lbs N
100
150
200
250
300
1990
2000
2010
2020
Year


WV
CropNeed
State Bucket
Redistributed
Million Lbs N
0
5
10
15
20
25
30
35
1990
2000
2010
2020
Year


VA
CropNeed
State Bucket
Redistributed
Million Lbs N
80
100
120
140
160
1990
2000
2010
2020
Year

Pause for questions

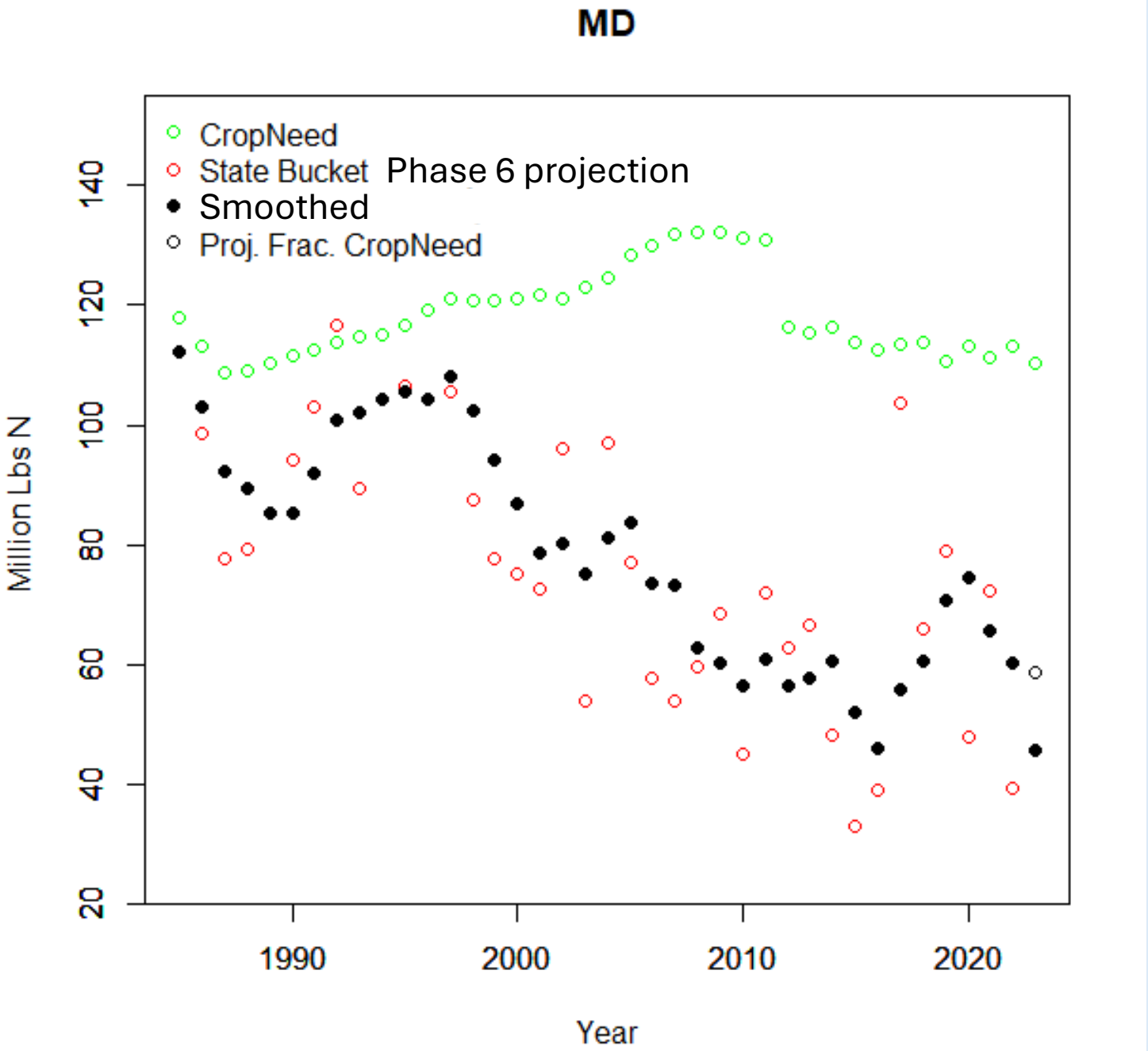
- Is it realistic to smooth data over a multi year period?
  - Is banking fertilizer realistic?
  - Can a better time period be derived?
- Are there other metrics than yields and crop need met to consider?

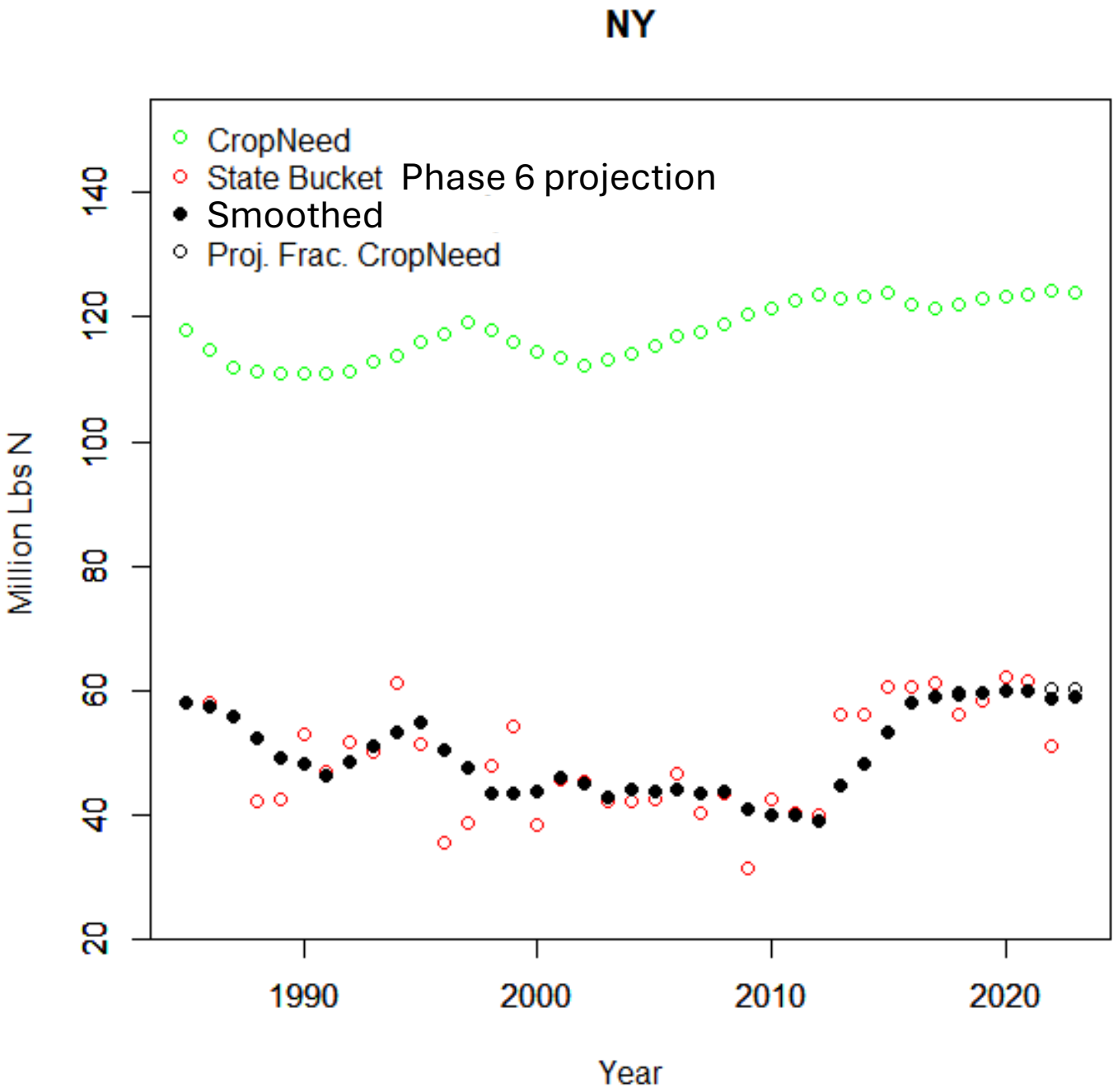
Filling data gaps:

- We need to interpolate data for states who do not report
  - Currently:
    - NY: 2018-Present
    - MD: 2023-Present
- How do we retain independence?
  - Fraction of crop need met

Fraction of crop need met

- Ties states fertilizer usage to crop yields
  - Based on the last known year with BOTH fertilizer AND yields
    - Calculate the amount of crop need (application goal) that is satisfied with known fertilizer
      - Extrapolate into years with no known fertilizer but a known yield.
- Retains the ability of the states to keep fertilizer independent and tied to their own behavior


MD
CropNeed
State Bucket
Smoothed
Proj. Frac. CropNeed
Phase 6 projection
Million Lbs N
20
40
60
80
100
120
140
1990
2000
2010
2020
Year


NY
CropNeed
State Bucket
Smoothed
Proj. Frac. CropNeed
Phase 6 projection
Million Lbs N
20
40
60
80
100
120
140
1990
2000
2010
2020
Year

Pause for questions:

- Are there any data that we could use to supplement across time and space?
- Do we want to retain independence of state fertilizer stocks?
- Is it good enough to use crop yields?

Questions?