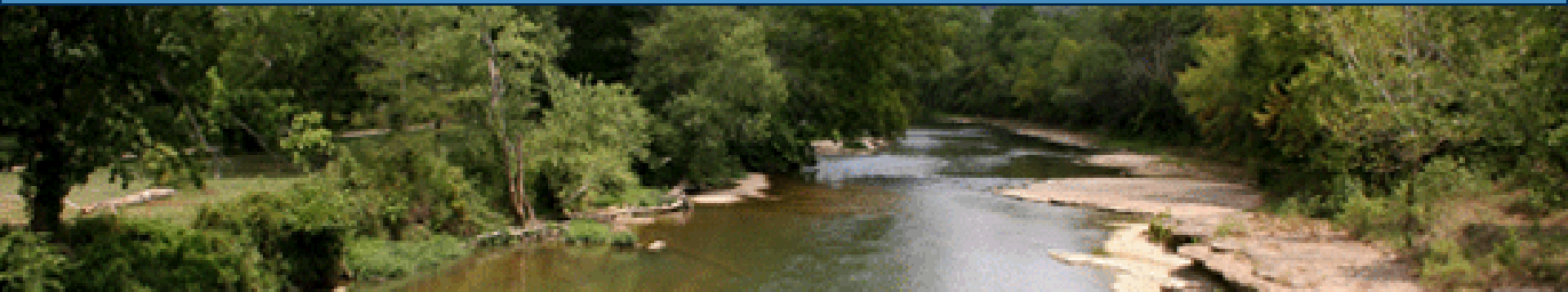
UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE

ARKANSAS WATER
RESOURCES CENTER

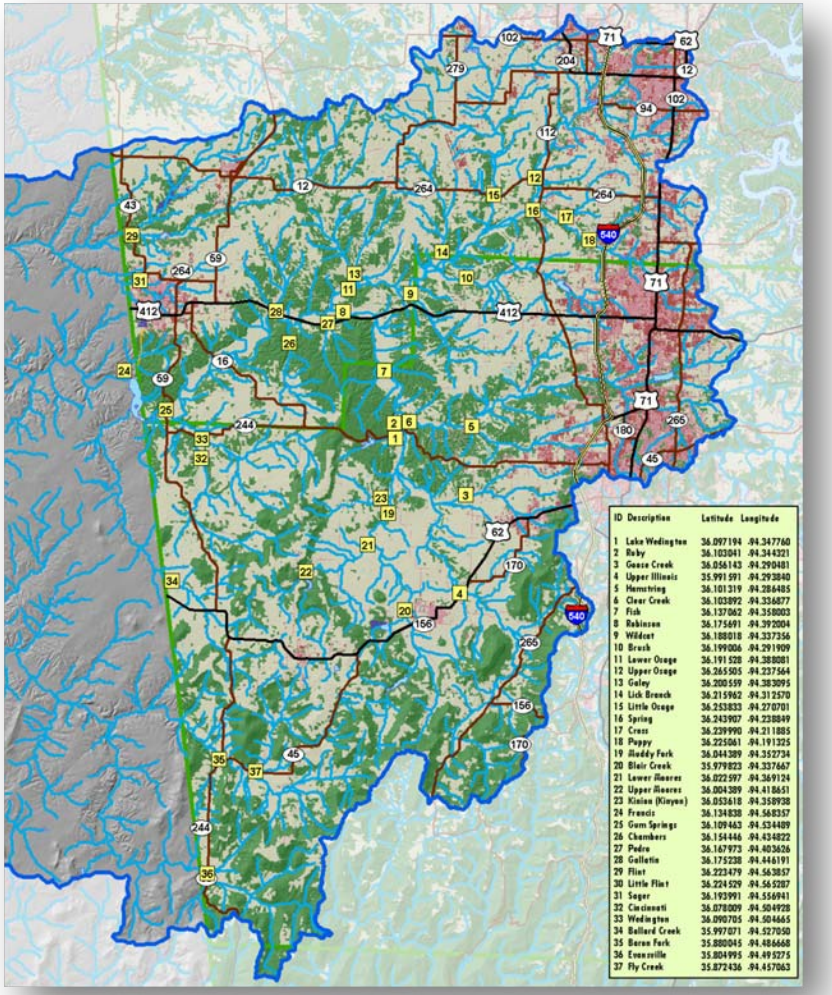
Illinois River Volunteer Monitoring Methods and Results

UA Division of Agriculture Arkansas Water Resources Center



Volunteer monitors collected water samples at 37 sites in the UIRW.

- Volunteer monitors were trained by AWRC personnel at their site(s) during September to collect and handle water samples.
- Single point grab samples were collected during base flow conditions during September and December 2008 and March and May 2009.
- For continuity in sampling, water samples were collected by AWRC or IRWP if volunteers were unavailable during a specific month.



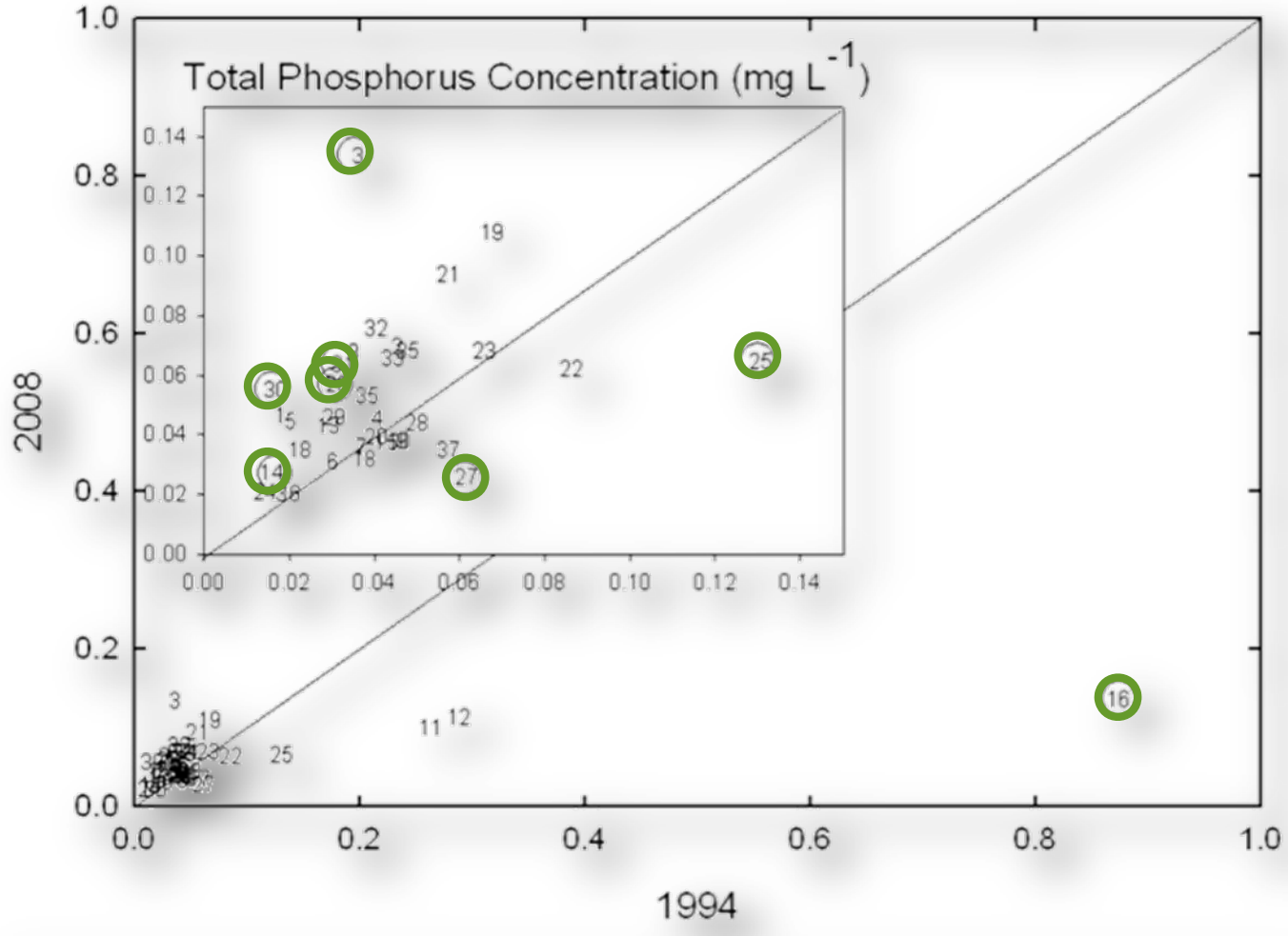
Water samples were analyzed at the AWRC Water Quality Lab.

- Water samples were delivered to the AWRC WQL for analysis within 1 business day by trained volunteers.
- Samples were analyzed for:
  - NO_3-N
  - SRP
  - TN
  - TP
  - TSS
  - Cl
  - F
  - Turbidity
  - Conductivity
- We prioritized the HUC-12 based on geomean constituent concentrations for TN, TP, NO_3-N and SRP
  - Sub-watershed sites were divided into approximately 3 equal groups of high, medium and low priority rankings (following Parker et al., 1996)

What were the methods of Parker et al. (1996)?

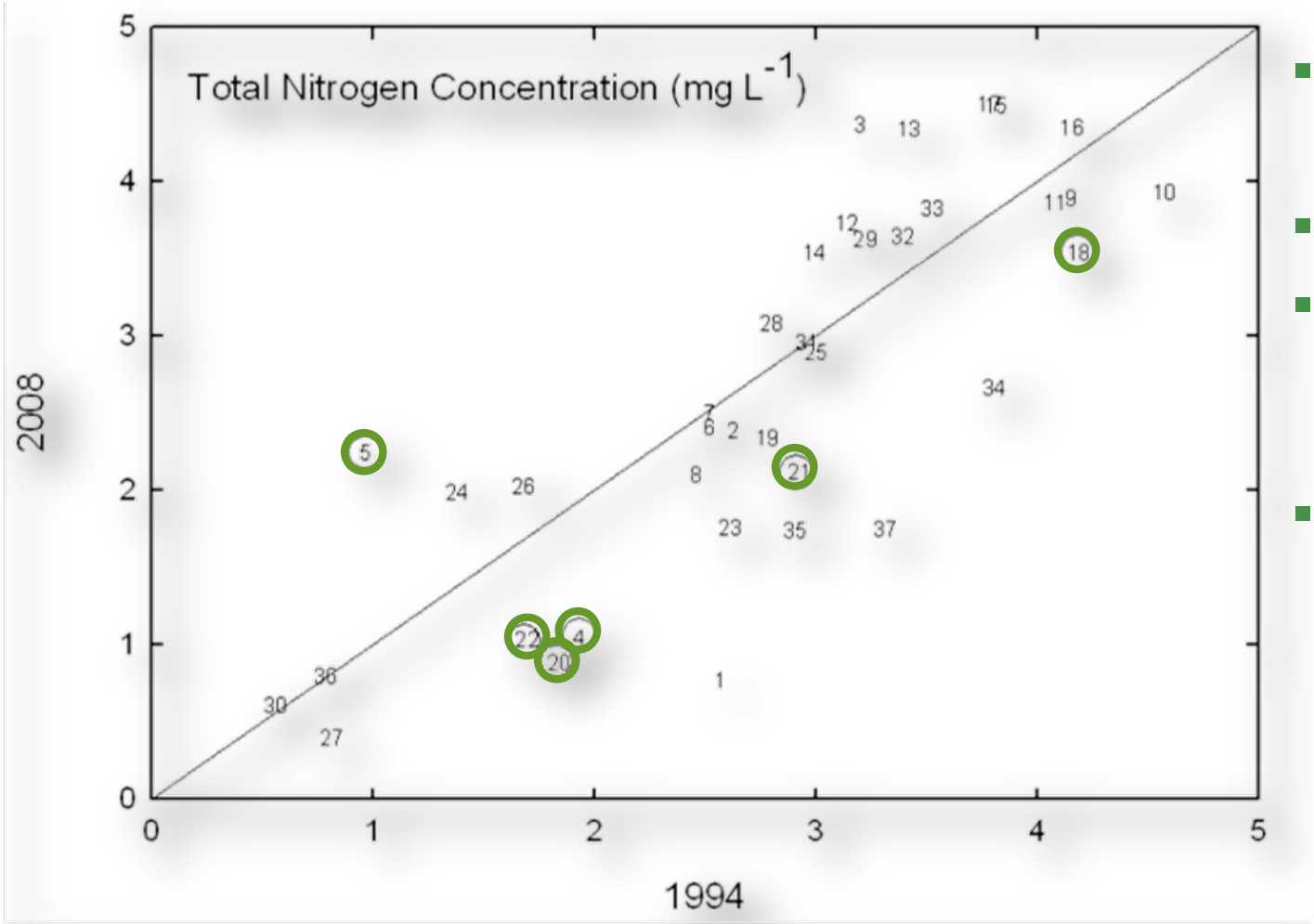
- Parker et al. (1996) sampled these same 37 sites from 1993-1994 during base flow conditions and storm events.
- They determined discharge at each site, combined it with concentration data and calculated unit area loads for each site.
- Parker et al. (1996) prioritized sub-watershed sites based on the calculated unit area loads.
- For comparison, we could only use the base flow concentrations measured by Parker et al. (1996).
- We re-prioritized the historical sites based on base flow concentrations only following the same method (i.e., 3 ~ equal groups of high, medium and low priority rankings).

Phosphorus in the UIRW during base flow then and now…



- TP ranged from 0.02-0.14 mg L^{-1}
- >50% as SRP
- Highest concentrations downstream of WWTPs
- Greatest changes between studies at sites downstream of WWTPs

Nitrogen in the UIRW during base flow then and now…



- TN ranged from 0.39-4.49 mg L^{-1}
- ~80% as NO_3-N
- TN decreased at 5 sites and only increased at 1 site
- NO3-N increased at 14% of sites

Site No.	Site Name	n	Min	Geomean	Max	Base Flow Current Priority	Base Flow Historical Priority
16	Spring	5	0.068	0.135	0.178	High	High
3	Goose Creek	4	0.074	0.133	0.236	High	Medium
12	Upper Osage	5	0.060	0.113	0.410	High	High
19	Muddy Fork	5	0.052	0.107	0.172	High	Medium
11	Lower Osage	5	0.070	0.099	0.168	High	High
21	Lower Moores	5	0.036	0.093	0.162	High	Medium
32	Cincinnati	5	0.052	0.075	0.166	High	Medium
2	Ruby	5	0.054	0.069	0.110	High	Medium
34	Ballard Creek	5	0.042	0.068	0.120	High	High
23	Kinion	4	0.051	0.068	0.080	High	Medium
8	Robinson	5	0.034	0.068	0.158	High	Medium
33	Wedington	5	0.046	0.065	0.084	Medium	Medium
25	Gum Springs	3	0.044	0.064	0.082	Medium	Medium
31	Sager	5	0.052	0.064	0.084	Medium	Medium
22	Upper Moores	4	0.010	0.062	0.190	Medium	Low
26	Chambers	5	0.044	0.057	0.076	Medium	Low
30	Little Flint	5	0.024	0.055	0.254	Medium	Low
35	Baron Fork	4	0.016	0.053	0.168	Medium	Low
1	Lake Wedington	5	0.014	0.046	0.864	Medium	Medium
29	Flint	5	0.022	0.046	0.074	Medium	Medium
4	Upper Illinois	5	0.026	0.045	0.078	Medium	Medium
5	Hamestring Creek	5	0.026	0.044	0.124	Low	Low
28	Gallatin	3	0.026	0.044	0.064	Low	Medium
13	Galey	5	0.036	0.043	0.066	Low	High
20	Blair Creek	5	0.026	0.039	0.068	Low	Medium
10	Brush	5	0.028	0.038	0.050	Low	High
9	Wildcat	5	0.014	0.038	0.060	Low	High
15	Little Osage	5	0.032	0.037	0.046	Low	High
7	Fish	5	0.018	0.036	0.074	Low	Medium
17	Cross	5	0.026	0.035	0.046	Low	High
37	Fly Creek	5	0.026	0.035	0.056	Low	Medium
18	Puppy	5	0.026	0.032	0.044	Low	High
6	Clear Creek	5	0.024	0.031	0.040	Low	Medium
14	Lick Branch	5	0.020	0.027	0.038	Low	Medium
27	Pedro	4	0.018	0.026	0.050	Low	Low
24	Frances	4	0.010	0.021	0.072	Low	Low
36	Evansville	5	0.018	0.020	0.026	Low	Low

Following the method of Parker et al. (1996) for **TP**:

11 High Priority Sites

10 Medium Priority Sites

16 Low Priority Sites

Site No.	Site Name	Min	Geomean	Max	Base Flow Current Priority	Base Flow Historical Priority
16	Spring	0.068	0.135	0.178	High	High
3	Goose Creek	0.074	0.133	0.236	High	Medium
12	Upper Osage	0.060	0.113	0.410	High	High
19	Muddy Fork	0.052	0.107	0.172	High	Medium
11	Lower Osage	0.070	0.099	0.168	High	High
21	Lower Moores	0.036	0.093	0.162	High	Medium
32	Cincinnati	0.052	0.075	0.166	High	Medium
2	Ruby	0.054	0.069	0.110	High	Medium
34	Ballard Creek	0.042	0.068	0.120	High	High
23	Kinion	0.051	0.068	0.080	High	Medium
8	Robinson	0.034	0.068	0.158	High	Medium
33	Wedington	0.046	0.065	0.084	Medium	Medium
25	Gum Springs	0.044	0.064	0.082	Medium	Medium
31	Sager	0.052	0.064	0.084	Medium	Medium
22	Upper Moores	0.010	0.062	0.190	Medium	Low
26	Chambers	0.044	0.057	0.076	Medium	Low
30	Little Flint	0.024	0.055	0.254	Medium	Low
35	Baron Fork	0.016	0.053	0.168	Medium	Low
1	Lake Wedington	0.014	0.046	0.864	Medium	Medium
29	Flint	0.022	0.046	0.074	Medium	Medium
4	Upper Illinois	0.026	0.045	0.078	Medium	Medium
5	Hamestring Creek	0.026	0.044	0.124	Low	Low
28	Gallatin	0.026	0.044	0.064	Low	Medium
13	Galey	0.036	0.043	0.066	Low	High
20	Blair Creek	0.026	0.039	0.068	Low	Medium
10	Brush	0.028	0.038	0.050	Low	High
9	Wildcat	0.014	0.038	0.060	Low	High
15	Little Osage	0.032	0.037	0.046	Low	High
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18	Puppy	0.026	0.032	0.044	Low	High
6	Clear Creek	0.024	0.031	0.040	Low	Medium
14	Lick Branch	0.020	0.027	0.038	Low	Medium
27	Pedro	0.018	0.026	0.050	Low	Low
24	Frances	0.010	0.021	0.072	Low	Low
36	Evansville	0.018	0.020	0.026	Low	Low

For TP, 46% of sites changed priority rankings between the historical study and the current study.

Which sites shifted to a **High** Priority?

Site 3: Goose Creek

Site 19: Muddy Fork

Site 21: Lower Moores

Site 32: Cincinnati

Site 2: Ruby

Site 23: Kinion

Site 8: Robinson

Site No.	Site Name	Min	Geomean	Max	Base Flow Current Priority	Base Flow Historical Priority
16	Spring	0.068	0.135	0.178	High	High
3	Goose Creek	0.074	0.133	0.236	High	Medium
12	Upper Osage	0.060	0.113	0.410	High	High
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31	Sager	0.052	0.064	0.084	Medium	Medium
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30	Little Flint	0.024	0.055	0.254	Medium	Low
35	Baron Fork	0.016	0.053	0.168	Medium	Low
1	Lake Wedington	0.014	0.046	0.864	Medium	Medium
29	Flint	0.022	0.046	0.074	Medium	Medium
4	Upper Illinois	0.026	0.045	0.078	Medium	Medium
5	Hamestring Creek	0.026	0.044	0.124	Low	Low
28	Gallatin	0.026	0.044	0.064	Low	Medium
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20	Blair Creek	0.026	0.039	0.068	Low	Medium
10	Brush	0.028	0.038	0.050	Low	High
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15	Little Osage	0.032	0.037	0.046	Low	High
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14	Lick Branch	0.020	0.027	0.038	Low	Medium
27	Pedro	0.018	0.026	0.050	Low	Low
24	Frances	0.010	0.021	0.072	Low	Low
36	Evansville	0.018	0.020	0.026	Low	Low

For TP, 46% of sites changed priority rankings between the historical study and the current study.

Which sites shifted from a **High** to a **Low** Priority?

Site 13: Galey

Site 10: Brush

Site 9: Wildcat

Site 15: Little Osage

Site 18: Puppy

Site No.	Site Name	n	Min	Geomean	Max	Base Flow Current Priority	Base Flow Historical Priority
17	Cross	5	4.14	4.49	4.88	High	High
15	Little Osage	5	3.54	4.49	5.55	High	High
3	Goose Creek	4	3.28	4.36	6.28	High	Medium
16	Spring	5	3.66	4.34	5.08	High	High
13	Galey	5	3.80	4.34	4.79	High	High
10	Brush	5	3.53	3.92	4.92	High	High
9	Wildcat	5	3.34	3.88	4.18	High	High
11	Lower Osage	5	3.63	3.86	4.24	High	High
33	Wedington	5	2.41	3.82	4.76	High	Medium
12	Upper Osage	5	2.70	3.73	4.90	High	High
32	Cincinnati	5	2.92	3.63	4.24	Medium	Medium
29	Flint	5	2.99	3.62	4.08	Medium	Medium
14	Lick Branch	5	3.16	3.54	4.14	Medium	Medium
18	Puppy	5	3.14	3.53	3.81	Medium	High
28	Gallatin	3	2.77	3.08	3.78	Medium	Medium
31	Sager	5	2.54	2.95	3.73	Medium	Medium
25	Gum Springs	3	2.61	2.89	3.05	Medium	Medium
34	Ballard Creek	5	1.33	2.66	4.63	Medium	High
7	Fish	5	2.34	2.50	2.68	Medium	Medium
6	Clear Creek	5	1.97	2.40	3.80	Medium	Medium
2	Ruby	5	2.04	2.38	2.81	Medium	Medium
19	Muddy Fork	5	1.64	2.33	3.83	Medium	Medium
5	Hamestring Creek	5	1.74	2.24	3.63	Medium	Low
21	Lower Moores	5	1.62	2.11	2.70	Medium	Medium
8	Robinson	5	1.91	2.10	2.39	Medium	Medium
26	Chambers	5	1.25	2.02	4.42	Medium	Low
24	Frances	4	1.47	1.98	4.44	Medium	Low
23	Kinion	4	0.84	1.75	4.63	Medium	Medium
37	Fly Creek	5	1.12	1.74	3.14	Medium	Medium
35	Baron Fork	4	1.17	1.74	4.21	Low	Low
4	Upper Illinois	5	0.59	1.04	1.49	Low	Medium
22	Upper Moores	4	0.72	1.03	1.36	Low	Low
20	Blair Creek	5	0.53	0.87	1.40	Low	Medium
36	Evansville	5	0.41	0.79	4.50	Low	Low
1	Lake Wedington	5	0.40	0.76	6.28	Low	Medium
30	Little Flint	5	0.03	0.60	2.13	Low	Low
27	Pedro	4	0.16	0.40	1.31	Low	Low

Following the method of Parker et al. (1996) for **TN**:

10 High Priority Sites

19 Medium Priority Sites

8 Low Priority Sites

Site No.	Site Name	n	Min	Geomean	Max	Base Flow Current Priority	Base Flow Historical Priority
17	Cross	5	4.14	4.49	4.88	High	High
15	Little Osage	5	3.54	4.49	5.55	High	High
3	Goose Creek	4	3.28	4.36	6.28	High	Medium
16	Spring	5	3.66	4.34	5.08	High	High
13	Galey	5	3.80	4.34	4.79	High	High
10	Brush	5	3.53	3.92	4.92	High	High
9	Wildcat	5	3.34	3.88	4.18	High	High
11	Lower Osage	5	3.63	3.86	4.24	High	High
33	Wedington	5	2.41	3.82	4.76	High	Medium
12	Upper Osage	5	2.70	3.73	4.90	High	High
32	Cincinnati	5	2.92	3.63	4.24	Medium	Medium
29	Flint	5	2.99	3.62	4.08	Medium	Medium
14	Lick Branch	5	3.16	3.54	4.14	Medium	Medium
18	Puppy	5	3.14	3.53	3.81	Medium	High
28	Gallatin	3	2.77	3.08	3.78	Medium	Medium
31	Sager	5	2.54	2.95	3.73	Medium	Medium
25	Gum Springs	3	2.61	2.89	3.05	Medium	Medium
34	Ballard Creek	5	1.33	2.66	4.63	Medium	High
7	Fish	5	2.34	2.50	2.68	Medium	Medium
6	Clear Creek	5	1.97	2.40	3.80	Medium	Medium
2	Ruby	5	2.04	2.38	2.81	Medium	Medium
19	Muddy Fork	5	1.64	2.33	3.83	Medium	Medium
5	Hamestring Creek	5	1.74	2.24	3.63	Medium	Low
21	Lower Moores	5	1.62	2.11	2.70	Medium	Medium
8	Robinson	5	1.91	2.10	2.39	Medium	Medium
26	Chambers	5	1.25	2.02	4.42	Medium	Low
24	Frances	4	1.47	1.98	4.44	Medium	Low
23	Kinion	4	0.84	1.75	4.63	Medium	Medium
37	Fly Creek	5	1.12	1.74	3.14	Medium	Medium
35	Baron Fork	4	1.17	1.74	4.21	Low	Low
4	Upper Illinois	5	0.59	1.04	1.49	Low	Medium
22	Upper Moores	4	0.72	1.03	1.36	Low	Low
20	Blair Creek	5	0.53	0.87	1.40	Low	Medium
36	Evansville	5	0.41	0.79	4.50	Low	Low
1	Lake Wedington	5	0.40	0.76	6.28	Low	Medium
30	Little Flint	5	0.03	0.60	2.13	Low	Low
27	Pedro	4	0.16	0.40	1.31	Low	Low

For TN, 46% of sites also changed priority rankings between the historical study and the current study.

Which sites shifted to a **High** Priority?

Site 3: Goose Creek

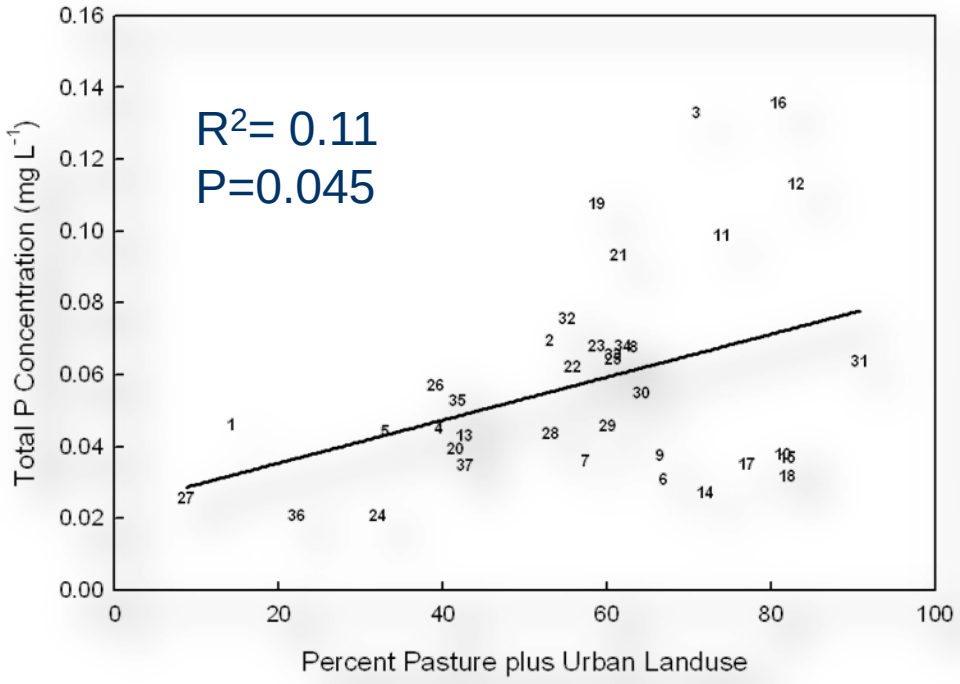
Site 33: Wedington

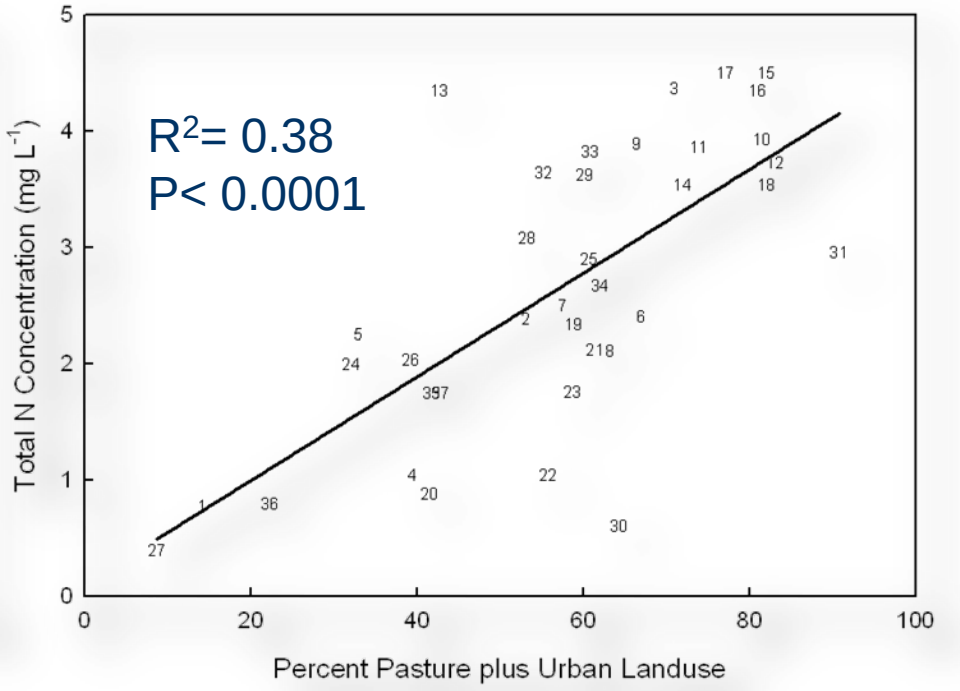
But, no sites shifted from a high to a low priority.

Looking at these data, we wondered if arbitrary breakpoints were best?

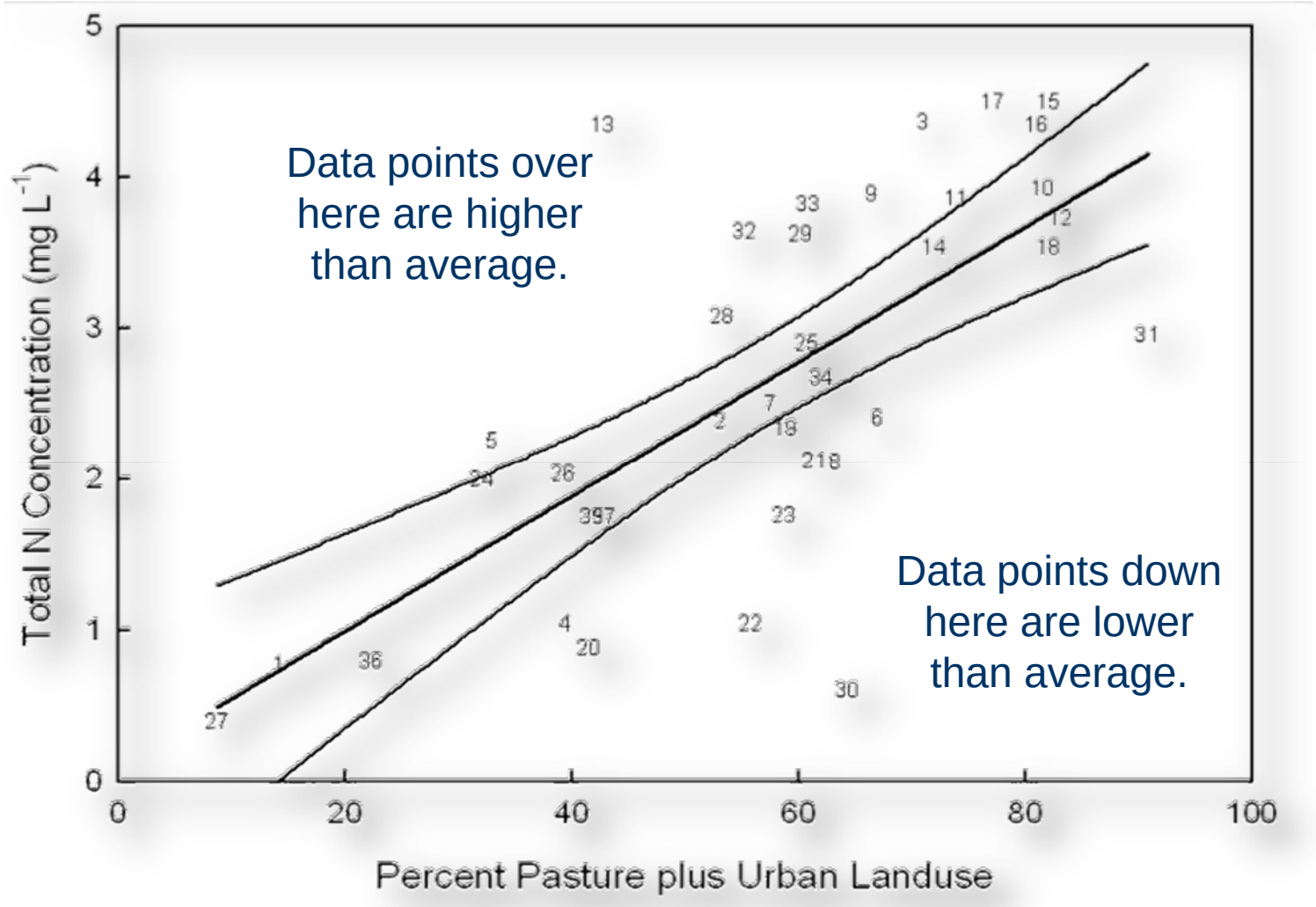
- Use the same breakpoints defined by Parker et al. (1996)?
  - Increase the number of highs and lows
- Consider whether concentrations significantly increased or decreased?
  - 1:1 graphs
- What about considering the gradient between nutrients and catchment land use?

In the UIWR, nutrients are positively correlated to pasture and urban land use in the catchment (based on VMP data).



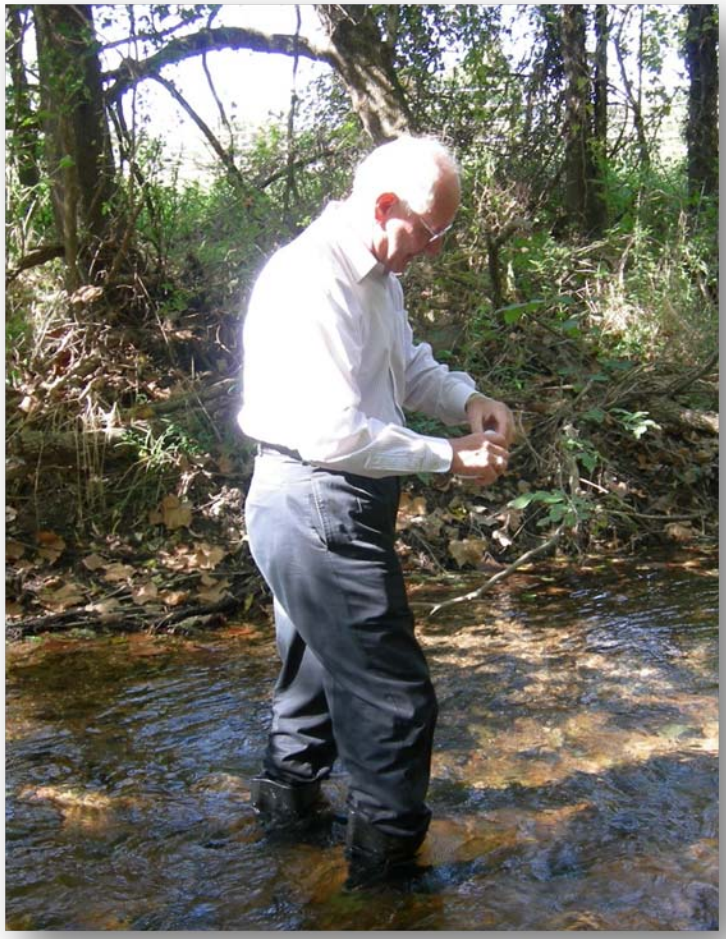


The regression line represents the average conditions for the respective catchment land use.



Conclusions

- We successfully used trained volunteers to collect water samples at 37 sites in the UIRW to establish current water quality conditions.
- Between the studies, base flow constituent concentrations were significantly different at some sites.
- The priority rankings were updated based on the current water quality conditions following the method of Parker et al. (1996).
- A different prioritization method may be more beneficial to effectively target priority sub-watersheds in the UIRW.



The collected data is valuable for the UIRW.

- The data collected during this study is valuable, because data is not widely available in the smaller sub-watersheds across the UIRW.
- This data was used to assist in the prioritization of the HUC 12s across the larger watershed during WMP development.