

Central NY Lakes

Monitoring, Nutrient Trends, and Water Quality Patterns

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How do Central NY lakes compare?

A statewide look at water quality trends

OVERVIEW

- Importance of long-term monitoring – why should we care?
- Regional comparison of water quality in NYS

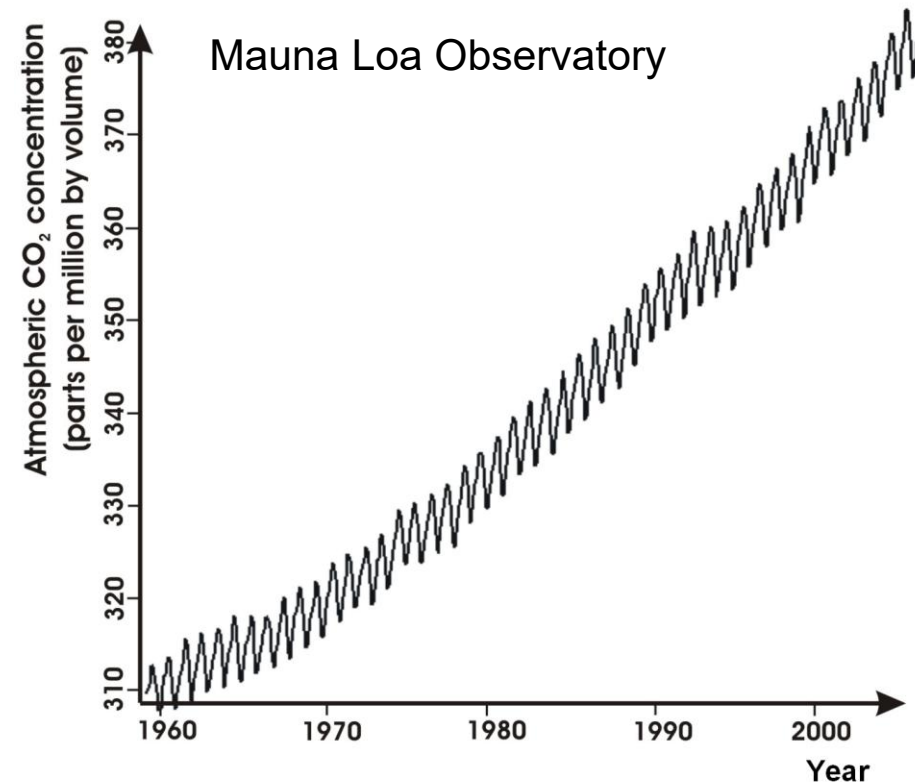
What is long-term?

“You know it when you see it ...”

“Never enough”

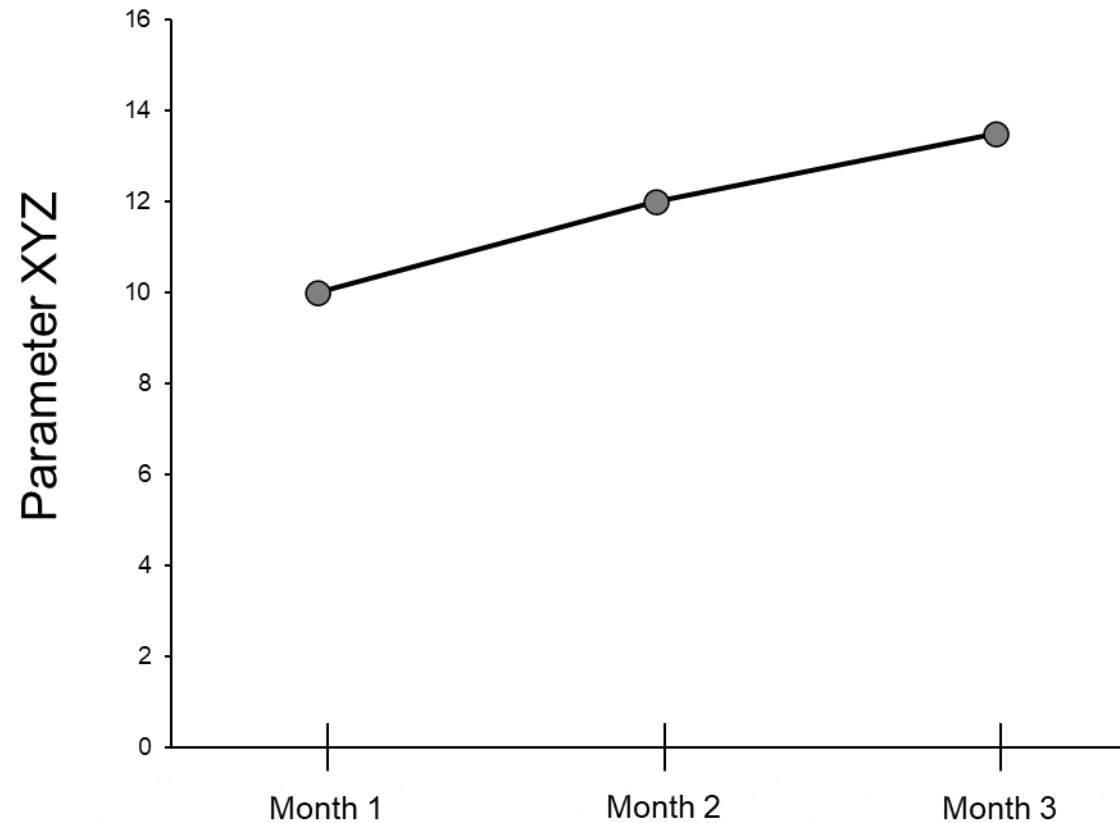
Statistical power

**Depends on specific
objective/question!**



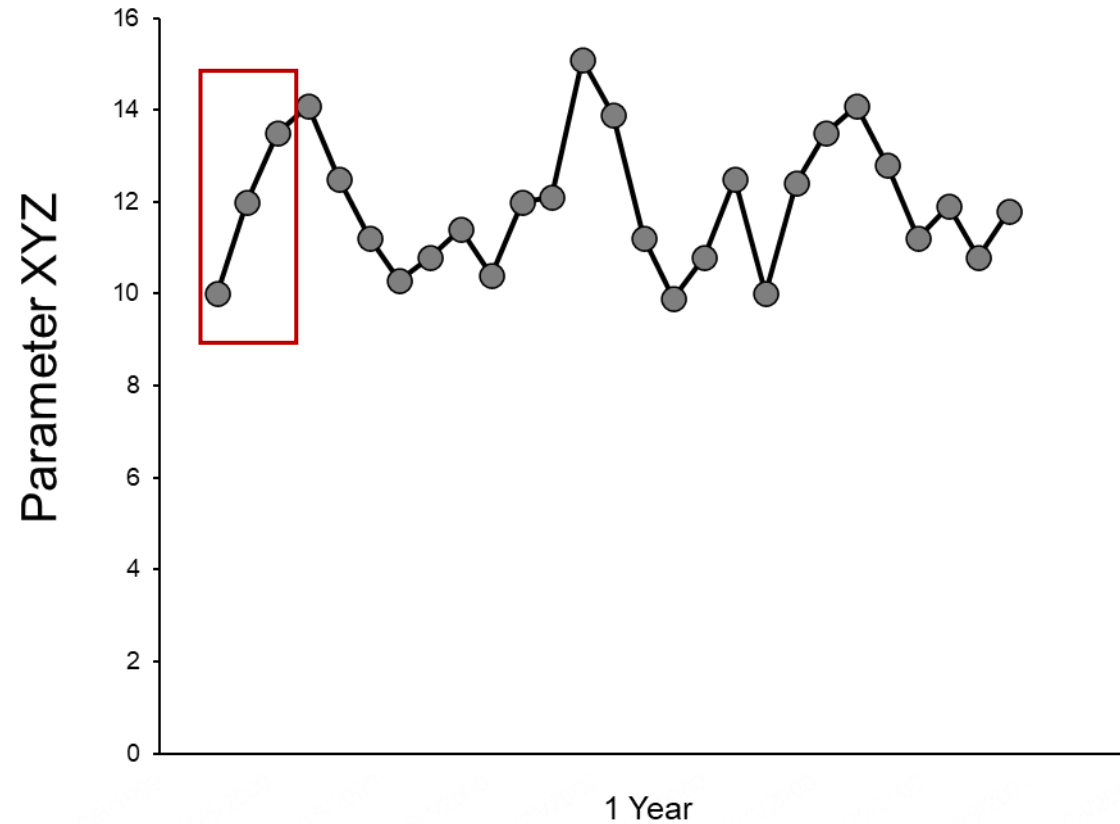
Why care about long-term monitoring and trends?

3 MONTHS



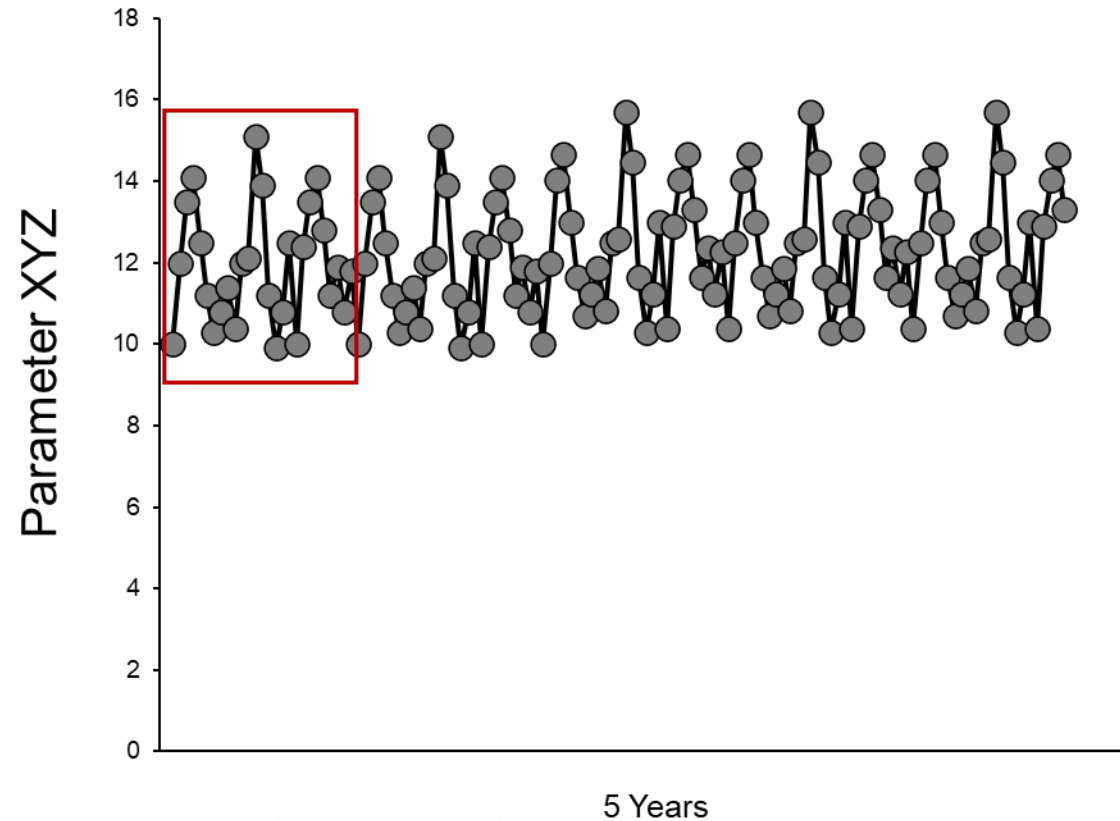
Why care about long-term monitoring and trends?

1 YEAR



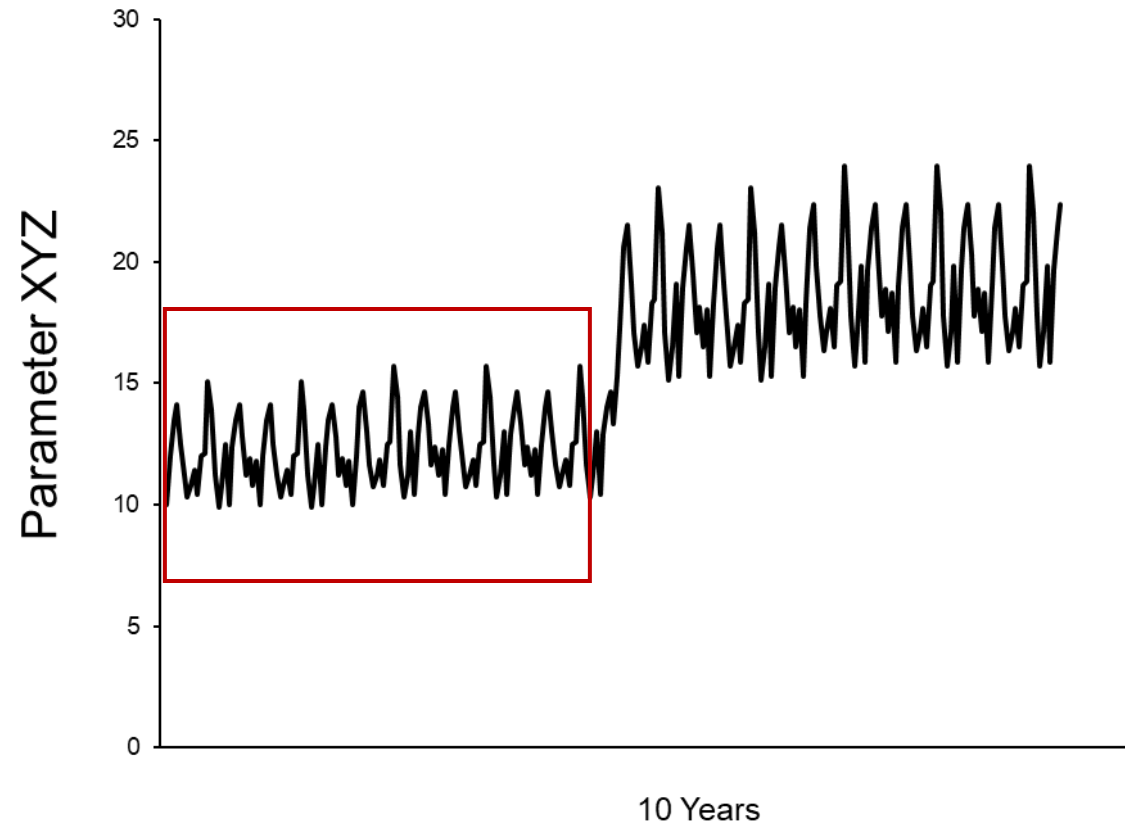
Why care about long-term monitoring and trends?

5 YEARS



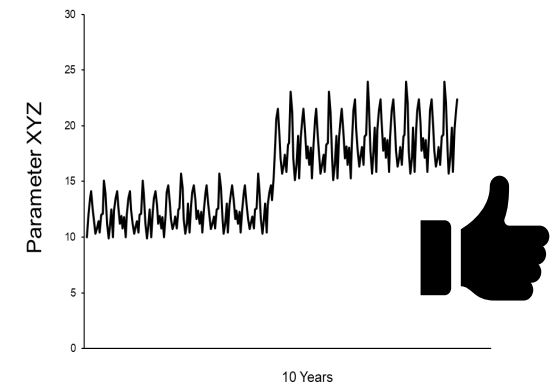
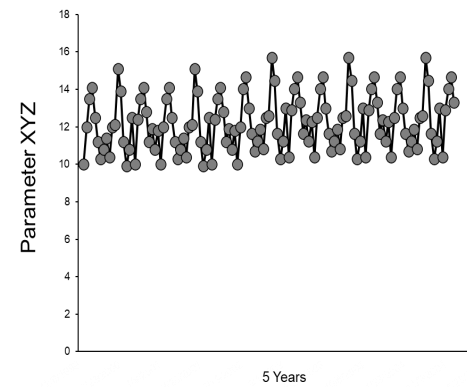
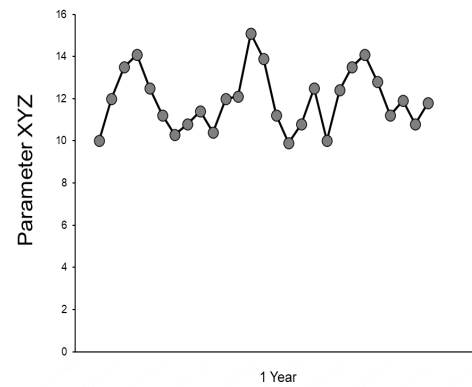
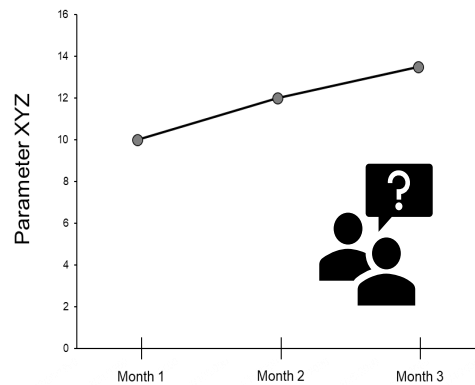
Why care about long-term monitoring and trends?

10 YEARS



Why care about long-term monitoring and trends?

- Patterns!
- Science-based decision(s)
- Scientific discovery
- Applications – models, ecological forecasting



Analysis

Regional comparison and long-term trends

CSLAP data

Lakes with > 20 years of data

Parameters:

Total phosphorus (TP)

Chlorophyll-a

Secchi depth

Total nitrogen (TN)

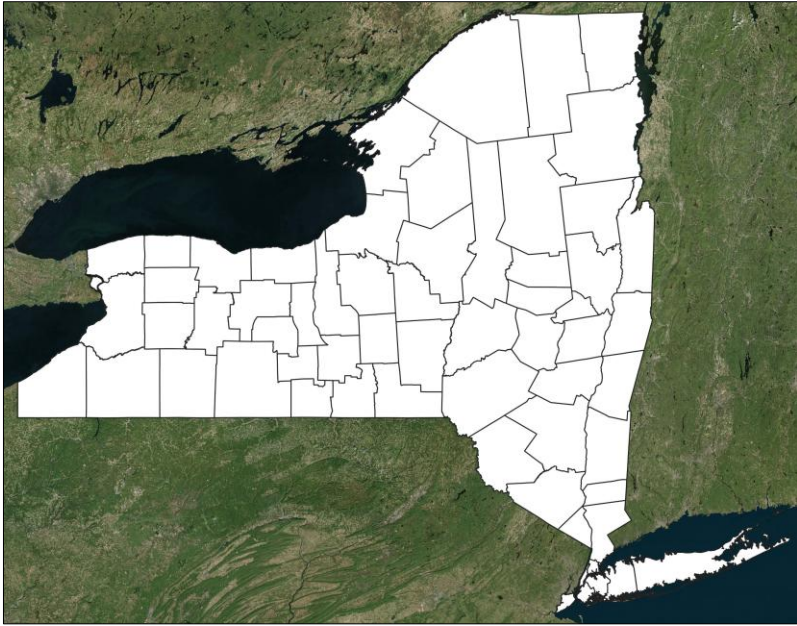
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Surface T_{water}

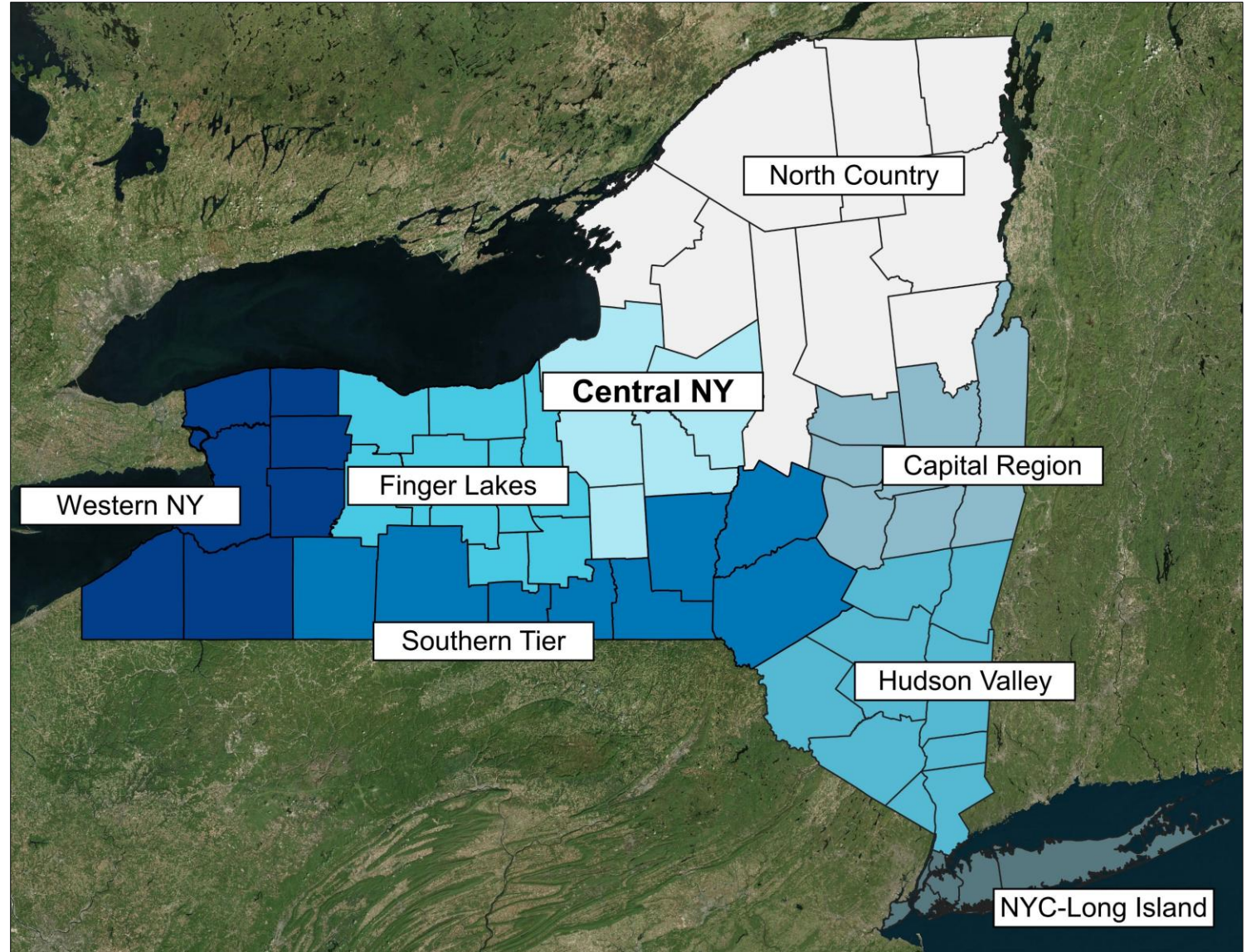


(a) Compare overall means between Regions

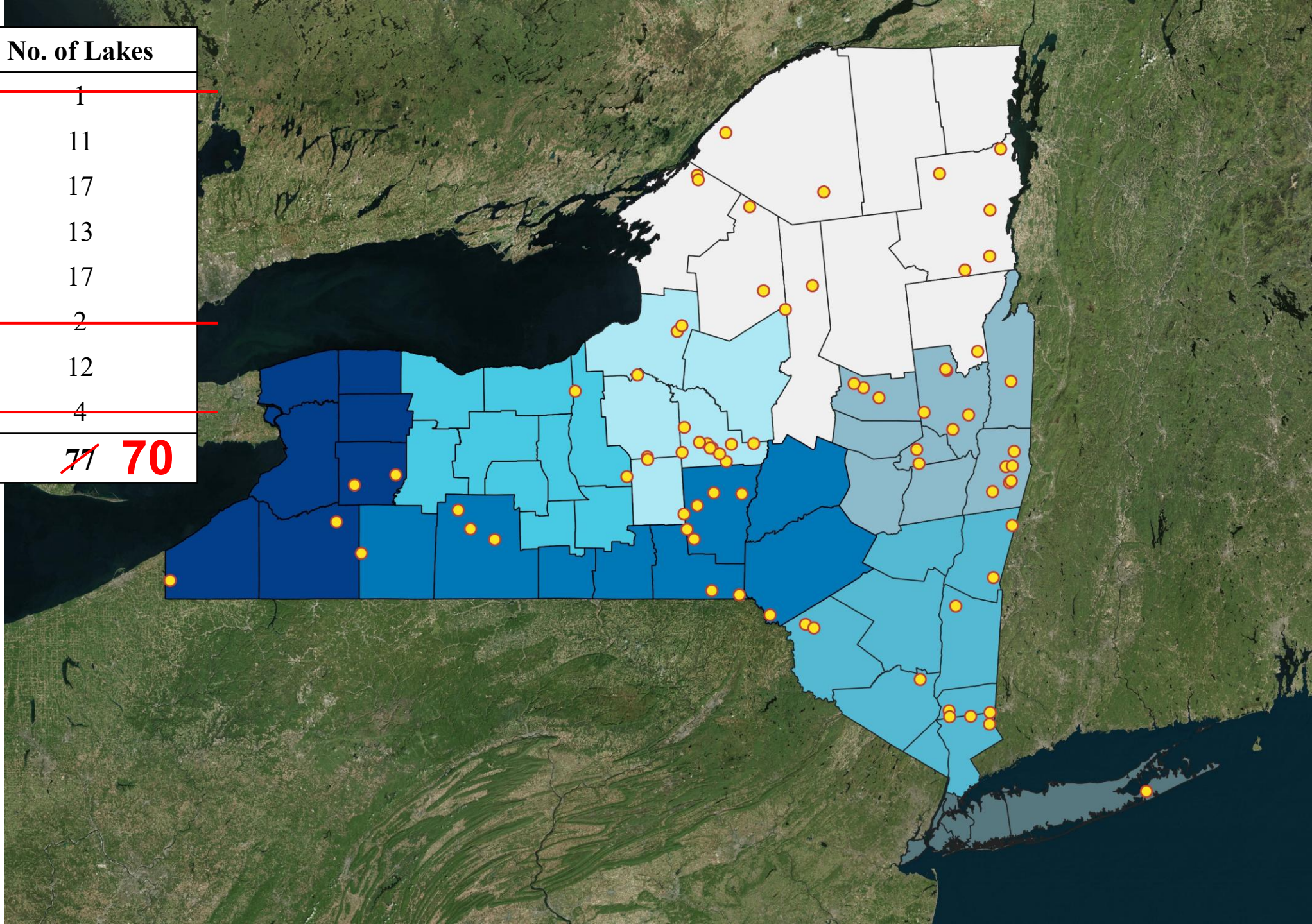
(b) Evaluate long-term trends within and between Regions



REGIONS

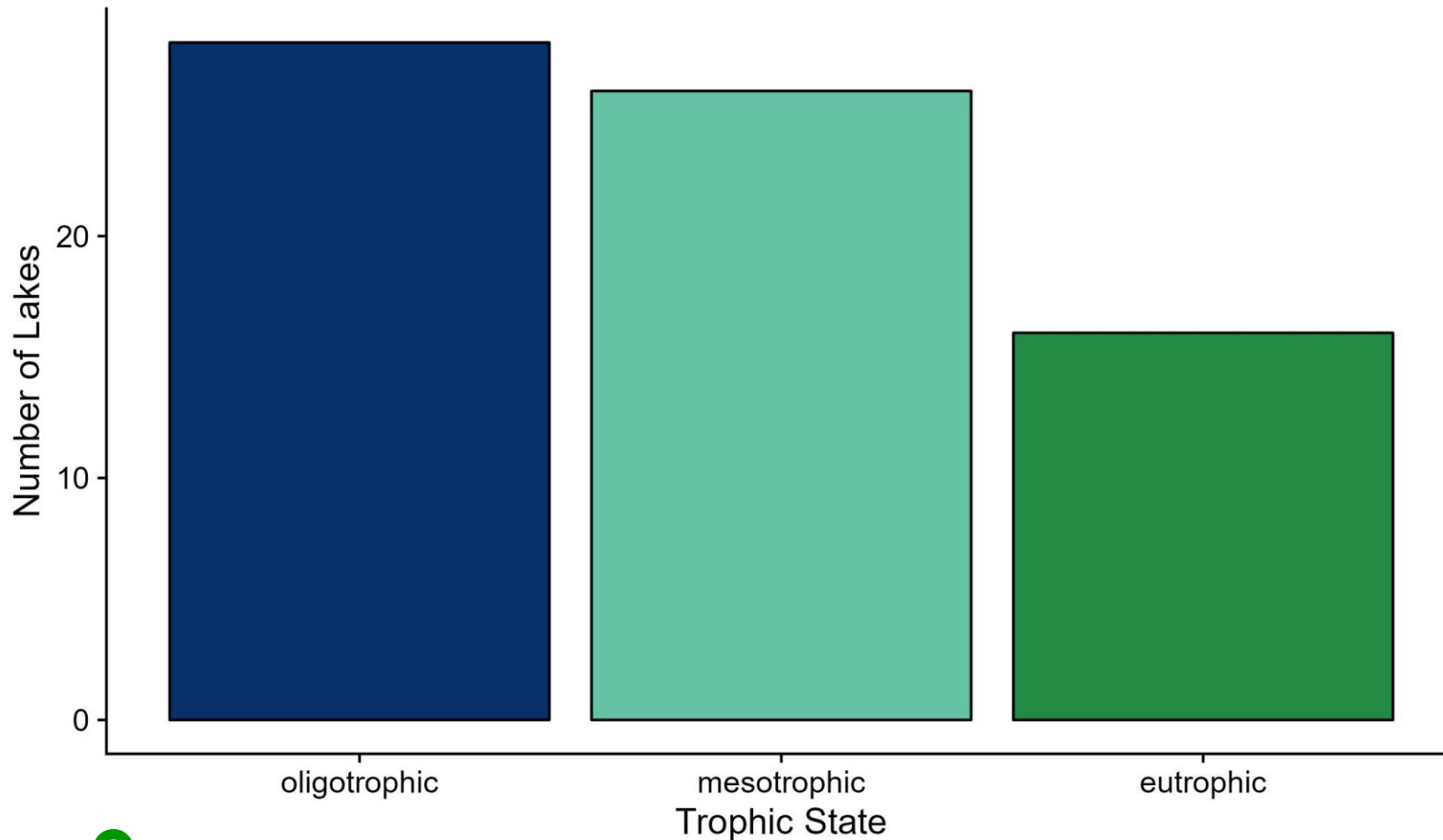


Region	No. of Lakes
NYC-Long Island	1
Hudson Valley	11
Capital Region	17
North Country	13
Central NY	17
Finger Lakes	2
Southern Tier	12
Western NY	4
TOTAL:	71 70



Characterizing the 70 lakes...

Trophic State Distribution



Determine by:
Total Phosphorus
Chlorophyll-a
Secchi depth

Oligotrophic

Low nutrients, clear water, high oxygen at depth

Mesotrophic

Moderate nutrients and productivity

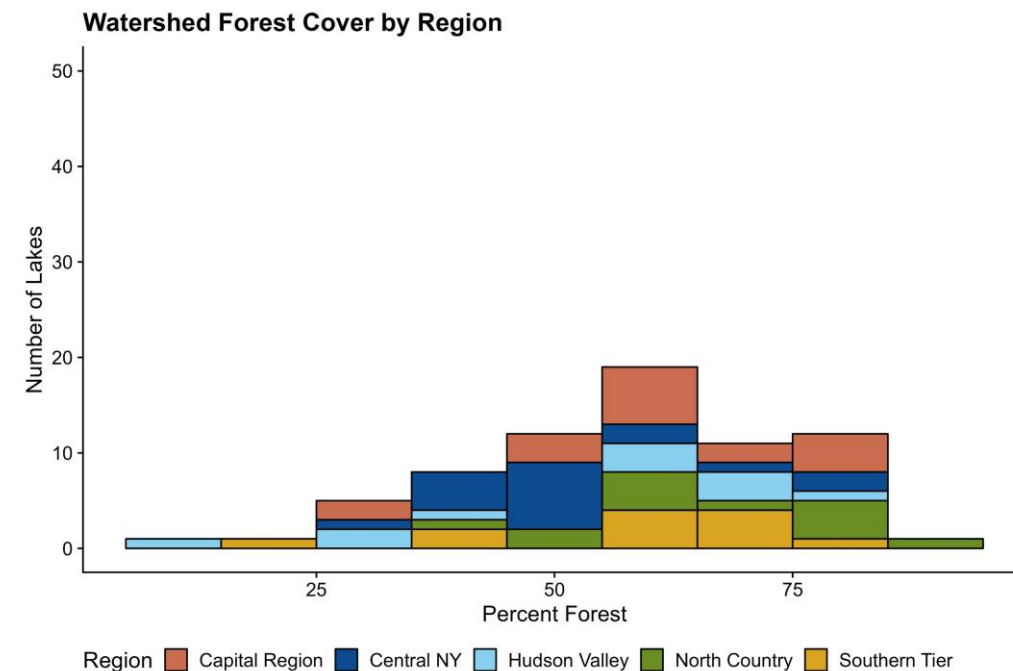
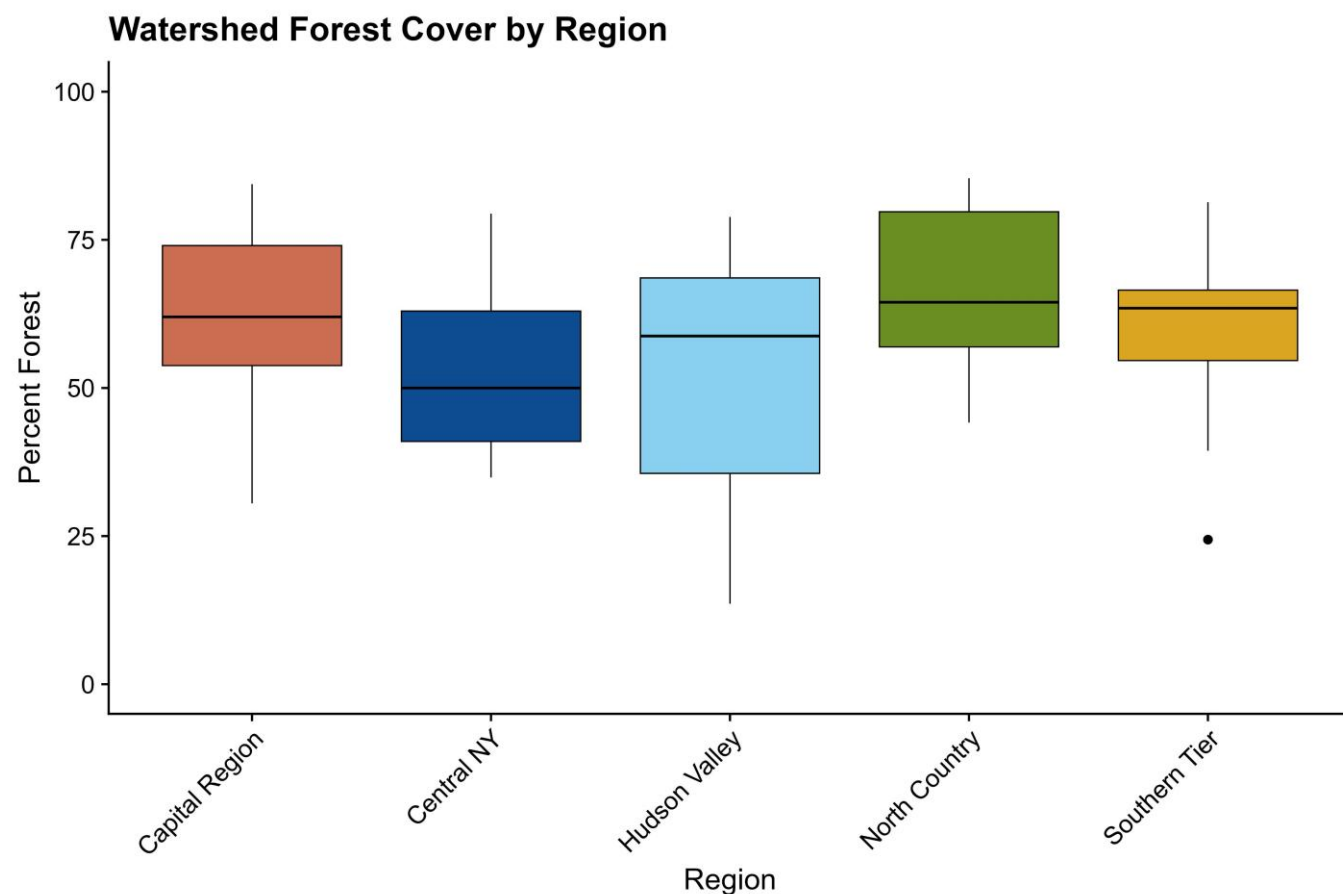
Eutrophic

High nutrients, algae-prone, oxygen loss at depth

Characterizing the 70 lakes...

FOREST

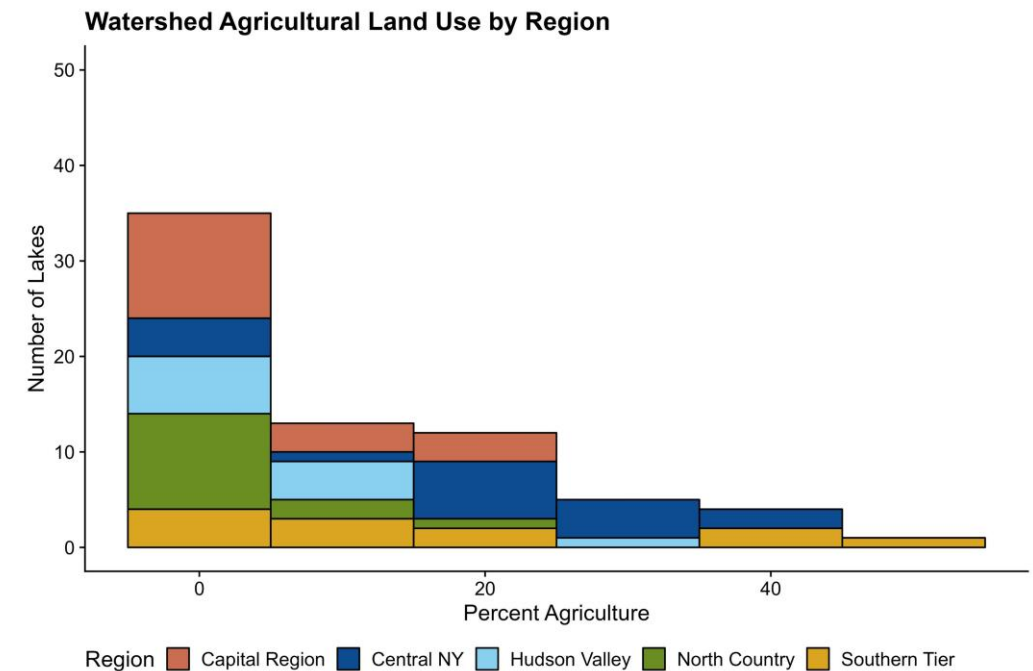
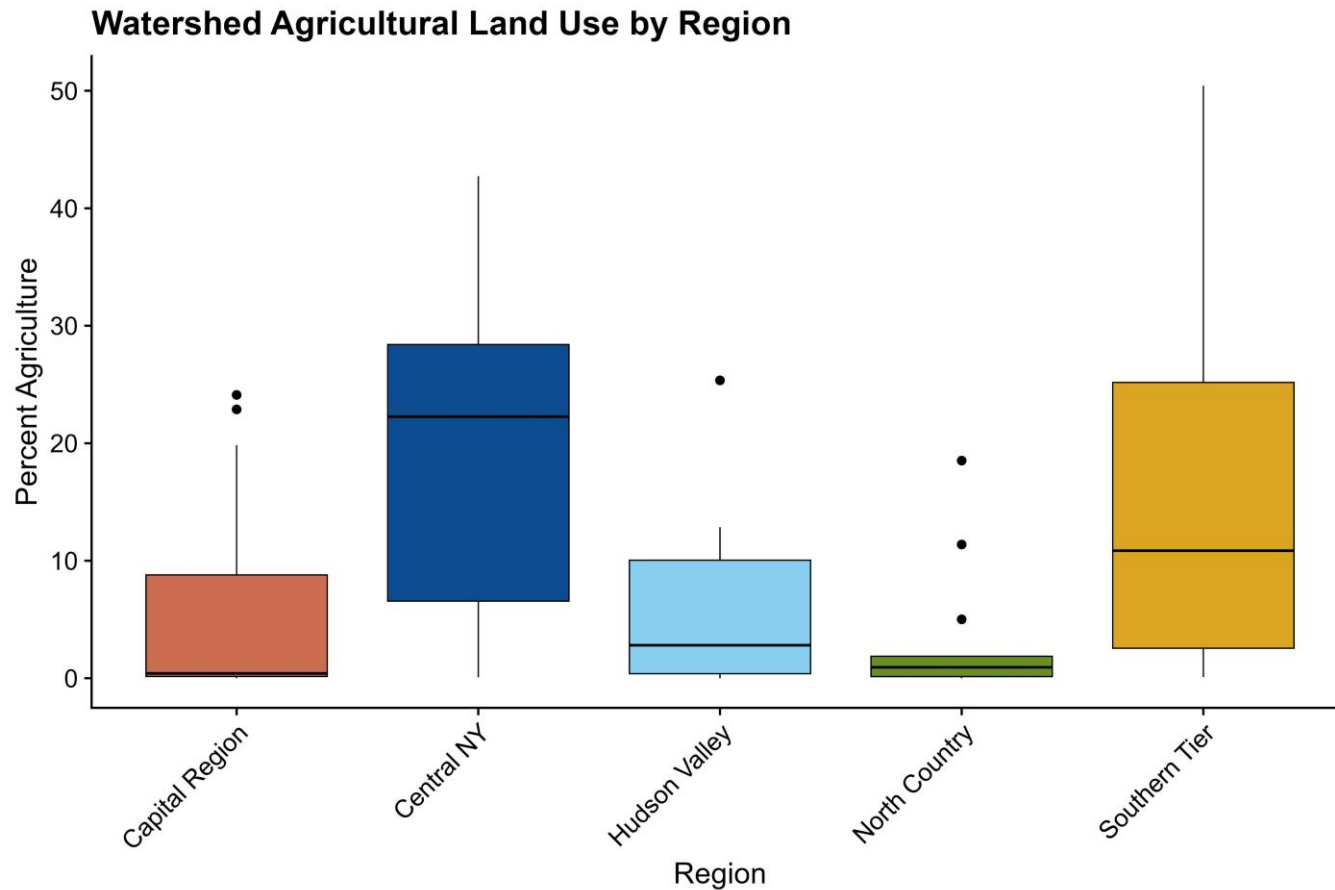
Watershed land use land cover (LULC)



Characterizing the 70 lakes...

AGRICULTURE

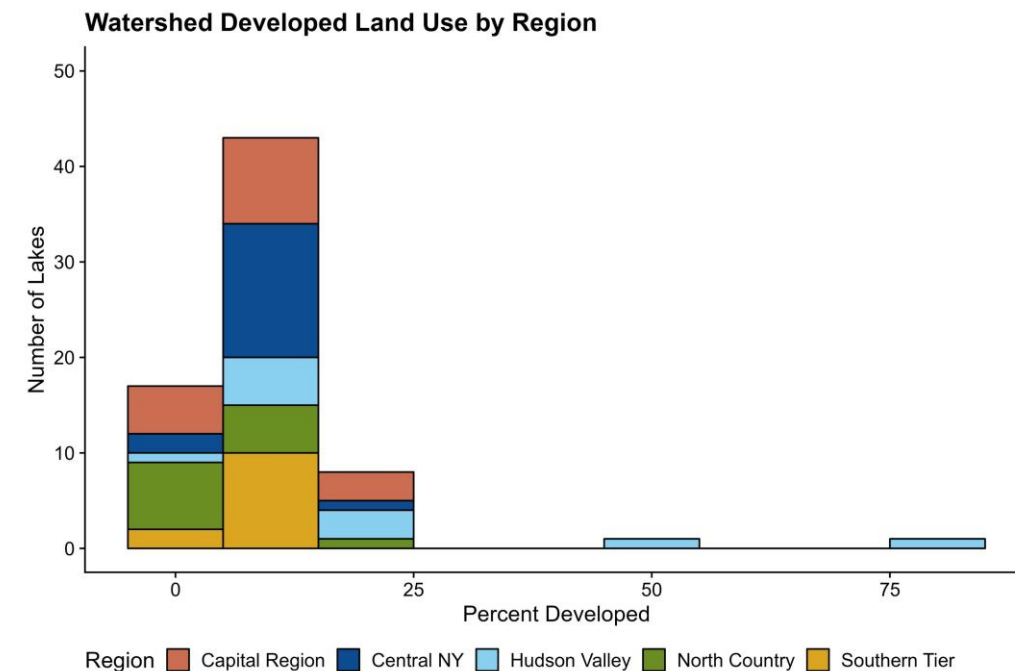
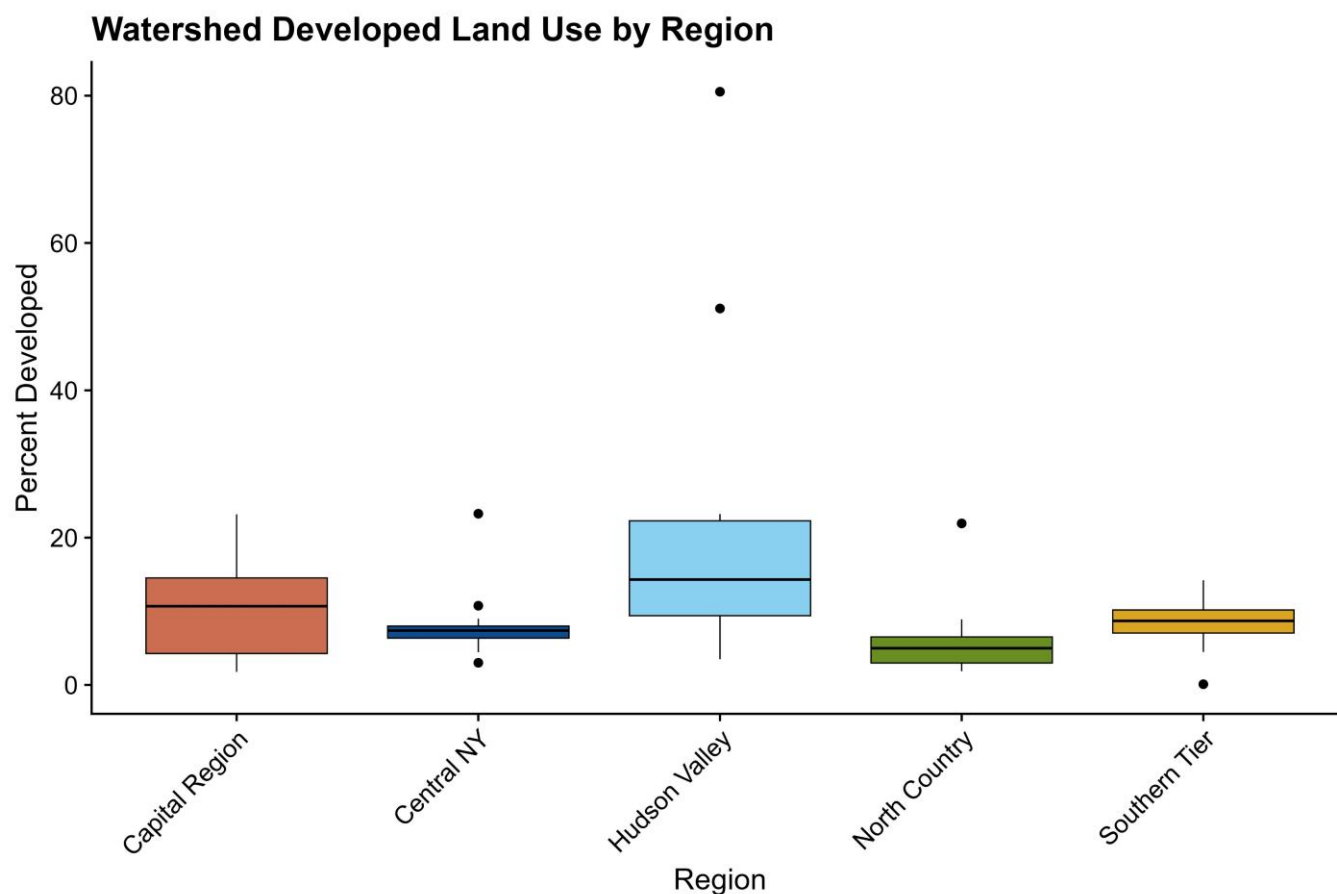
Watershed land use land cover (LULC)



Characterizing the 70 lakes...

DEVELOPED

Watershed land use land cover (LULC)



Total Phosphorus

Surface

REGIONAL

Significant overall regional differences in surface total phosphorus concentrations

Kruskal-Wallis $p < 0.02$

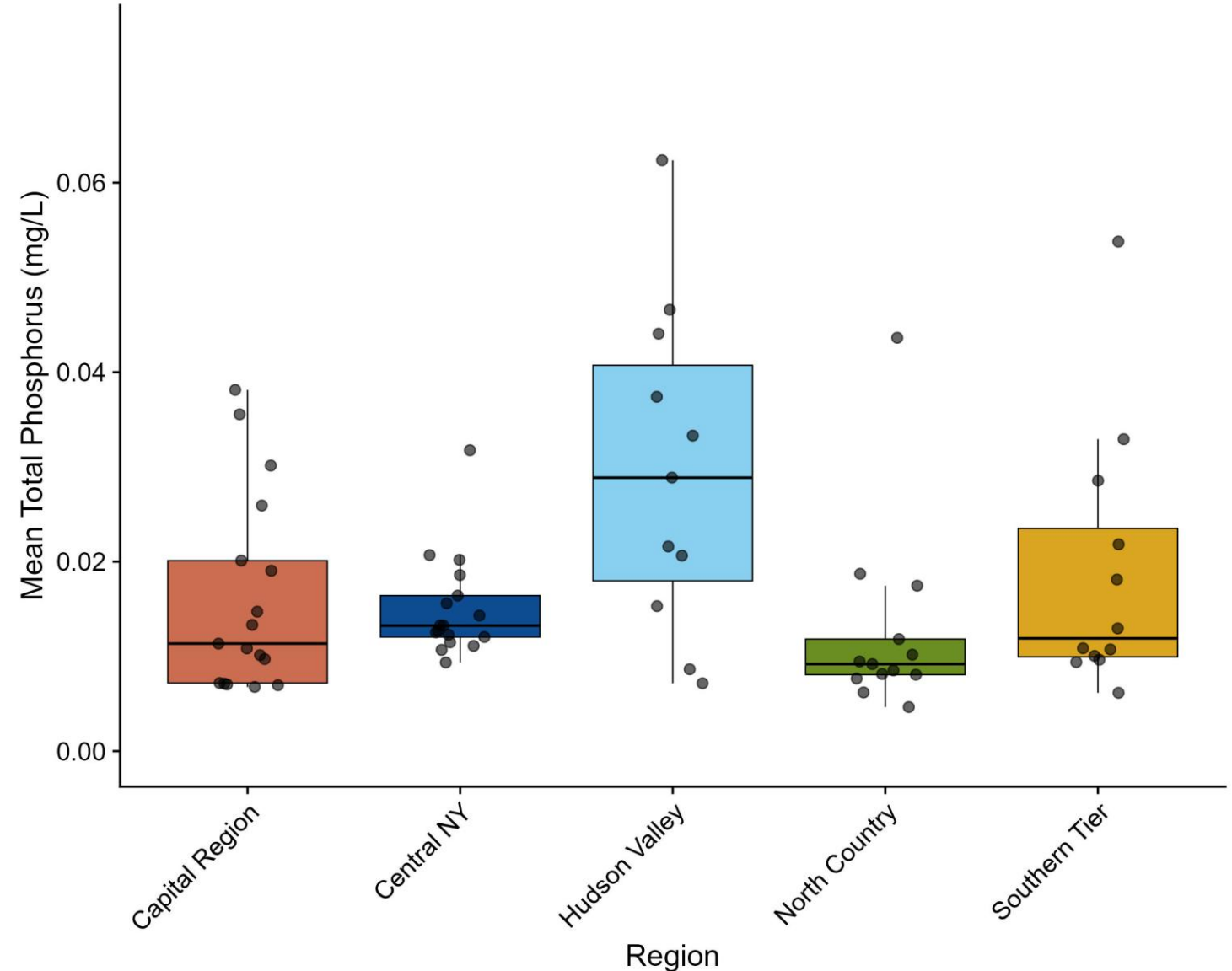
$n = 70$ lakes

Hudson Valley – highest median, and range

North County – lowest mean

Central NY – tightest range

Surface (Epilimnion) Total Phosphorus by Region
(Lake-Level Means)



Total Phosphorus

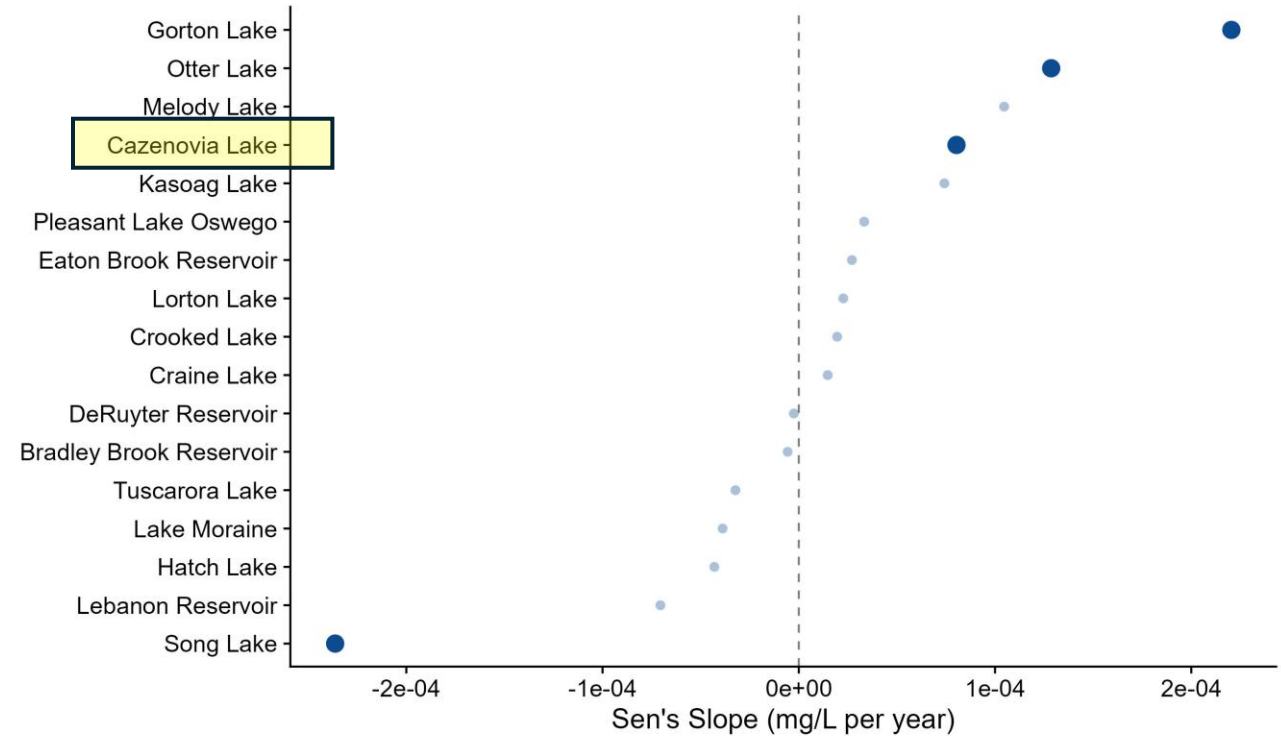
Surface

TRENDS

Region	Decreasing	Increasing	No Trend
Capital Region	3	2	12
Central NY	1	3	13
Hudson Valley	2	3	6
North Country	2	1	10
Southern Tier	1	1	10
TOTAL:	9	10	51

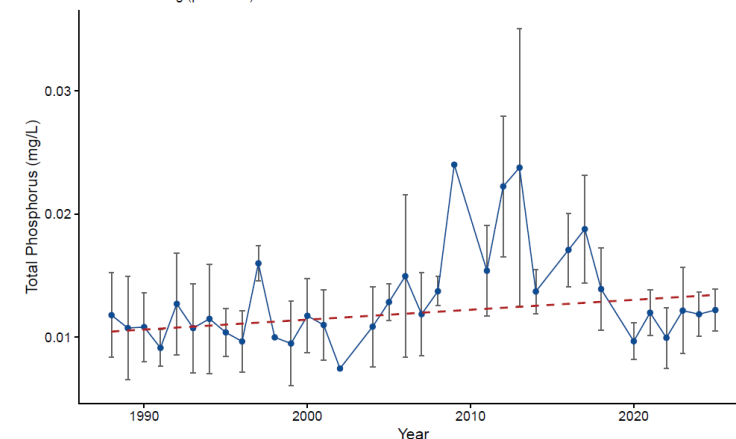
13% Decreasing
14% Increasing
73% No Trend

Long-Term Trends in Surface Total Phosphorus: Central NY



Cazenovia Lake (Central NY)

Trend: Increasing (p = 0.028)



Chlorophyll-a

Surface

REGIONAL

No significant overall regional differences in chlorophyll-a concentrations

Kruskal-Wallis $p = 0.06$

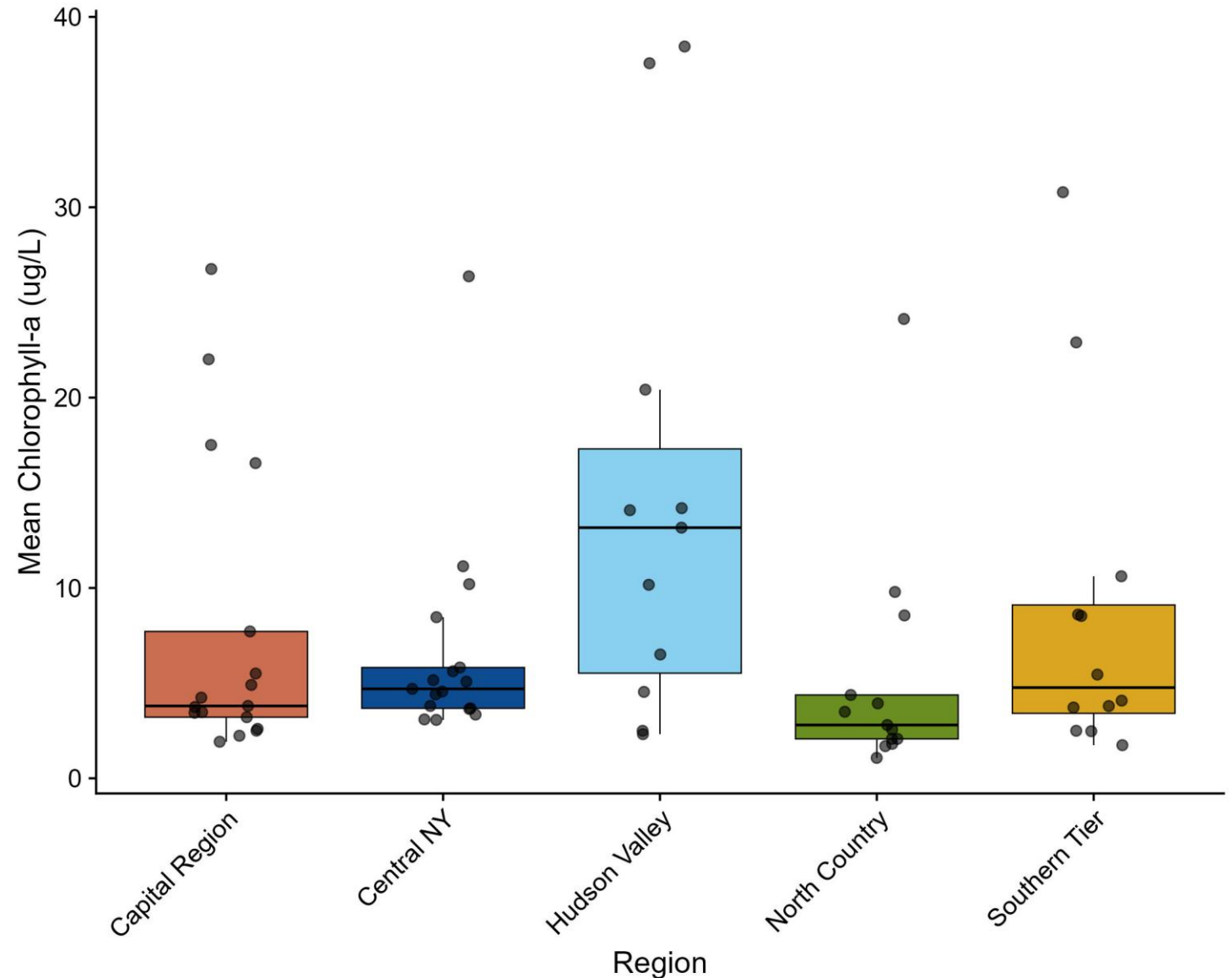
$n = 70$ lakes

Hudson Valley – highest median, and range

North County – lowest median

Central NY – relatively low variability, tight clustering around median

Surface Chlorophyll-a by Region
(Lake-Level Means)



Chlorophyll-a Surface

TRENDS

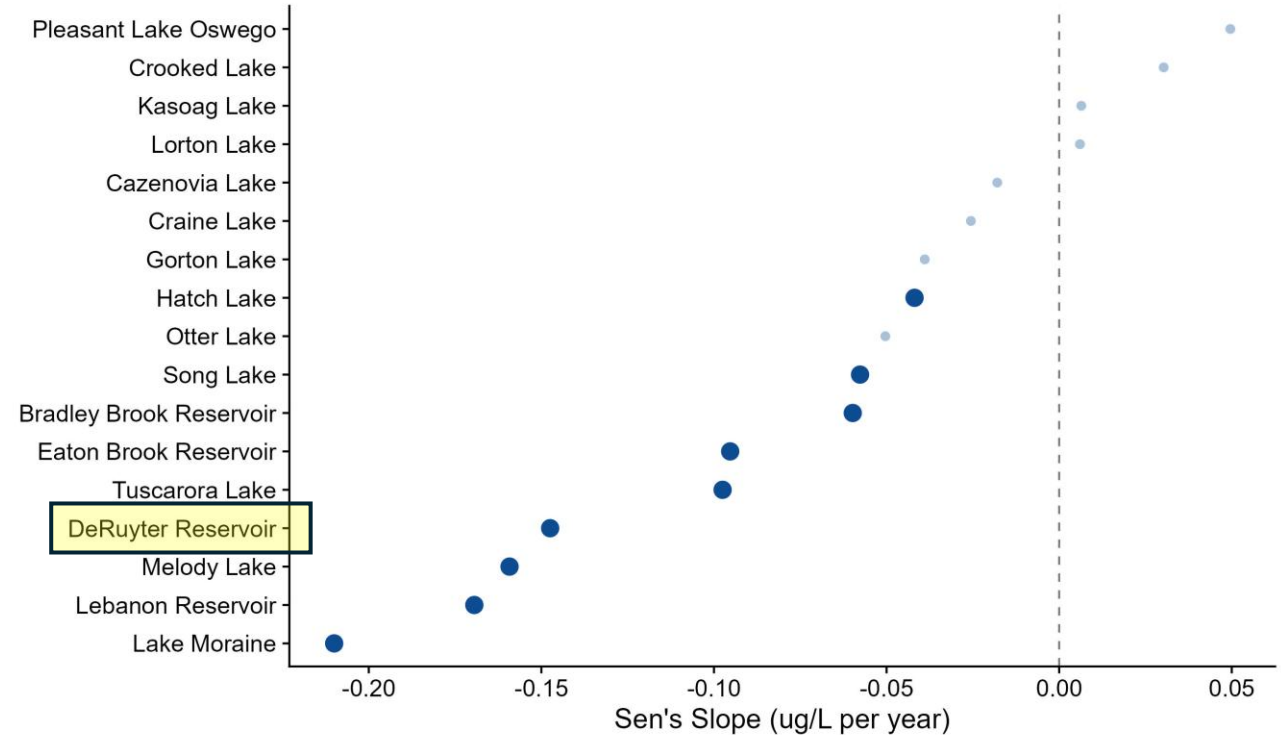
Region	Decreasing	Increasing	No Trend
Capital Region	5	1	11
Central NY	9	0	8
Hudson Valley	4	0	7
North Country	3	0	10
Southern Tier	3	1	8
TOTAL:	24	2	44

34% Decreasing

3% Increasing

63% No Trend

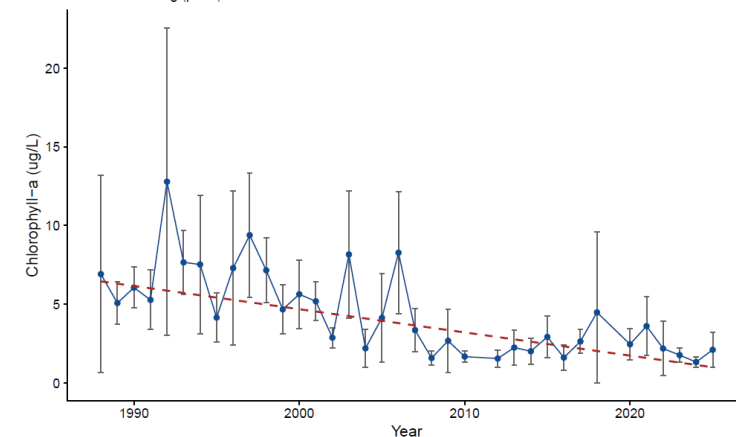
Long-Term Trends in Surface Chlorophyll-a: Central NY



Trend Significance • Not Significant • Significant ($p < 0.05$)

DeRuyter Reservoir (Central NY)

Trend: Decreasing ($p = 0$)



Secchi depth

REGIONAL

No significant overall regional differences in Secchi depth

ANOVA $p = 0.133$

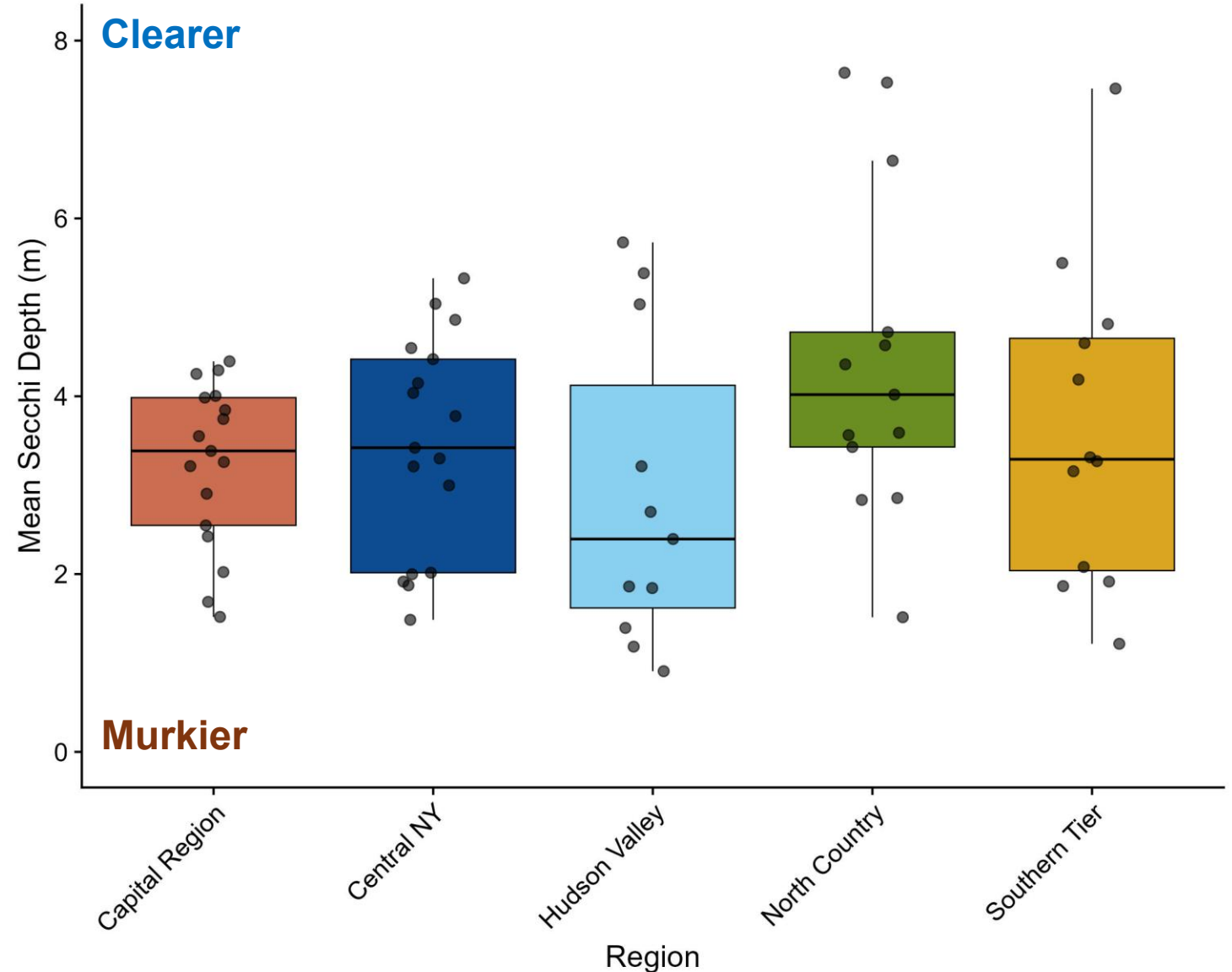
$n = 70$ lakes

Hudson Valley – lowest median (murkiest)

North County – highest median (clearest)

Central NY – mid range

Secchi Depth by Region
(Lake-Level Means)



Secchi depth

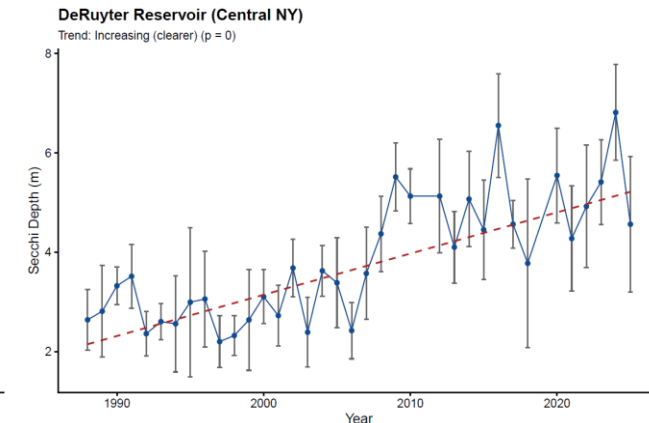
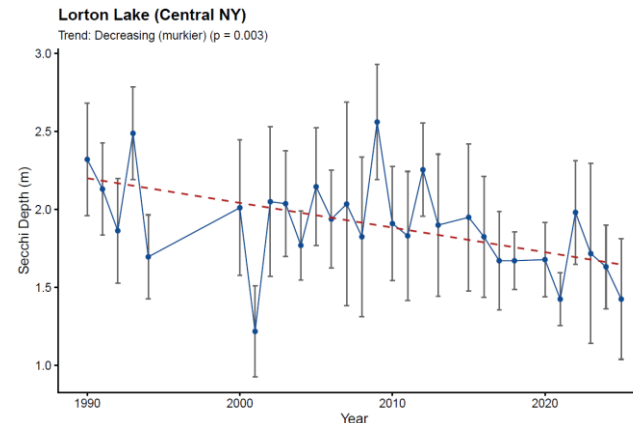
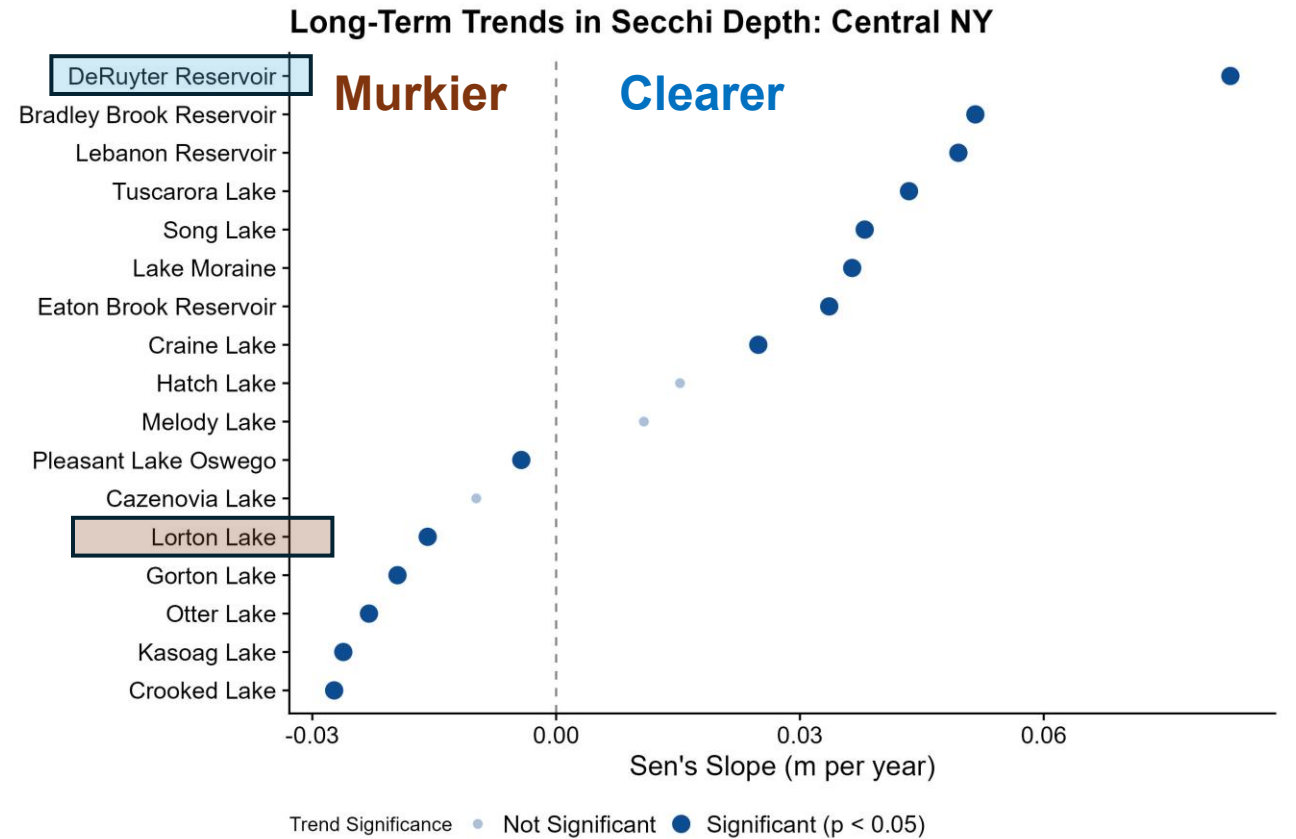
TRENDS

Region	Murkier		Clearer	No Trend
	Decreasing	Increasing		
Capital Region	5	2	10	
Central NY	6	8	3	
Hudson Valley	5	2	4	
North Country	3	2	8	
Southern Tier	2	2	8	
TOTAL:	21	16	33	

30% Decreasing (murkier)

23% Increasing (clearer)

47% No Trend



Total Nitrogen

Surface

REGIONAL

Significant overall regional differences in surface total nitrogen concentrations

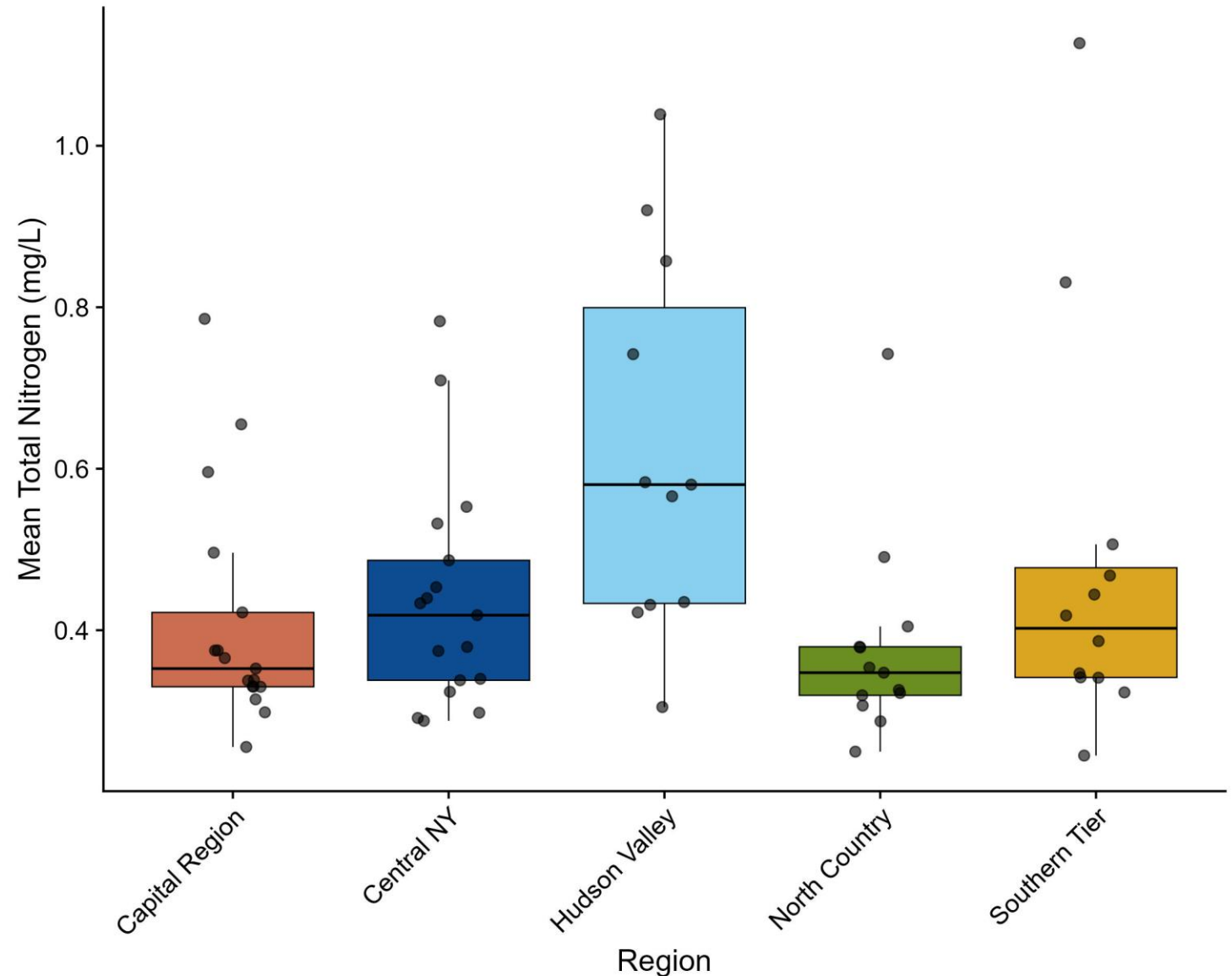
- Kruskal-Wallis $p < 0.02$
- $n = 70$ lakes

Hudson Valley – highest – *sig. diff. from all other Regions*

North County – lowest median

Central NY – mid range

Surface (Epilimnion) Total Nitrogen by Region
(Lake-Level Means)



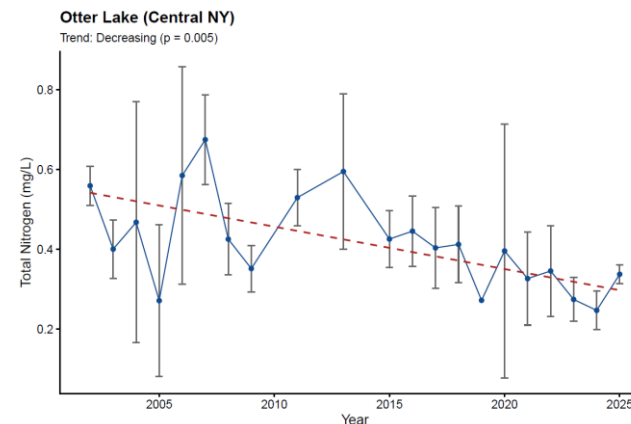
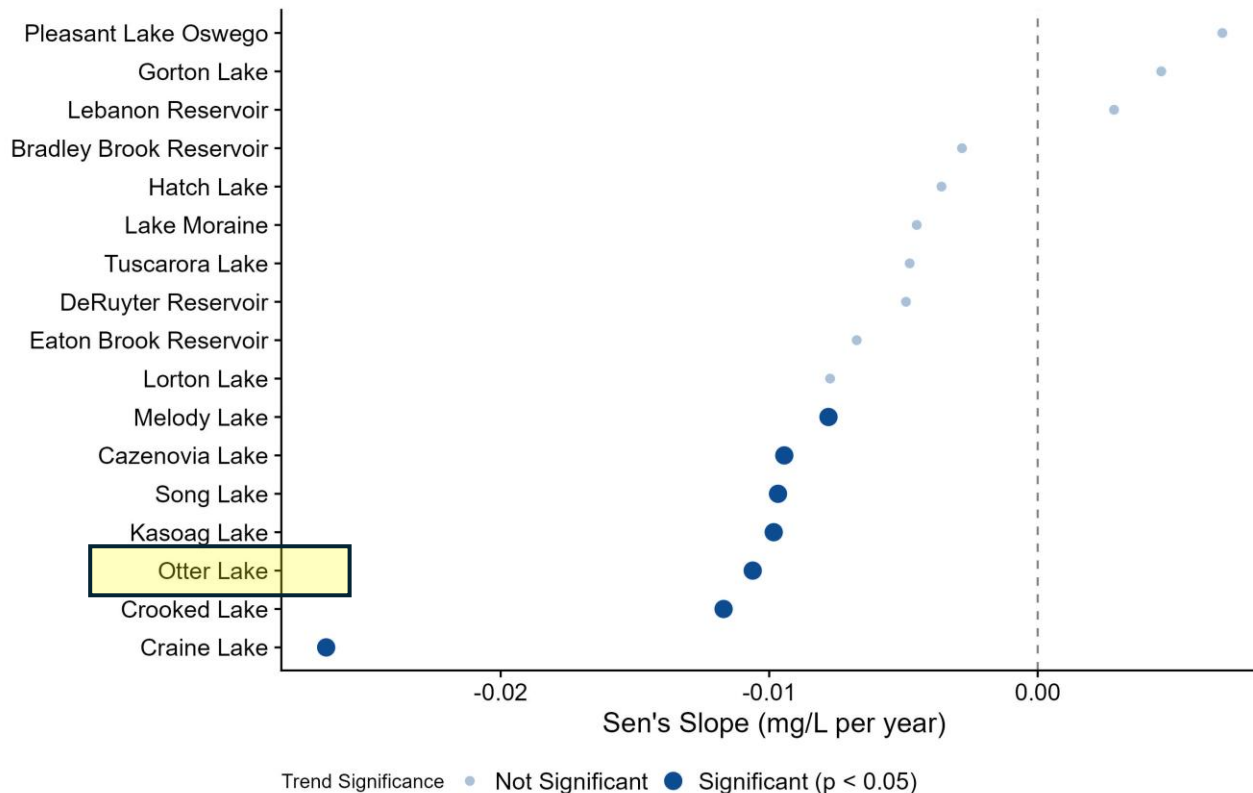
Total Nitrogen Surface

TRENDS

Region	Decreasing	Increasing	No Trend
Capital Region	5	0	12
Central NY	7	0	10
Hudson Valley	4	1	6
North Country	6	0	7
Southern Tier	3	0	9
TOTAL:	25	1	44

36% Decreasing
1% Increasing
63% No Trend

Long-Term Trends in Surface Total Nitrogen: Central NY



Looking good, Central NY*

Significant Trends

Lake	TP	Chl-a	Secchi
Song Lake	↓	↓	↑
Bradley Brook Res.	-	↓	↑
DeRuyter Res.	-	↓	↑
Eaton Brook Res.	-	↓	↑
Lake Moraine	-	↓	↑
Lebanon Res.	-	↓	↑
Tuscarora Lake	-	↓	↑
Craine Lake	-	-	↑
Hatch Lake	-	↓	-
Melody Lake	-	↓	-
Cazenovia Lake	↑	-	-
Crooked Lake	-	-	↓
Kasoag Lake	-	-	↓
Lorton Lake	-	-	↓
Pleasant Lake	-	-	↓
Gorton Lake	↑	-	↓
Otter Lake	↑	-	↓

Is it getting hot in here?

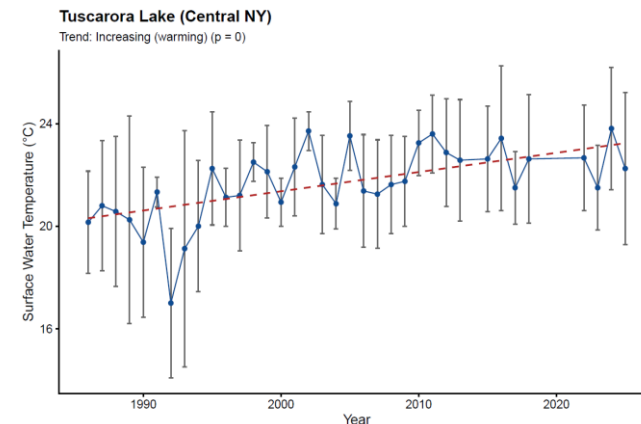
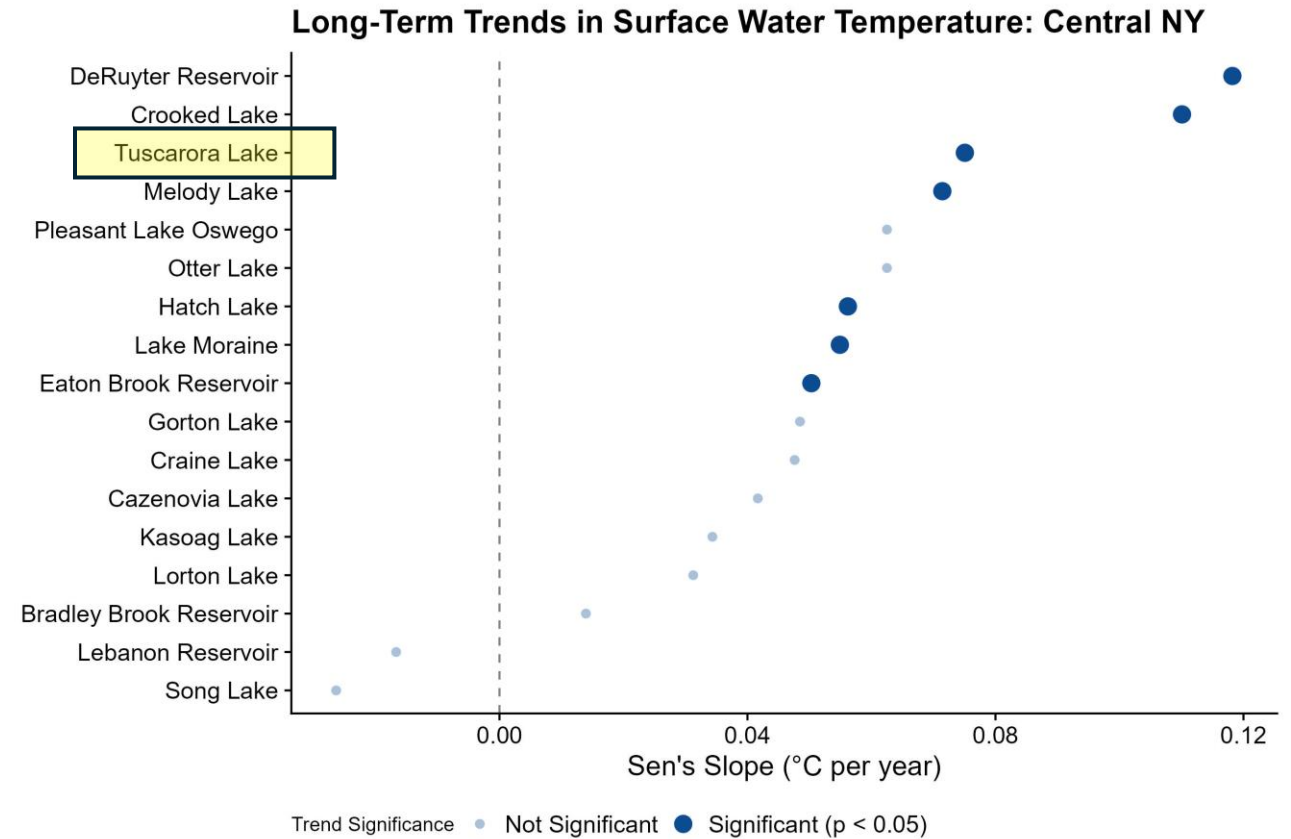


Water Temperature Surface

TRENDS

Region	Decreasing	Increasing	No Trend
Capital Region	0	6	11
Central NY	0	7	10
Hudson Valley	0	5	6
North Country	2	7	4
Southern Tier	0	7	5
TOTAL:	2	32	36

3% Decreasing
46% Increasing
51% No Trend



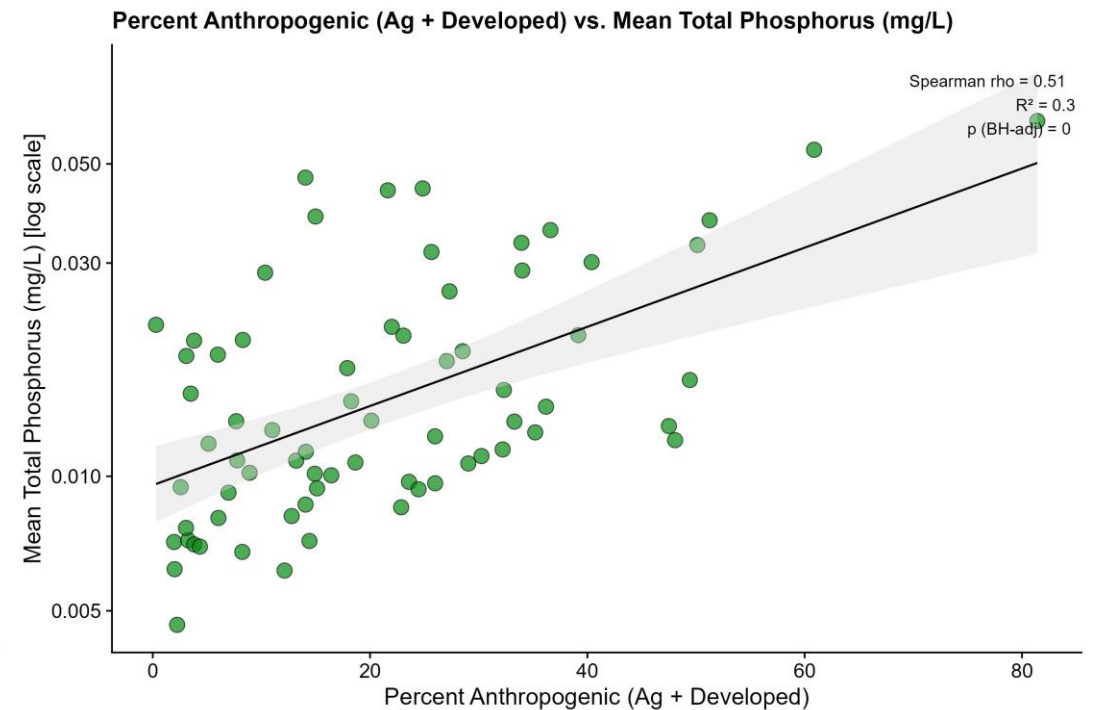
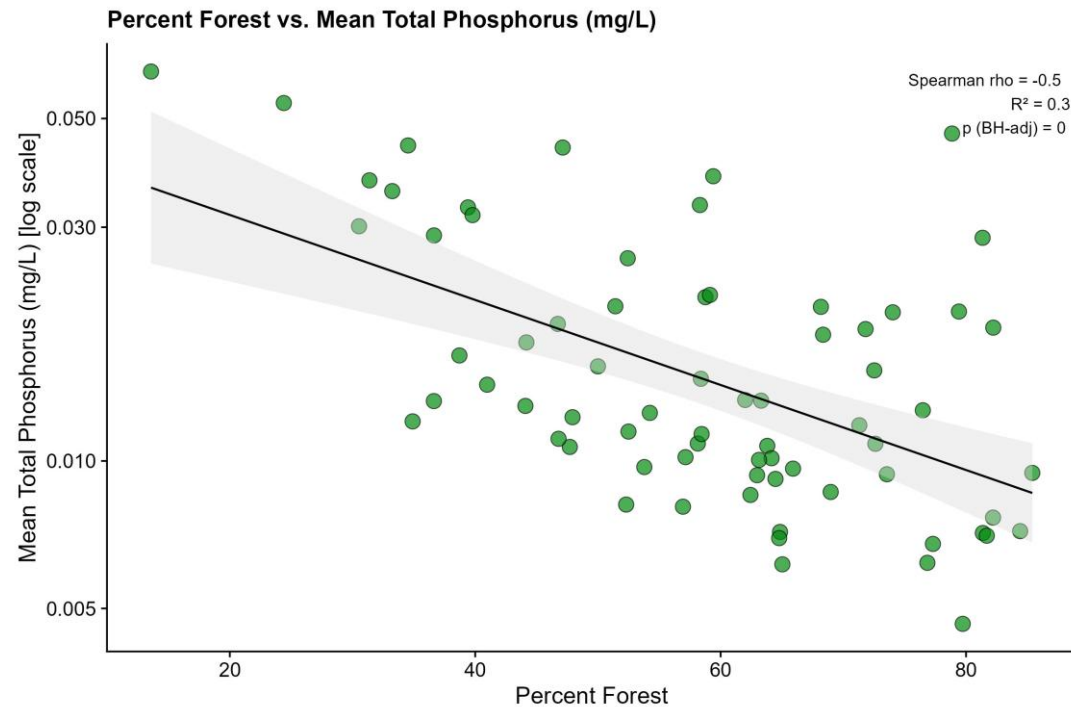
Can LULC Explain Regional Differences?

Total P and Total N

No regional differences in correlations between LULC and TP, TN

Or, agricultural watershed in CNY and Southern Tier have similar summer average nutrient concentrations

BUT...



Thank you!

Reminder:

Binder with plots @ UFI table

More lake data!



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