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# Extending Trophic State Assessments Using Volunteer-collected Water Quality Data



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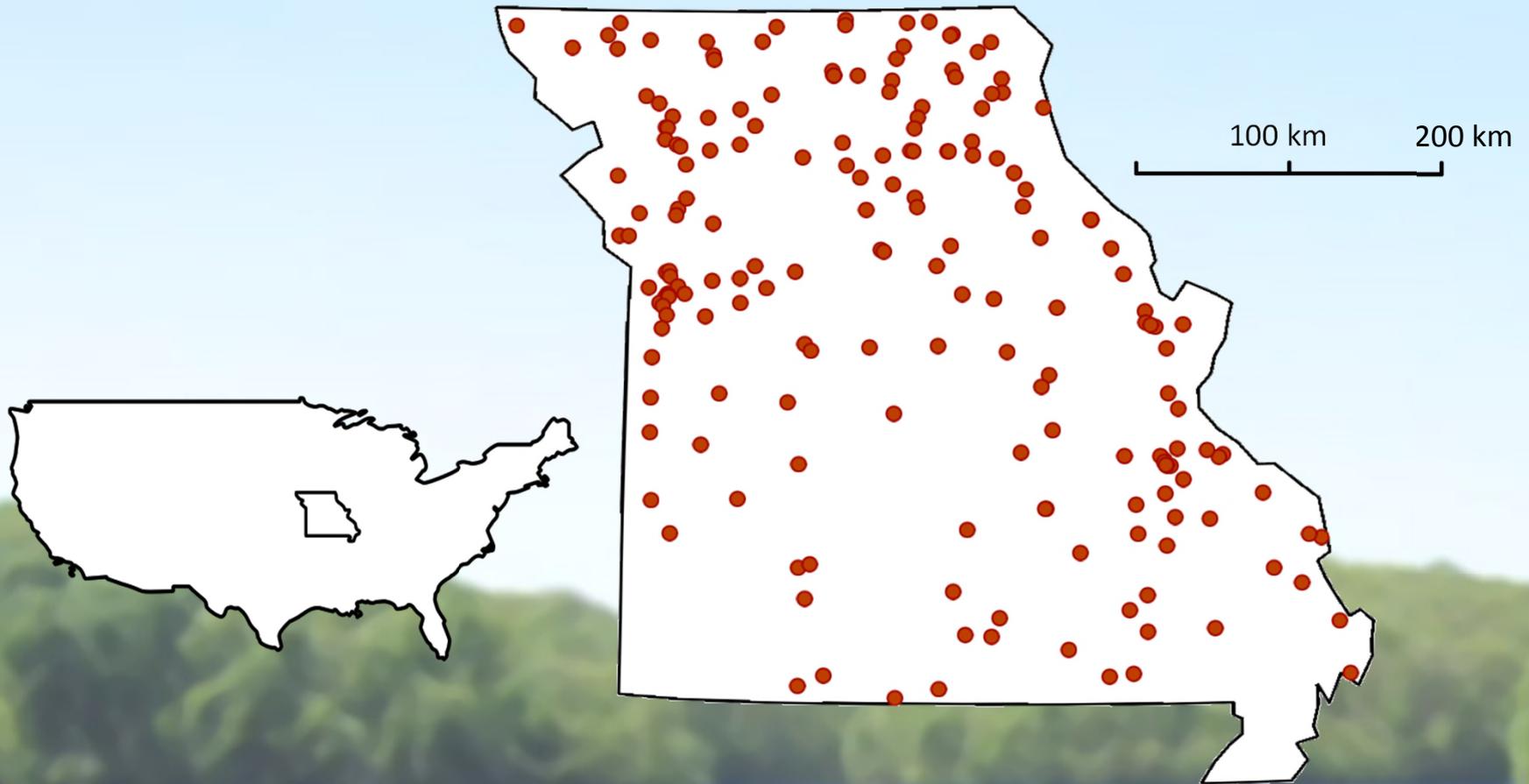


University of  
Missouri

The Missouri Department of Natural Resources

Region V11, US Environmental Protection Agency, through the Missouri Department of Natural Resources, has provided partial funding for this project under Section 319 of the Clean Water Act

# University of Missouri Lake Sampling



# Missouri, USA

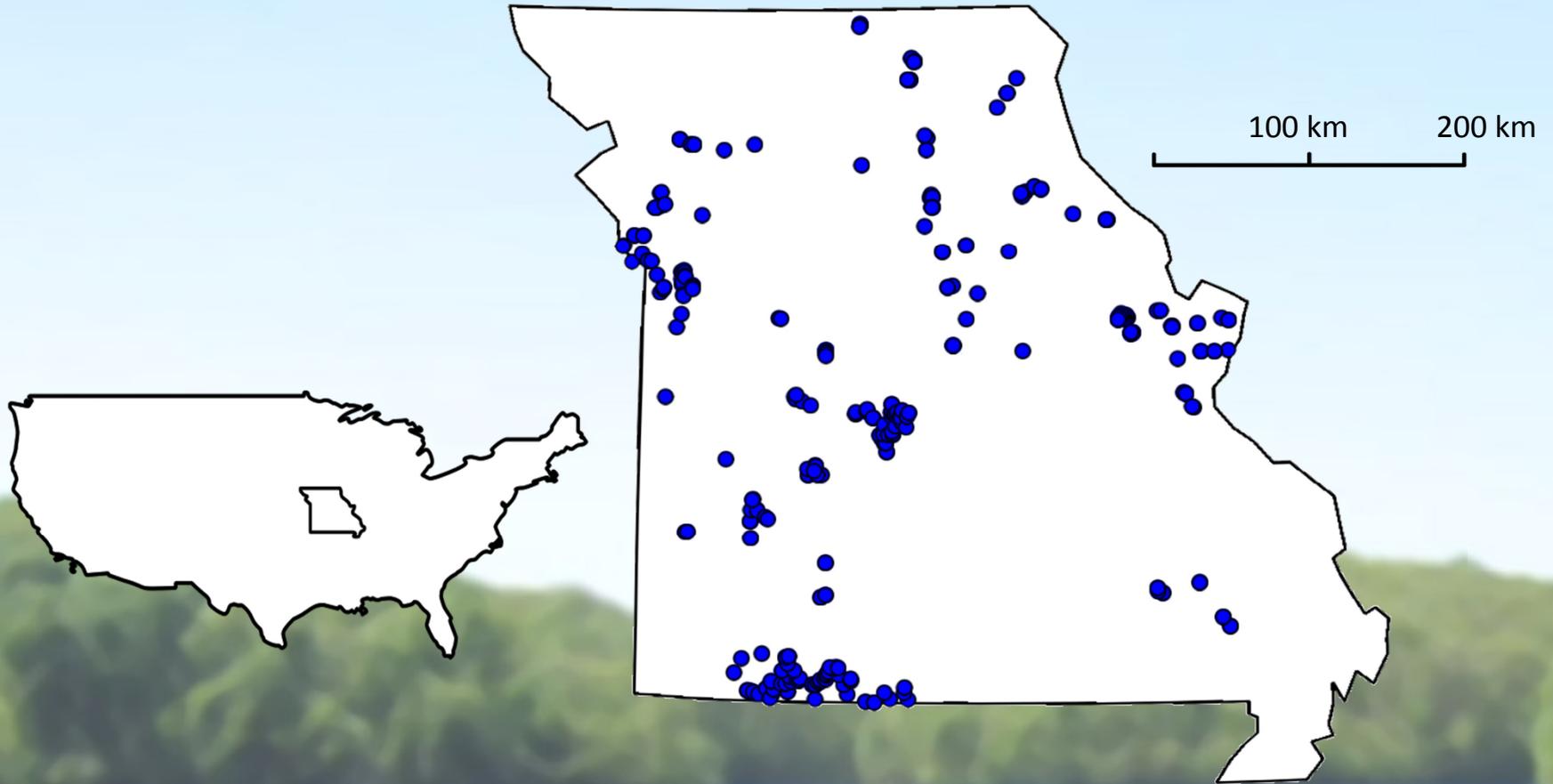
## Trophic State Assessment

Trophic State	Secchi (%)	Total Phosphorus (%)	Total Nitrogen (%)	Chlorophyll (%)
Oligotrophic	8	6	8	9
Mesotrophic	22	22	19	19
Eutrophic	60	63	62	62
Hypereutrophic	11	10	11	10

# Lakes of Missouri Volunteer Program



# The Lakes of Missouri Volunteer Program



# Methodological Differences

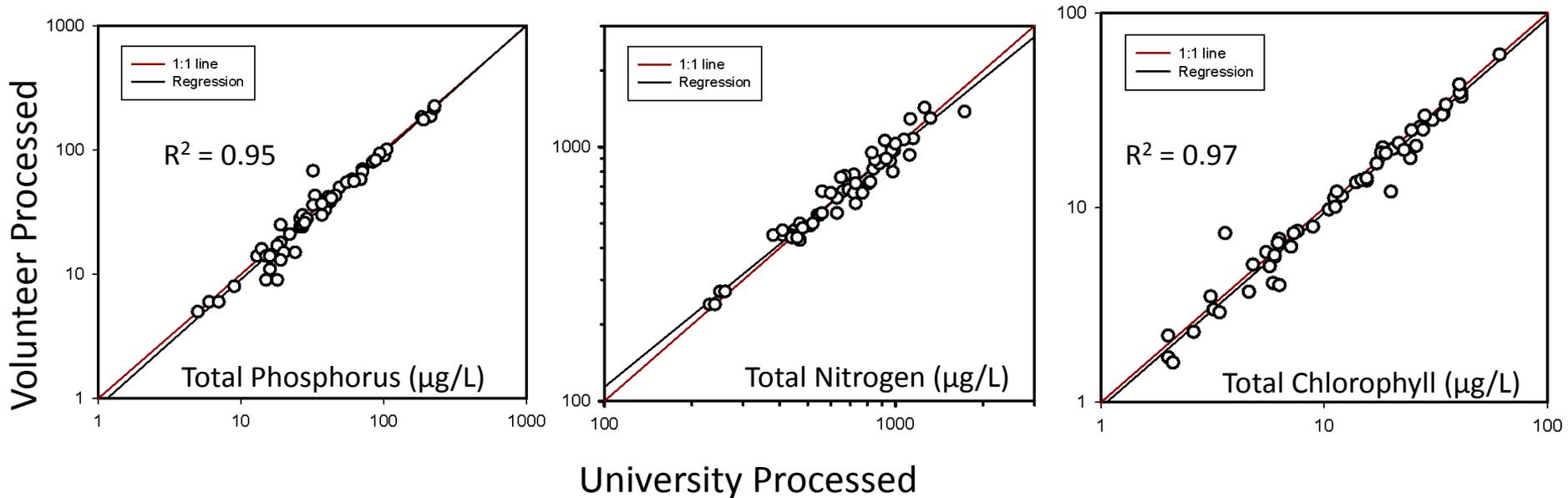
	University	Volunteer
Sampling Frequency:	Every 3 weeks	Every 3 weeks
Season Duration:	May through August (4 samples)	April through September (8 samples)
Site Selection:	Typically near dam	Multiple additional sites on larger reservoirs
Sample Storage:	Phosphorus pipetted directly into tubes	Phosphorus frozen in 60 ml Nalgene bottle
	Filters stored frozen in desiccant	Filters stored frozen in desiccant
Sample Analysis:	Triplicate nutrients	Duplicate nutrients

# **Extending Trophic State Assessments**



# Reliability of Volunteer Data

Side-by-side sampling events



	TP	TN	TCHL
Mean Difference	4	50	1.4
Mean RPD	12.7%	7.0%	12.3%

$$\text{RPD} = 100 * |(\text{University} - \text{Volunteer}) / [(\text{University} + \text{Volunteer})/2]|$$

**With proper training, data from samples collected and processed by volunteers are nearly identical to data derived from samples collected and processed by University staff.**



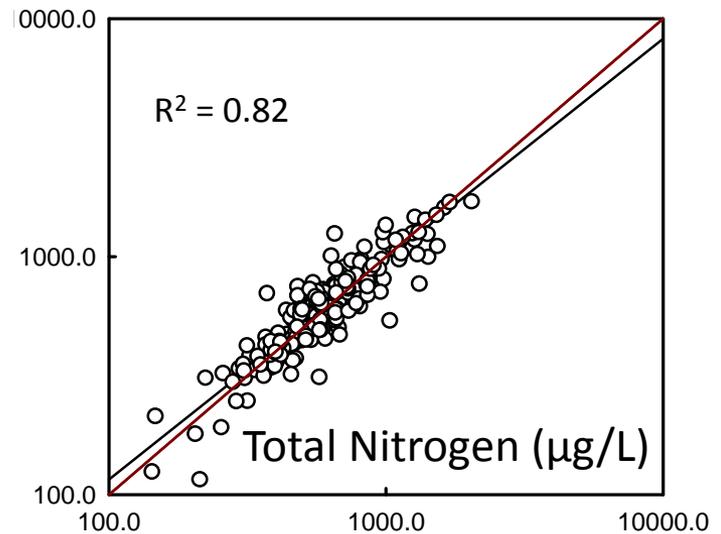
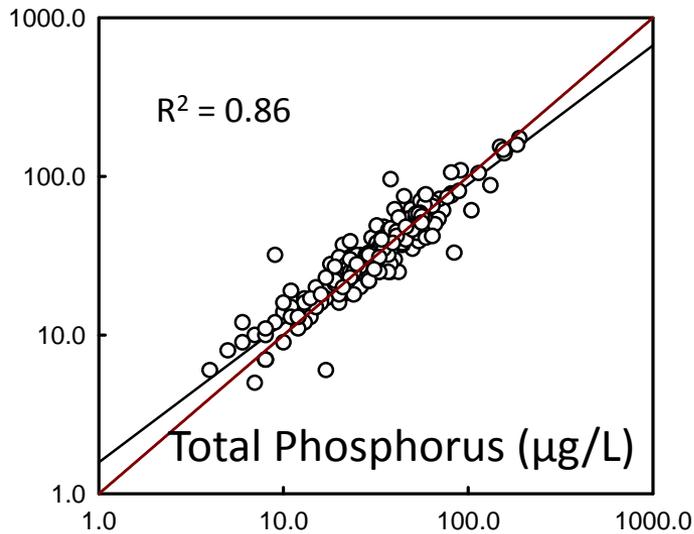
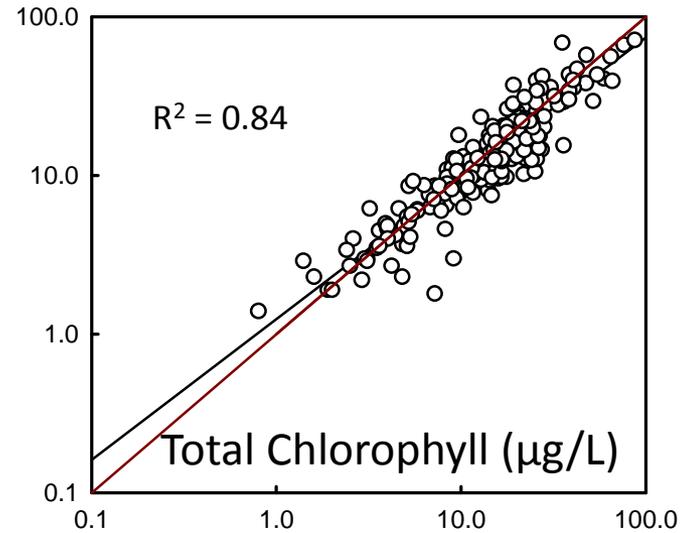
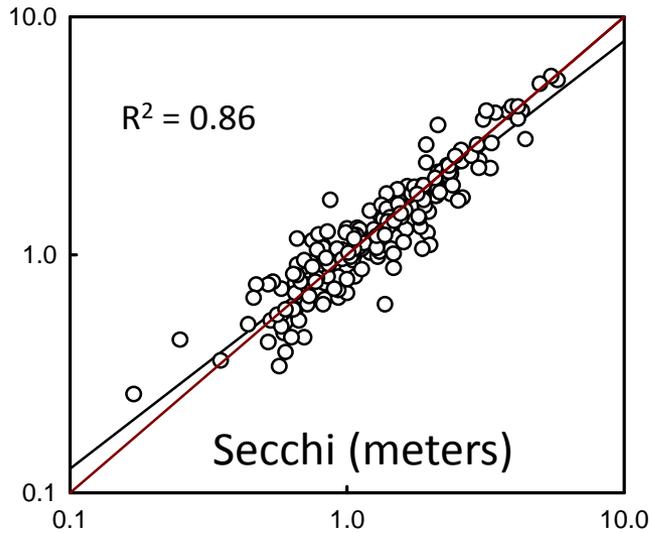
# Comparing Seasonal Datasets

- In 220 cases, a lake site was sampled in the same season by university personnel and by volunteers (36 lakes - 43 sites)
- Samples were not necessarily collected on the same day
- Volunteer data were trimmed to match temporal scale of university data (May 15 – Aug 31)
- At least 3 samples per season, aggregated to seasonal mean



# Comparison of 220 single-season mean values

Volunteer Collected and Processed



University Collected and Processed

# Seasonal Dataset (n=220)

	Secchi	Total Phosphorus	Total Nitrogen	Total Chlorophyll
Mean difference	0.3 m	6 µg/L	89 µg/L	4 µg/L
Mean RPD	17%	18%	14%	24%
Maximum RPD	75%	112%	63%	120%

$$\text{RPD} = 100 * |(\text{University} - \text{Volunteer}) / [(\text{University} + \text{Volunteer})/2]|$$

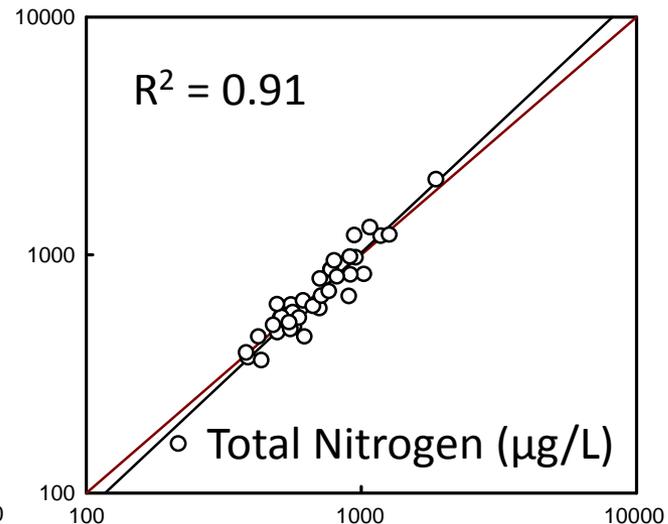
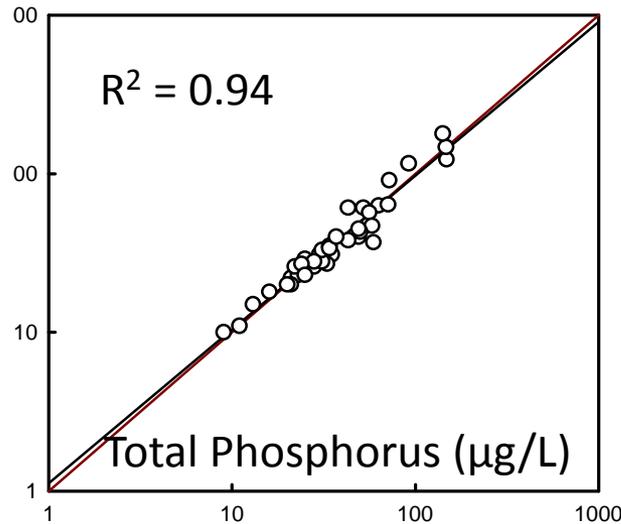
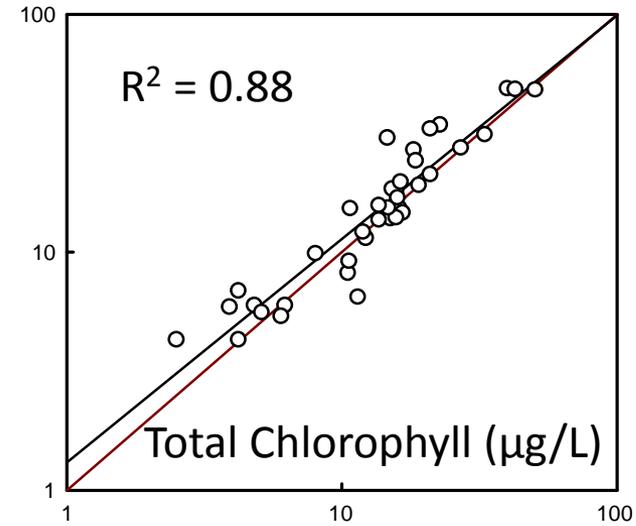
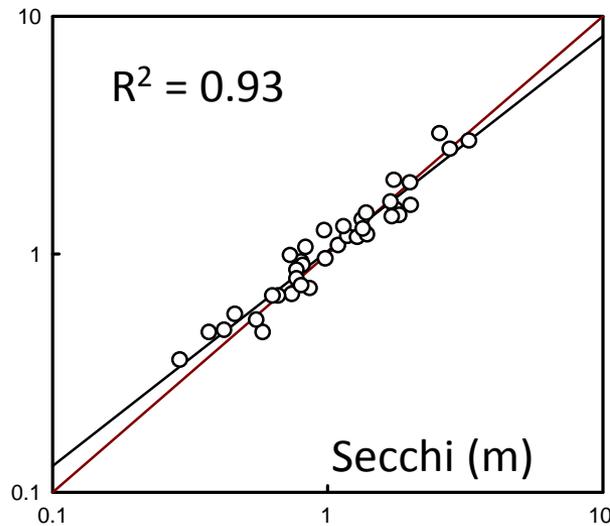
# Comparing Long-Term Datasets

- **Lakes are not necessarily sampled in the same year**
- **Lakes were monitored for at least 4 seasons by both programs**
- **Data trimmed to same temporal scale**



# Comparison of 38 long-term lake mean values ( $\geq 4$ seasons, $n = 38$ )

Volunteer Collected and Processed



University Collected and Processed

# Long-Term Dataset (n=38)

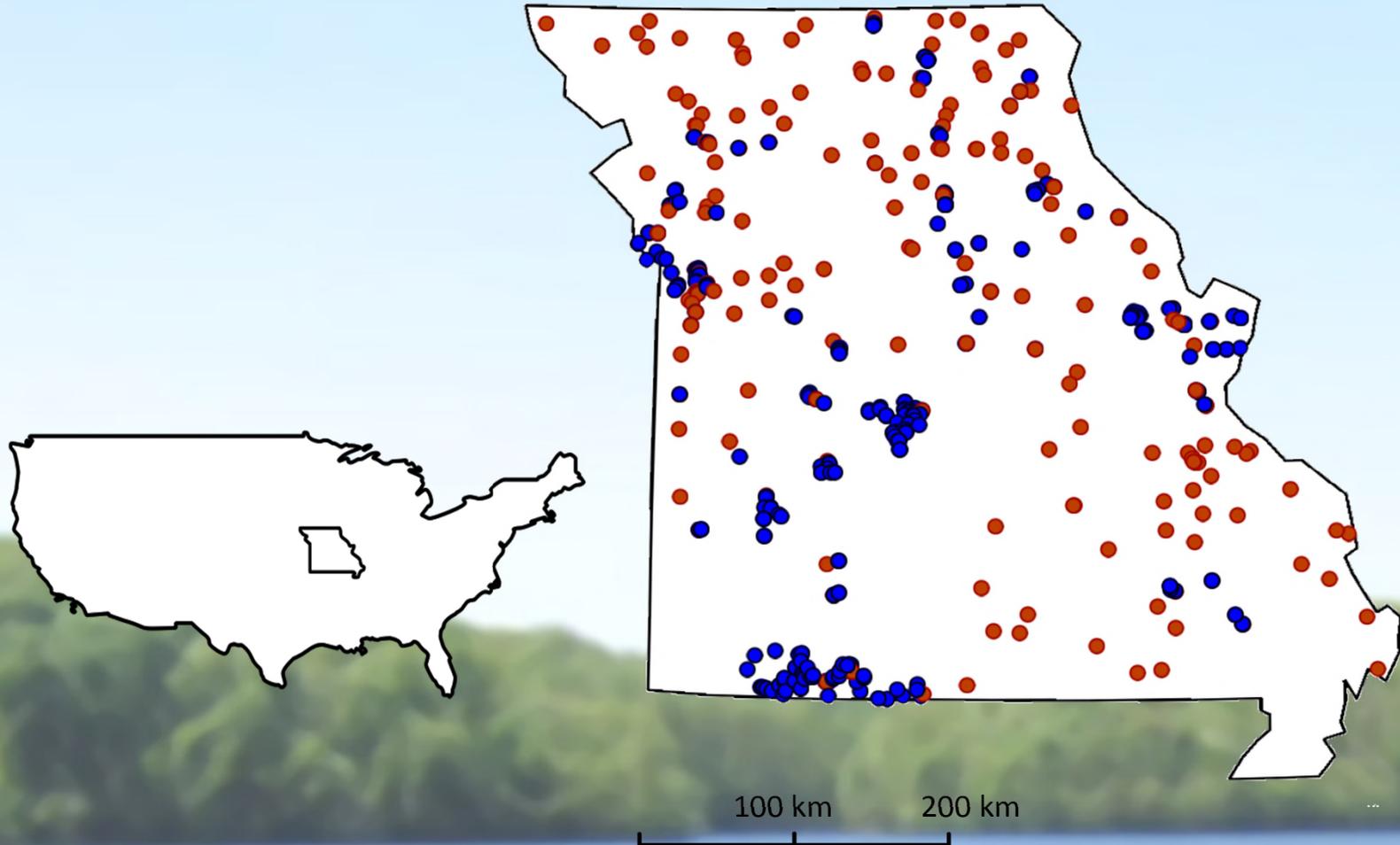
	Secchi	Total Phosphorus	Total Nitrogen	Total Chlorophyll
Mean Difference	0.19 m	7 µg/L	74 µg/L	2.9 µg/L
Mean RPD	12%	12%	11%	19%
Maximum RPD	30%	46%	31%	70%

$$\text{RPD} = 100 * |(University - Volunteer) / [(University + Volunteer)/2]|$$

# Comparing Trophic State Assessments

	Secchi	Total Phosphorus	Total Nitrogen	Total Chlorophyll
Percent of lake sites with matching trophic assessment (n=38)	95%	87%	82%	87%
Average difference between unmatched values	0.16 m	8 $\mu\text{g/L}$	141 $\mu\text{g/L}$	4.0 $\mu\text{g/L}$

# Extending the Trophic Assessments



# Benefits of Volunteers

- **Why not just send out more field staff?**
- **Cost:benefit/sample**
- **Location near lake (eyes/ears argument)**
- **Volunteers are intended to augment, not replace field staff**



**Thank you**