What do babies weigh at birth?

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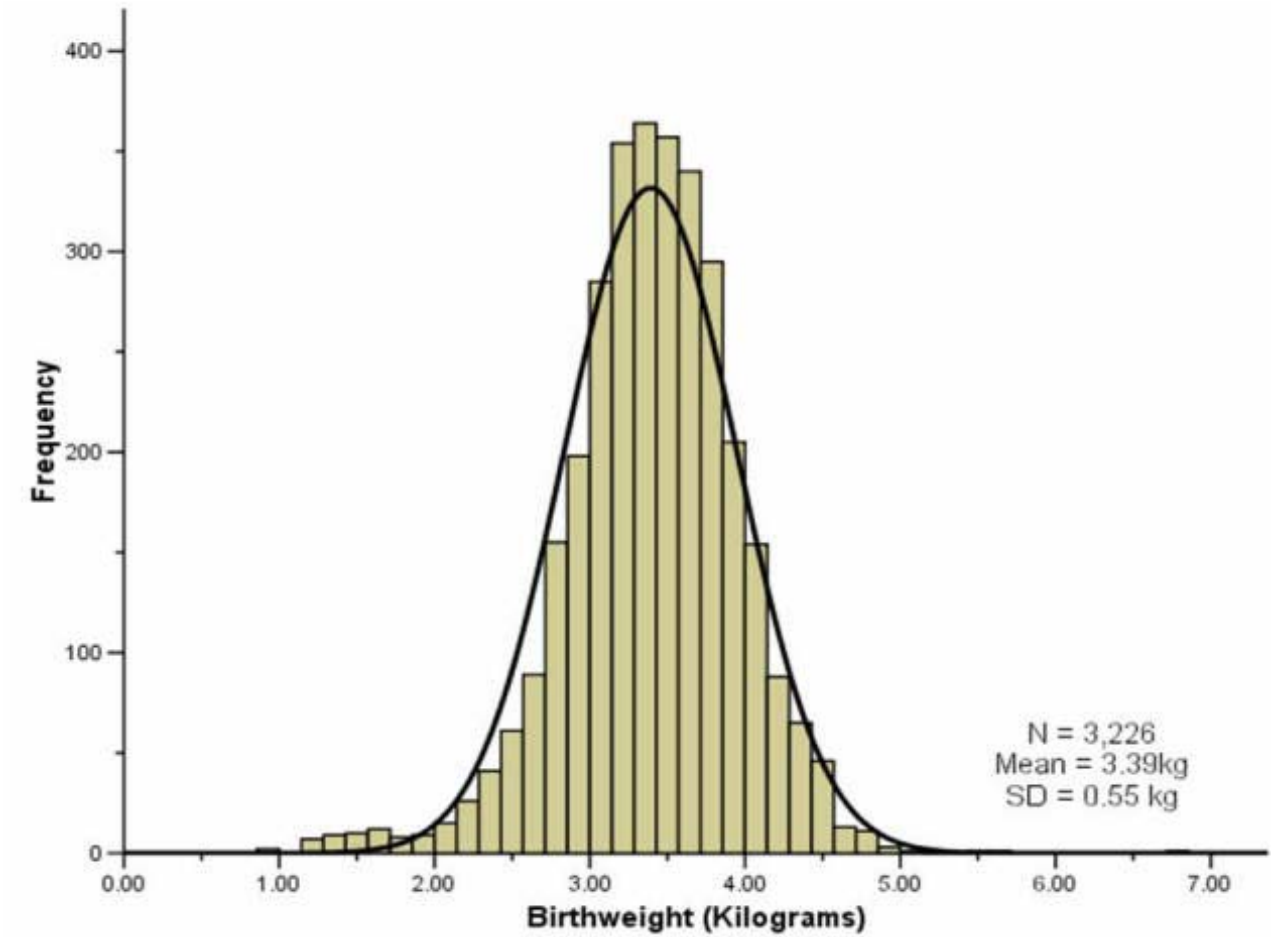

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Let’s say 1 baby is born per day in Ames.

Over the next week, the baby weights are as follows:

Day 1 = 6.0
Day 2 = 6.5
Day 3 = 7.0
Day 4 = 7.5
Day 5 = 8.0
Day 6 = 8.5
Day 7 = 9.0

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Over the next week, the baby weights are as follows. *And this is highly statistically significant*.

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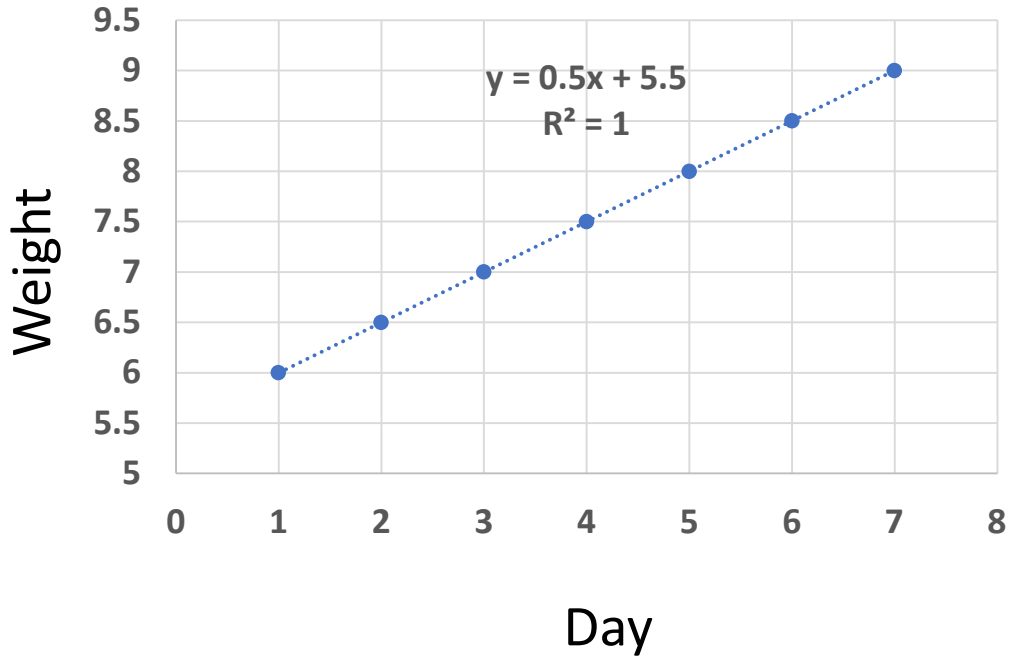

Should we call the CDC?

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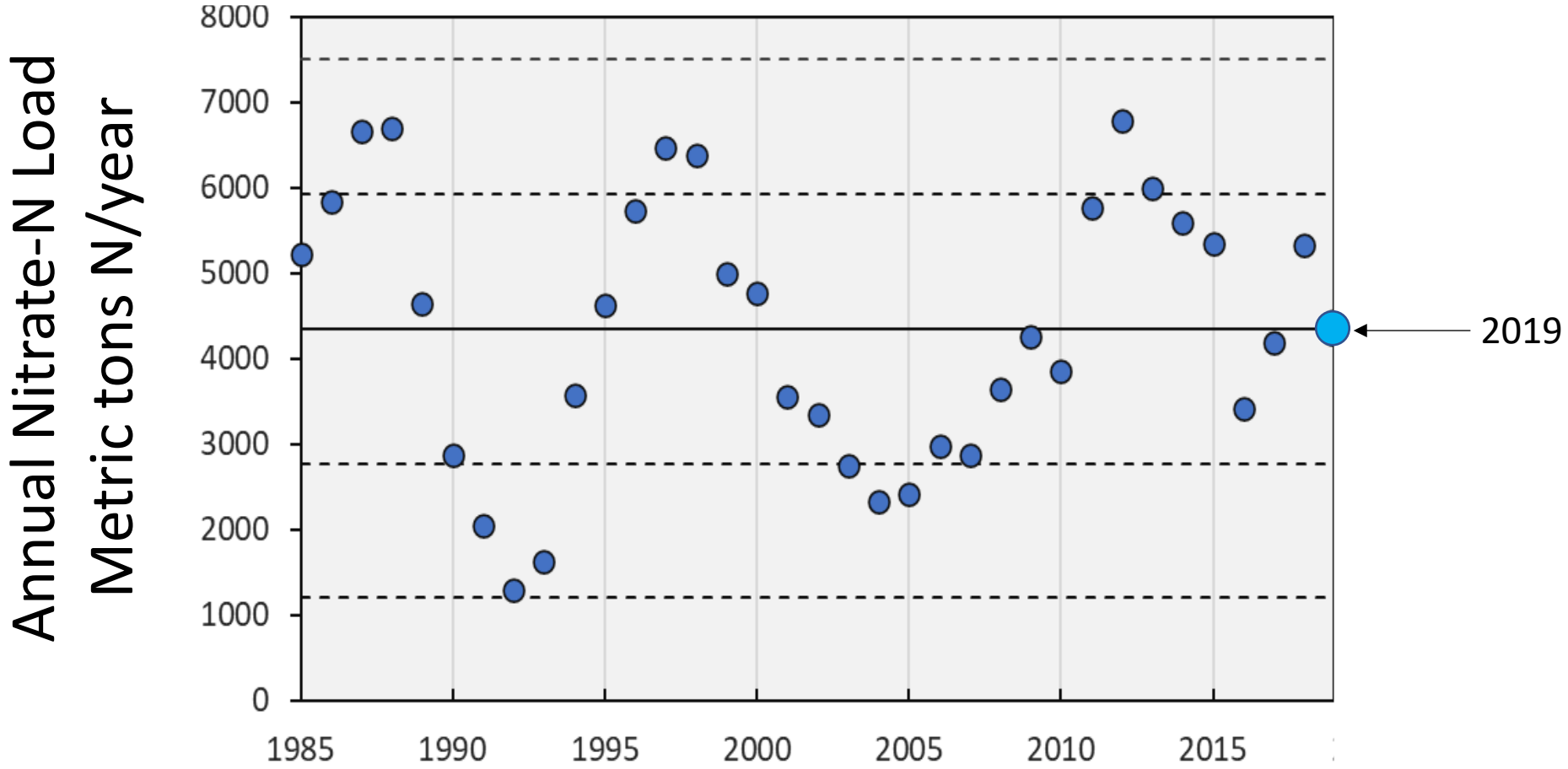
Of course not, it’s 7 days.

It’s *most likely* the luck of the draw.

5-year moving average nitrate load – Floyd River



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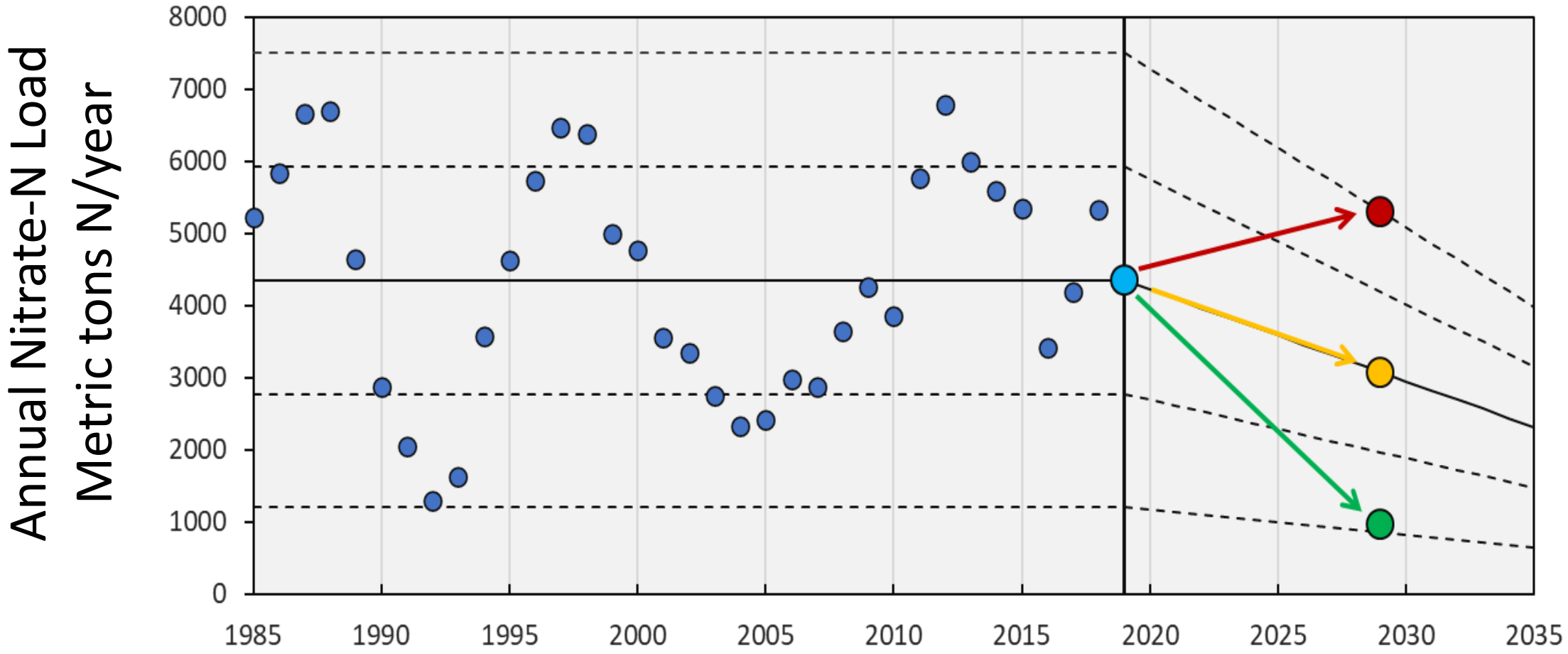
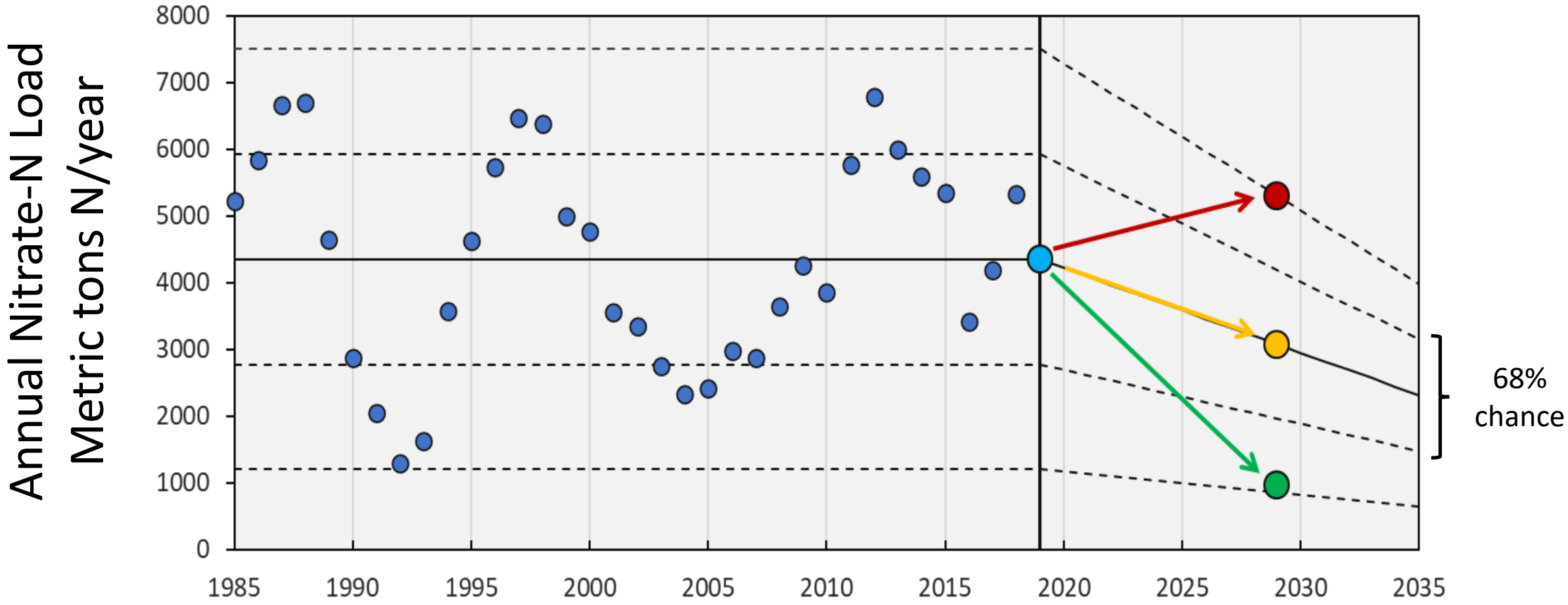


5-year moving average nitrate load – Floyd River



We’re trying to measuring trends owing to changes in cropping systems management in the context of weather.

Three factors affect our likelihood of measuring these trends:

i. *Variability in nitrate levels in the absence of changes in land use and management.*

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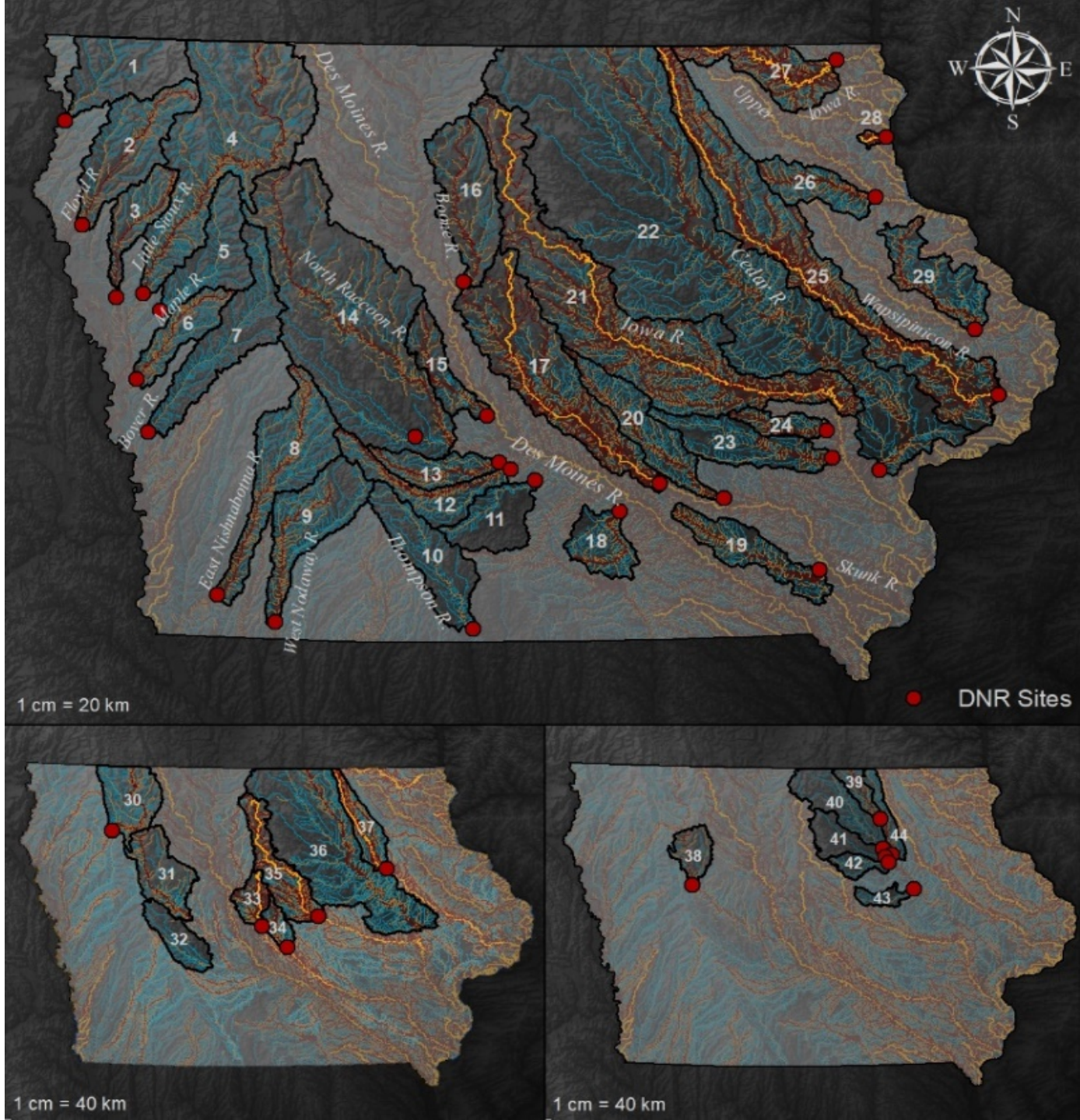
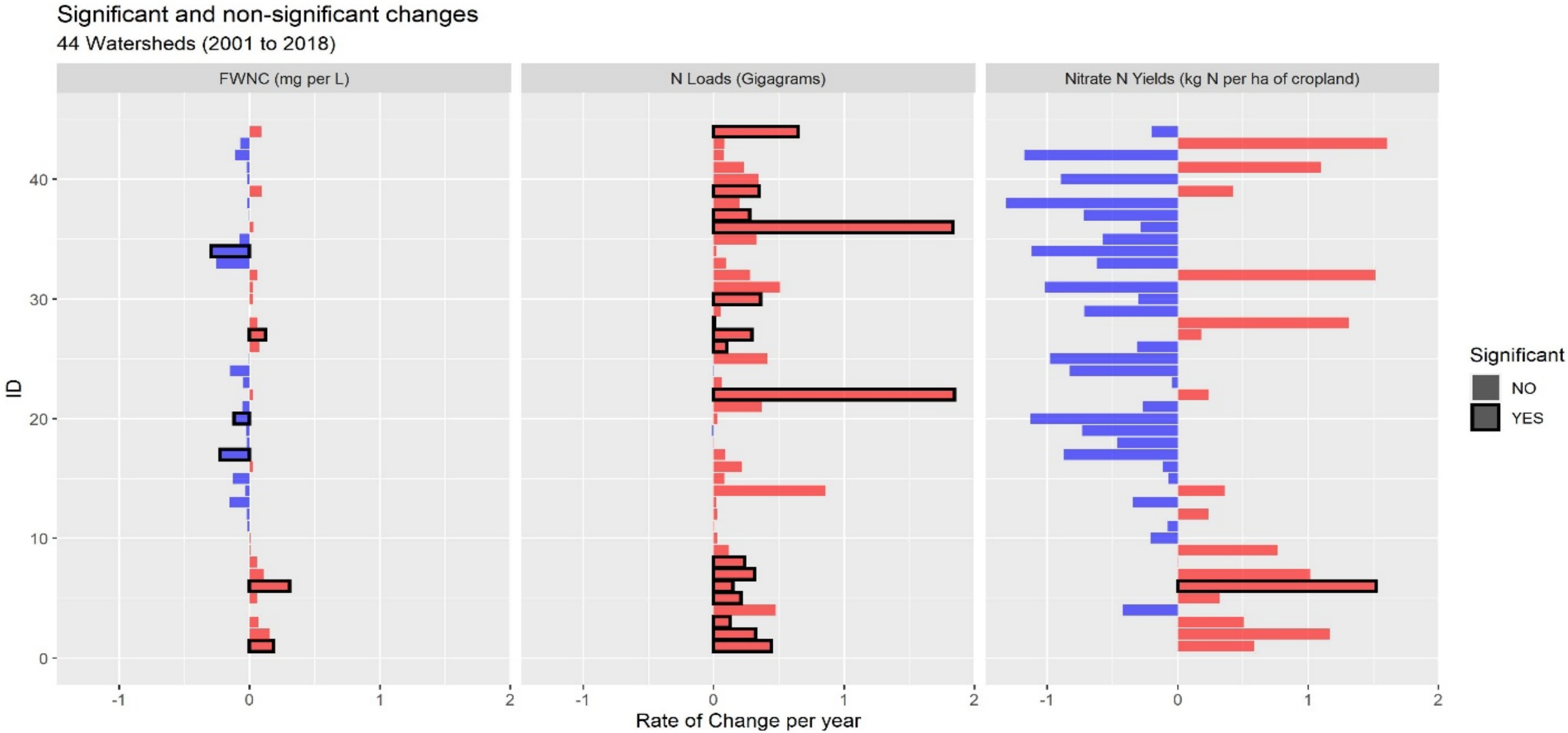
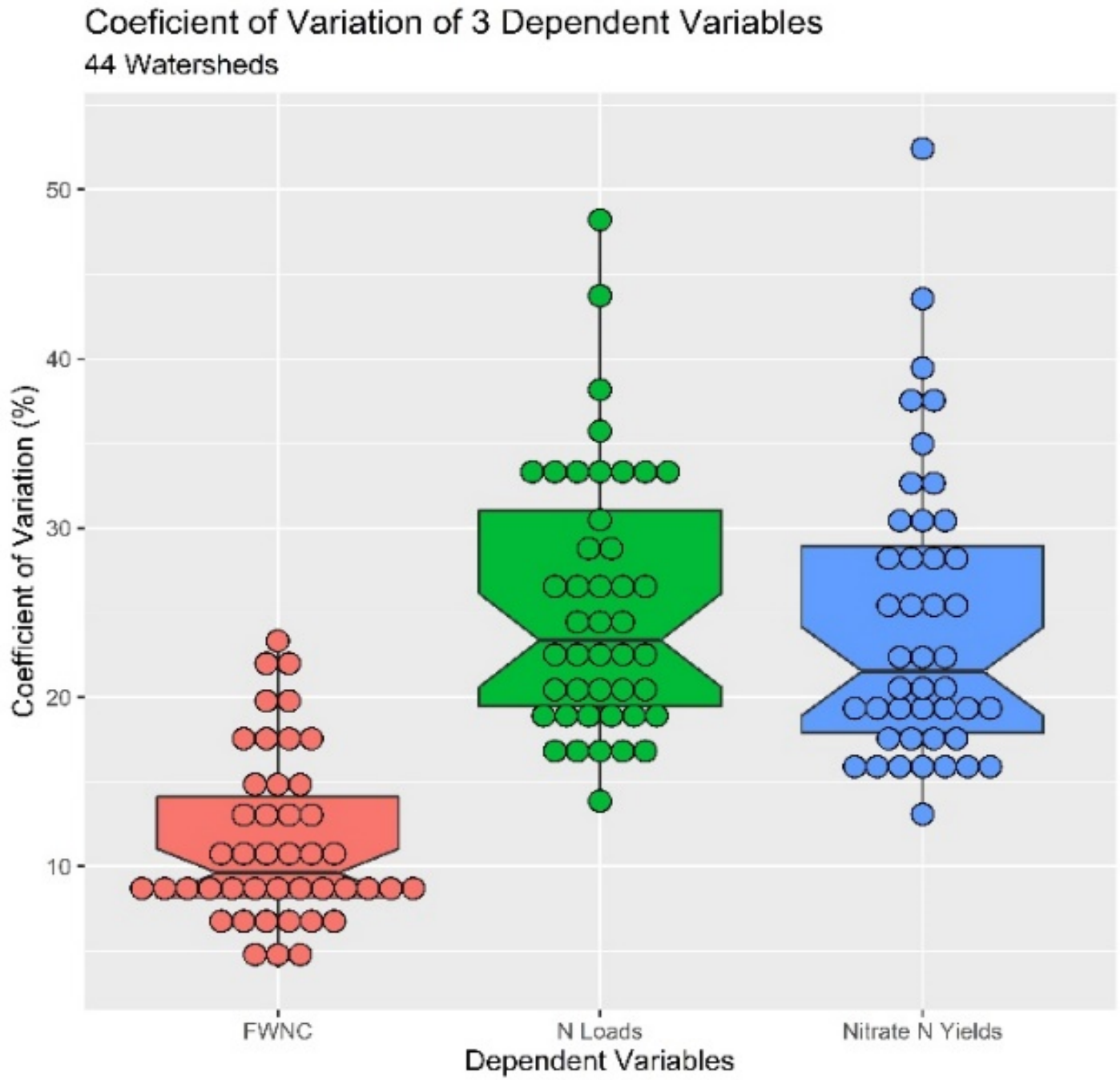
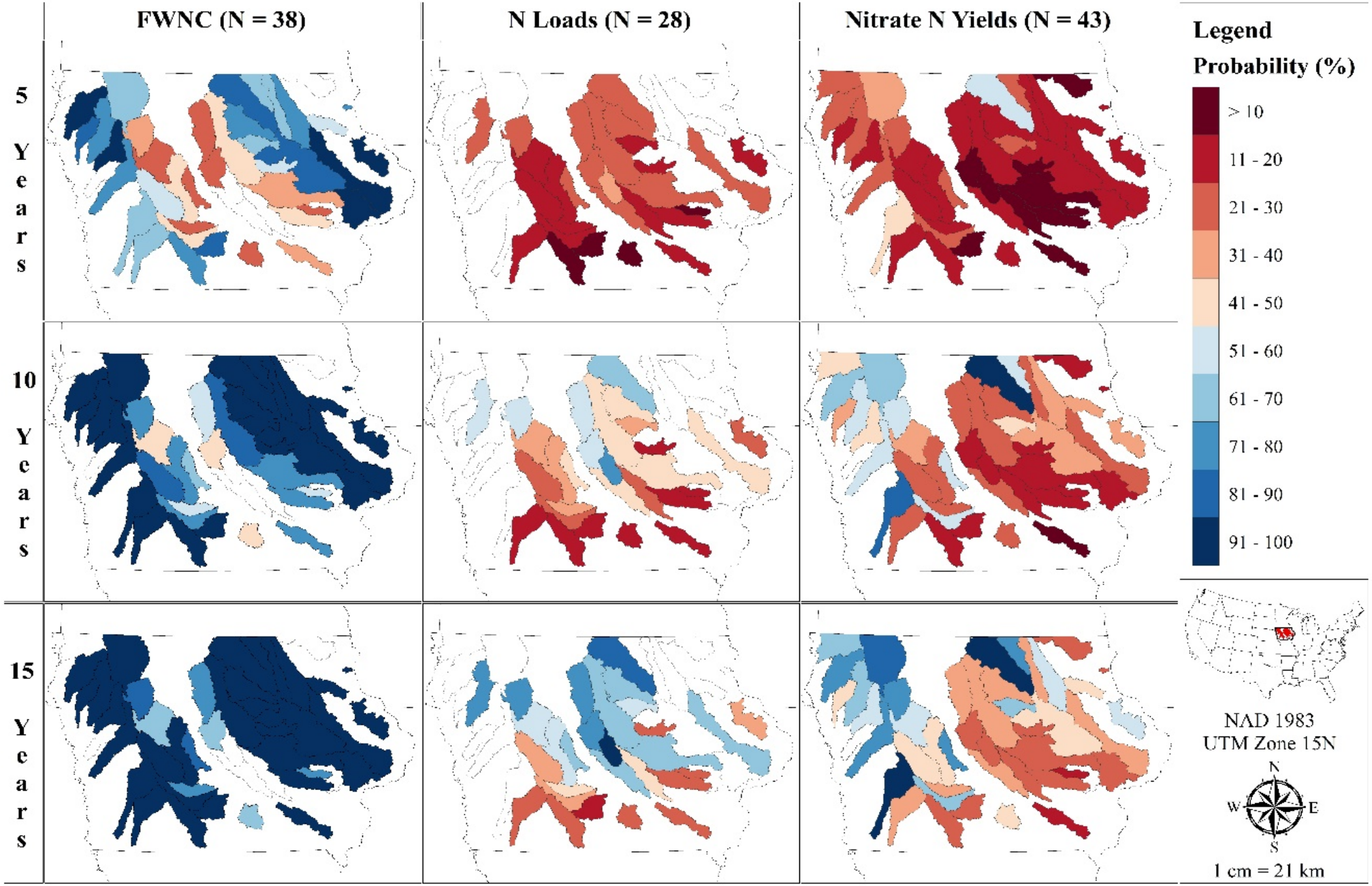
<u>So just how long will it take?</u>

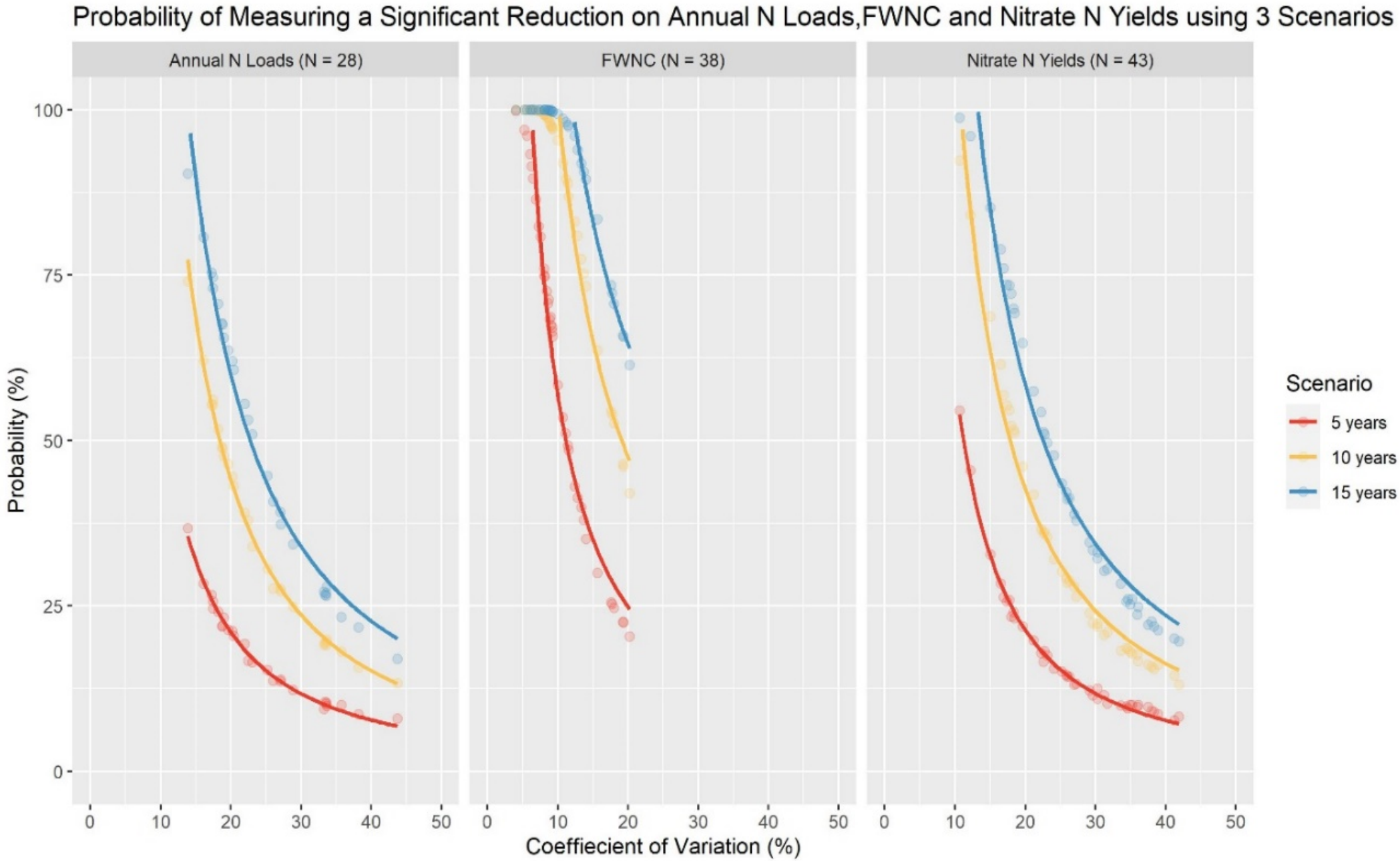
- 44 Watersheds
- 2001-2018 records of water quantity and nitrate concentration
- A ‘real’ 41% reduction in 5-year moving average over:
  i. 5 years
  ii. 10 years
  iii. 15 years
- 3 ways we quantify nitrate levels:
  i. Flow-weighted concentration (mg nitrate-N per liter)
  ii. Load (lbs per watershed)
  iii. Yield (lbs per acre cropland)




Significant and non-significant changes
44 Watersheds (2001 to 2018)
FWNC (mg per L)
N Loads (Gigagrams)
Nitrate N Yields (kg N per ha of cropland)
ID
0
10
20
30
40
-1
0
1
2
Rate of Change per year
Significant
NO
YES


Coeficient of Variation of 3 Dependent Variables
44 Watersheds
Coefficient of Variation (%)
50
40
30
20
10
FWNC
N Loads
Nitrate N Yields
Dependent Variables


FWNC (N = 38)
N Loads (N = 28)
Nitrate N Yields (N = 43)
5 Years
10 Years
15 Years
Legend
Probability (%)
> 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 - 100
NAD 1983
UTM Zone 15N
N
W
E
S
1 cm = 21 km


Probability of Measuring a Significant Reduction on Annual N Loads,FWNC and Nitrate N Yields using 3 Scenarios
Annual N Loads (N = 28)
FWNC (N = 38)
Nitrate N Yields (N = 43)
Probability (%)
100
75
50
25
0
0
10
20
30
40
50
Coeffiecient of Variation (%)
Scenario
5 years
10 years
15 years

What does this mean?

- On average, across all the watersheds, there is 93% chance of measuring a 41% reduction in 5-year moving average FWNC over 15 years, but only a 50% chance of measuring the same reduction in load.

- Changes in flow-weighted nitrate concentration can be measured faster than changes in load because they are less affected by weather.

- This analysis can be used to set realistic, watershed-specific expectations about measuring progress towards the INRS.

What can we do?

- What is the optimum sampling frequency to detect changes in FWNC, load and yield? Daily, weekly, monthly?
- What are the physical characteristics of watersheds where reductions can be measured relatively rapidly?
- How long will it take to measure smaller reductions?
- The opposite: what's the likelihood of measuring false reductions (or increases) owing to weather rather than improvements in land use and management?

- Gerasimos (Makis) Danalatos, grad student in Agronomy at ISU, did all the work and makes some really cool maps.

- IDNR funded this work

- Adam Schnieders, Roger Bruner and Calvin Wolter provided insight and data.

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