

Summer Phytoplankton Communities in Productive Ohio Reservoirs:

Importance of Cyanobacteria, Ecoregion, and Land Use Patterns

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Ecoregions

- **General descriptions of regional characteristics**
- **85 Level III assigned by USEPA**
- **Designations reflect larger scale similarities & differences than individual watersheds**

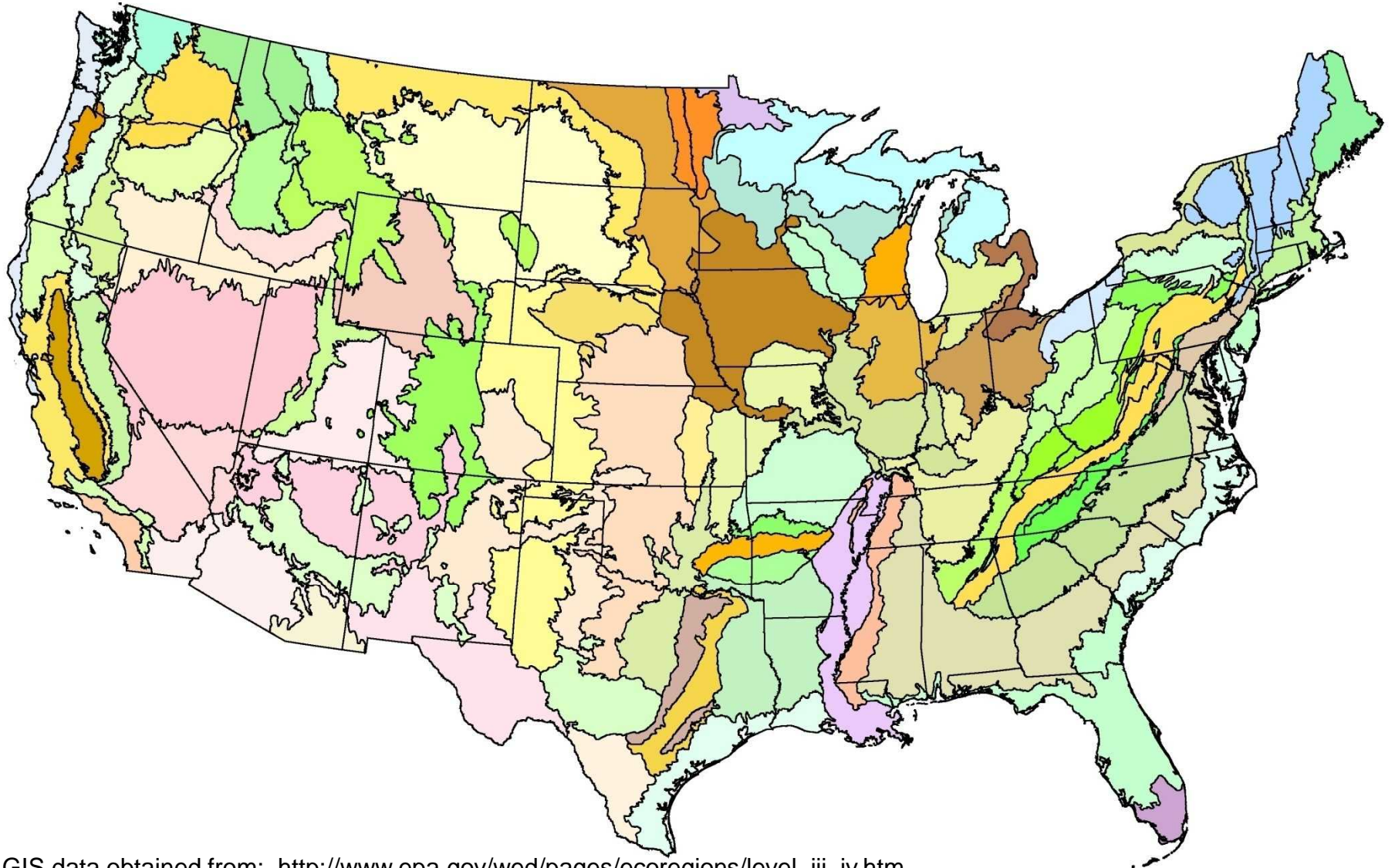
Hypothesis

- Do land use patterns at the Ecoregion scale & associated nutrient inflows affect phytoplankton, specifically Cyanobacteria composition?

Phytoplankton Database

- **59 water column samples (2008-2011)**
 - **29 spring**
 - **30 summer**
 - **early fall samples considered with summer samples**
- **25 reservoirs**
- **3 ecoregions**

EPA Level III Ecoregions

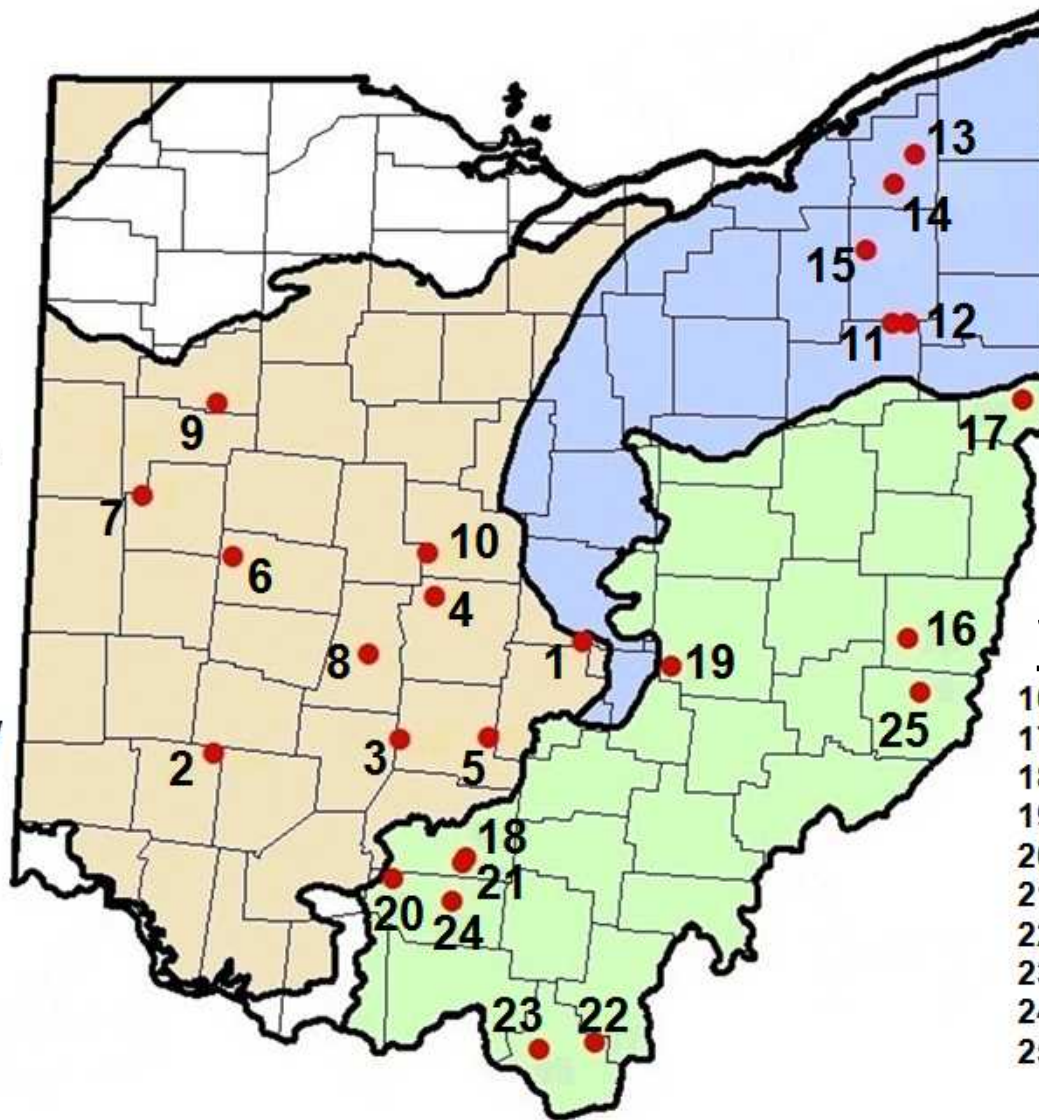


GIS data obtained from: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm



ECBP

1. Buckeye
2. Caesar Creek
3. Deer Creek Lake
4. Griggs
5. Hargus
6. Kiser
7. Loramie
8. Madison
9. Metzger
10. O'Shaughnessy



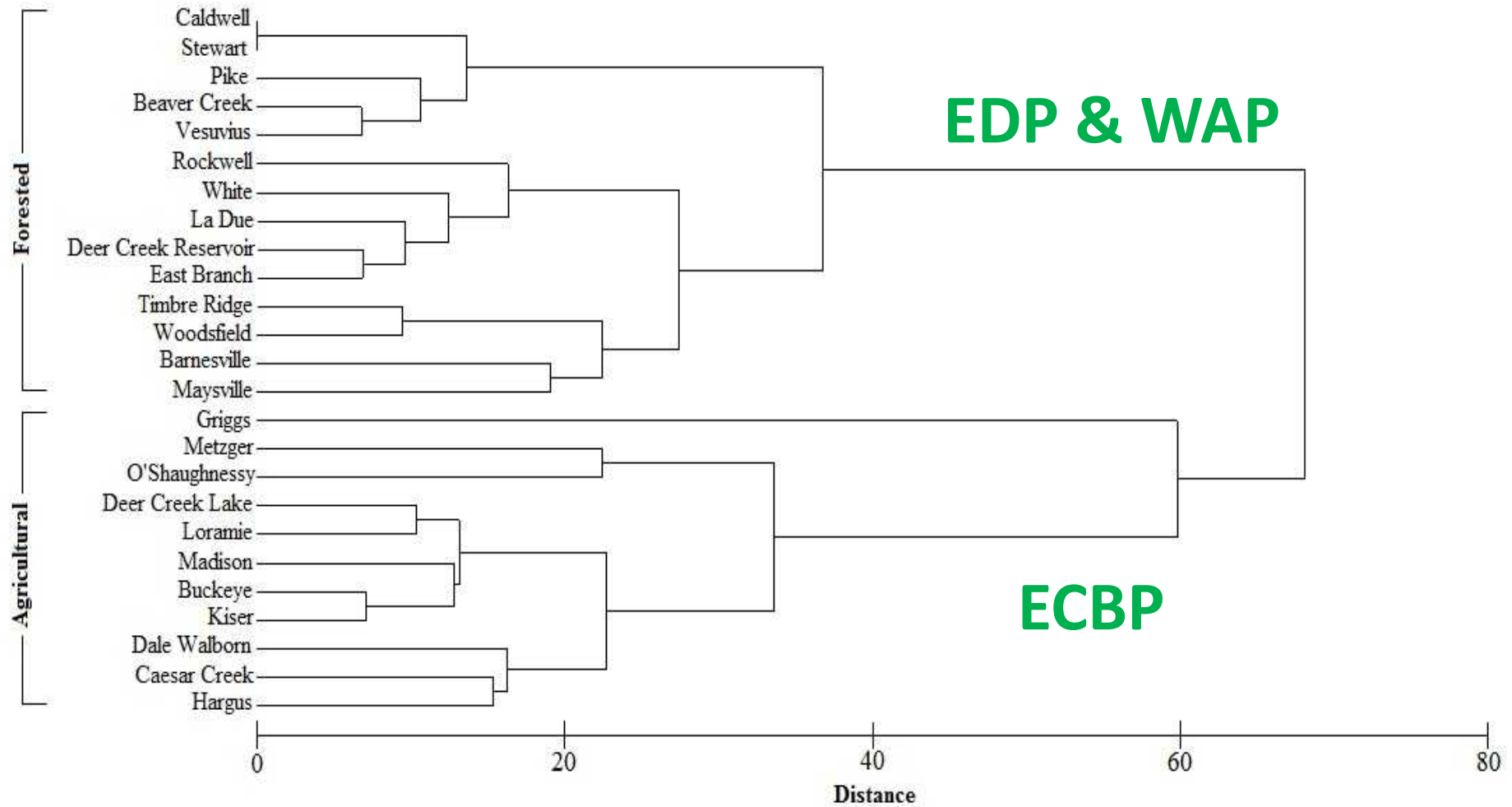
EDP

11. Dale Walborn
12. Deer Creek
13. East Branch
14. LaDue
15. Rockwell

WAP

16. Barnesville
17. Beaver Creek
18. Caldwell
19. Maysville
20. Pike
21. Stewart
22. Timbre Ridge
23. Vesuvius
24. White
25. Woodsfield

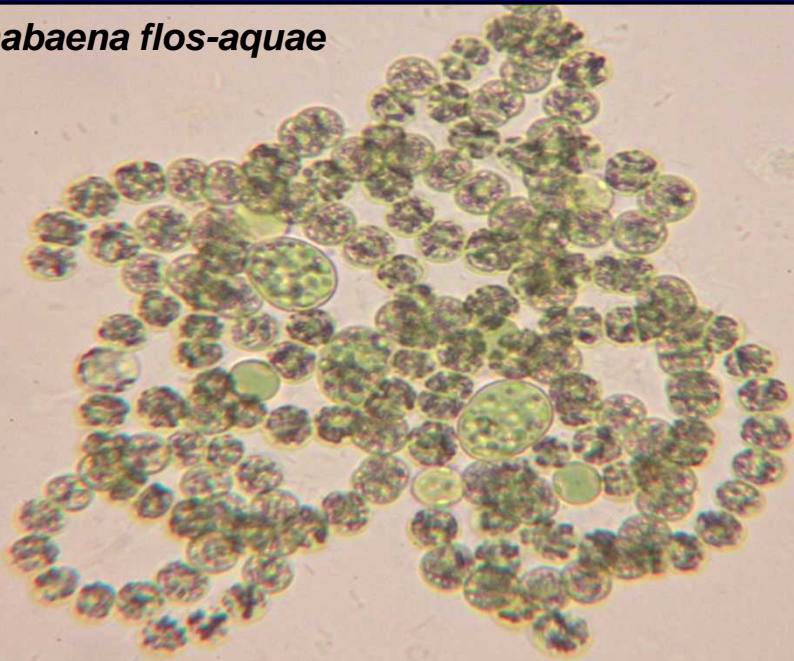
Land Use Dendrogram



	Reservoir	Area (hectares)	Maximum Depth (m)
Eastern Corn Belt Plains	Buckeye	1153	4
	Caesar Creek	1055	30
	Deer Creek Lake	522	11
	Griggs	157	6
	Hargus	53	12
	Kiser	159	4
	Loramie	341	2
	Madison	40	1
	Metzger	65	13
	O'Shaughnessy	369	12
	Mean	391	10
Erie Drift Plain	Dale Walborn	271	9
	Deer Creek Reservoir	135	5
	East Branch	163	5
	LaDue	597	6
	Rockwell	337	9
	Mean	301	7
Western Allegheny Plateau	Barnesville	19	10
	Beaver Creek	45	9
	Caldwell	4	6
	Maysville	18	-
	Pike	5	9
	Stewart	4	8
	Timbre Ridge	39	11
	Vesuvius	58	8
	White	135	7
	Woodsfield	3	-
	Mean	33	8

	Reservoir	n	Chlorophyll a (µg/L)	Secchi Depth (m)	TN (µg/L)	TP (µg/L)	N:P	Trophic Status
Eastern Corn Belt Plains	Buckeye	5	97.1	0.43	1544	67	30	E
	Caesar Creek	3	51.5	0.91	3370	47	85	E
	Deer Creek Lake	2	18.4	1.35	3100	81	39	E
	Griggs	2	39.6	0.8	5225	83	50	E
	Hargus	1	24.8	1.1	1120	40	28	E
	Kiser	3	53.8	0.82	813	63	12	E
	Loramie	3	61.4	0.16	4460	632	19	E
	Madison	1	48	0.38	4110	86	48	E
	Metzger	3	25	1.07	2907	31	91	E
	O'Shaughnessy	3	45.2	0.61	5253	80	51	E
	Mean		46	0.76	3190	121	45	
Erie Drift Plain	Dale Walborn	3	54.6	0.61	1163	38	31	E
	Deer Creek Reservoir	5	31.6	0.64	892	37	27	E
	East Branch	1	168	0.43	940	77	12	E
	LaDue	1	55.4	0.8	1850	29	64	E
	Rockwell	1	36.6	0.73	840	76	11	E
	Mean		69	0.64	1137	51	29	
Western Allegheny Plateau	Barnesville	7	10.4	1.93	474	19	55	E
	Beaver Creek	4	22	1.29	1810	12	229	E
	Caldwell	1	3.6	1.93	590	10	59	M
	Maysville	1	4	5	540	5	108	M
	Pike	1	4	1.2	500	5	100	M
	Stewart	1	11.1	1.91	420	5	84	E
	Timbre Ridge	1	1.9	2.5	150	5	30	O
	Vesuvius	3	8.1	0.53	317	15	24	M
	White	1	2.2	0.2	-	15	-	O
	Woodsfield	2	25.4	1.31	410	18	24	E
	Mean		9	1.78	579	11	79	

Anabaena flos-aquae



Aphanizomenon sp.

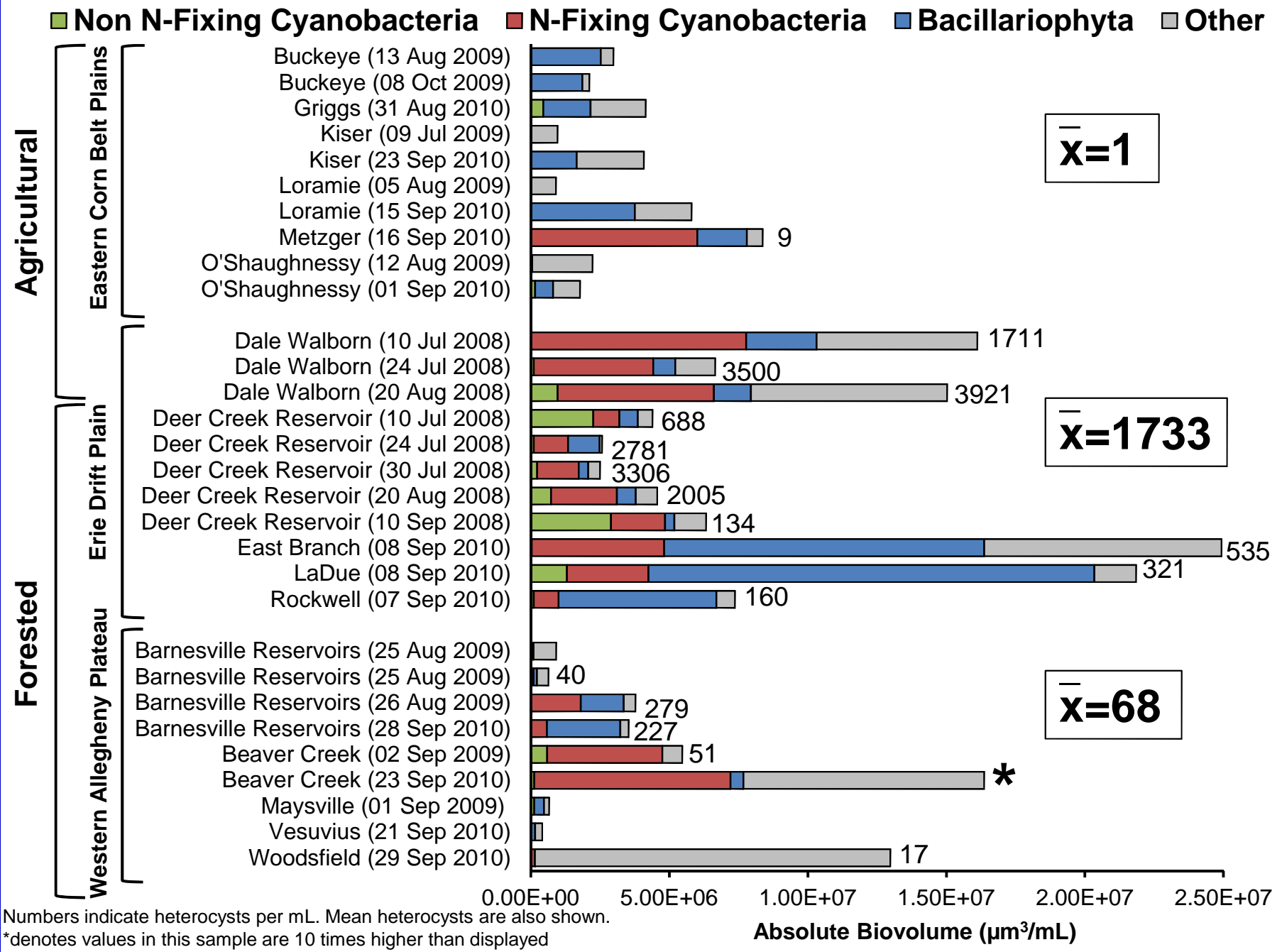


Cylindrospermopsis raciborskii

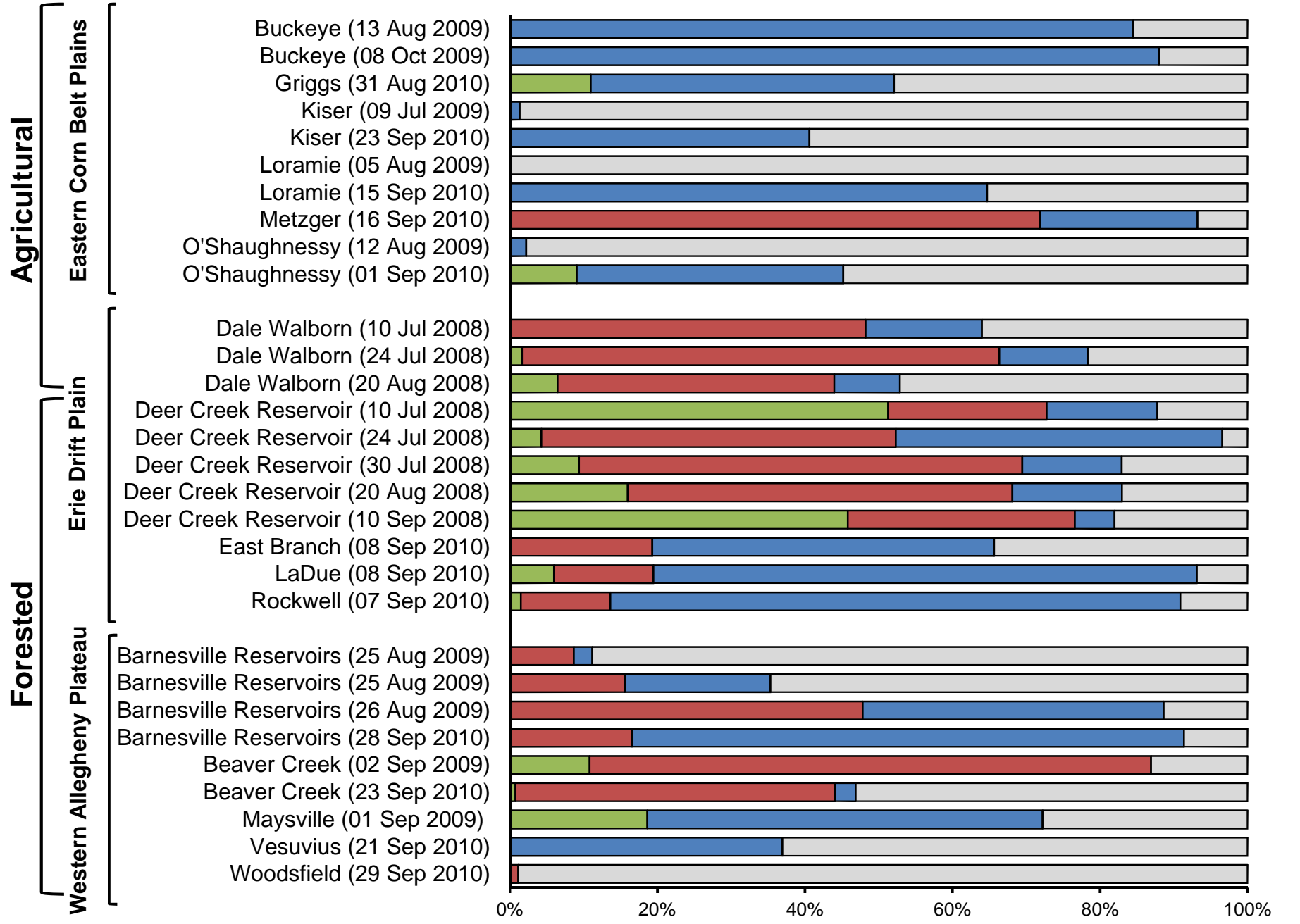


Planktothrix agardhii





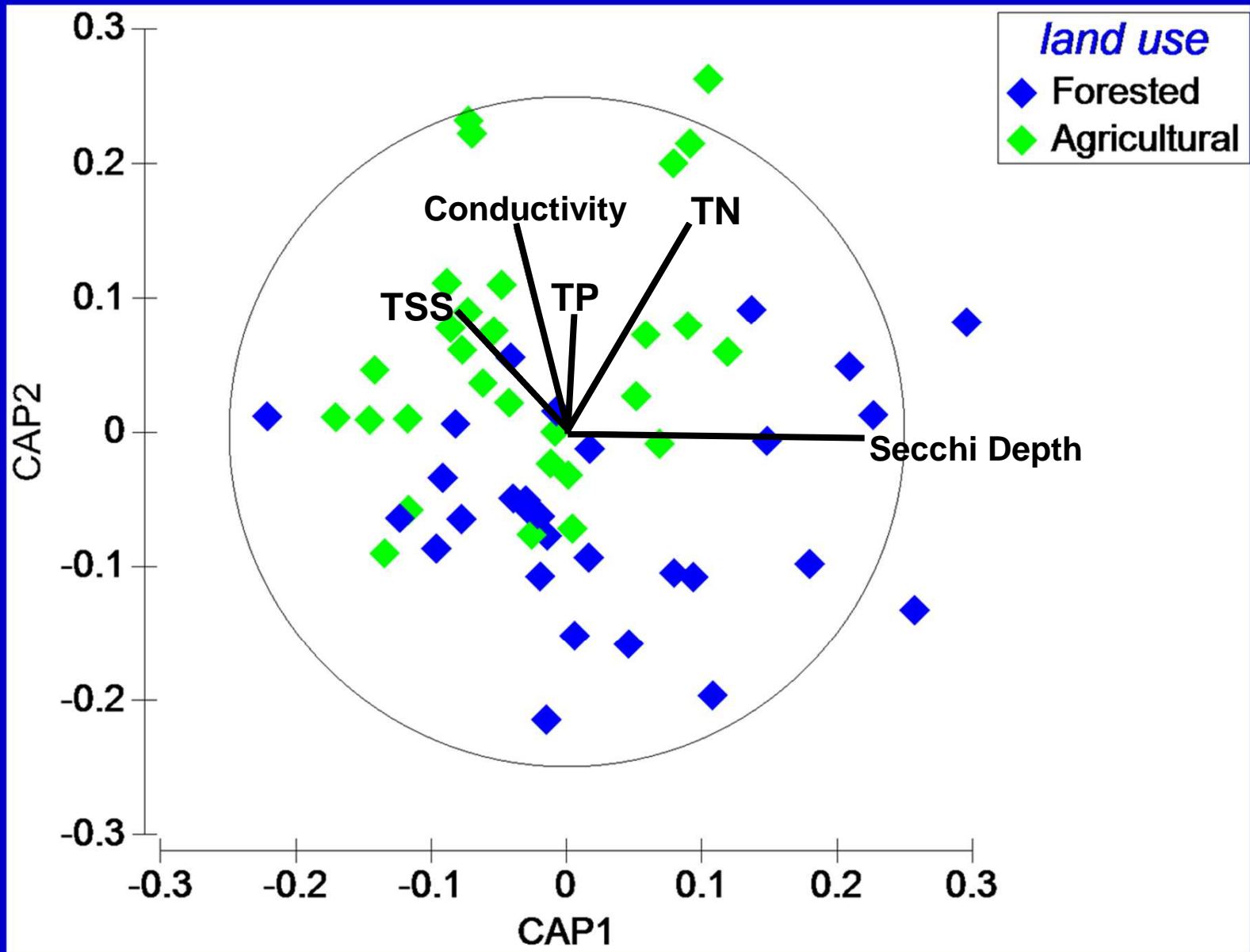
■ Non N-Fixing Cyanobacteria
 ■ N-Fixing Cyanobacteria
 ■ Bacillariophyta
 ■ Other



Statistical Approach

- Aggregated 38 phytoplankton genera that accounted for greater than 5% of the total biovolume.
- Canonical Correlation Analysis (CCA) – explore relationships between paired biotic and environmental data (Secchi depth, conductivity, TSS, TP, TN).

Phytoplankton Ordination



Conclusions

- **Phytoplankton reflect land use**
 - More N-fixing Cyanobacteria in forested watersheds, less in agricultural regions
- **Implications for integrated ecosystem management**
 - Increasing nutrients does not necessarily result in higher algal biovolume
 - Light limitation may structure algal composition

Acknowledgment

- **We are grateful to Linda Merchant-Masonbrink and other Ohio EPA staff for collecting the samples and providing water quality data**

Questions?

