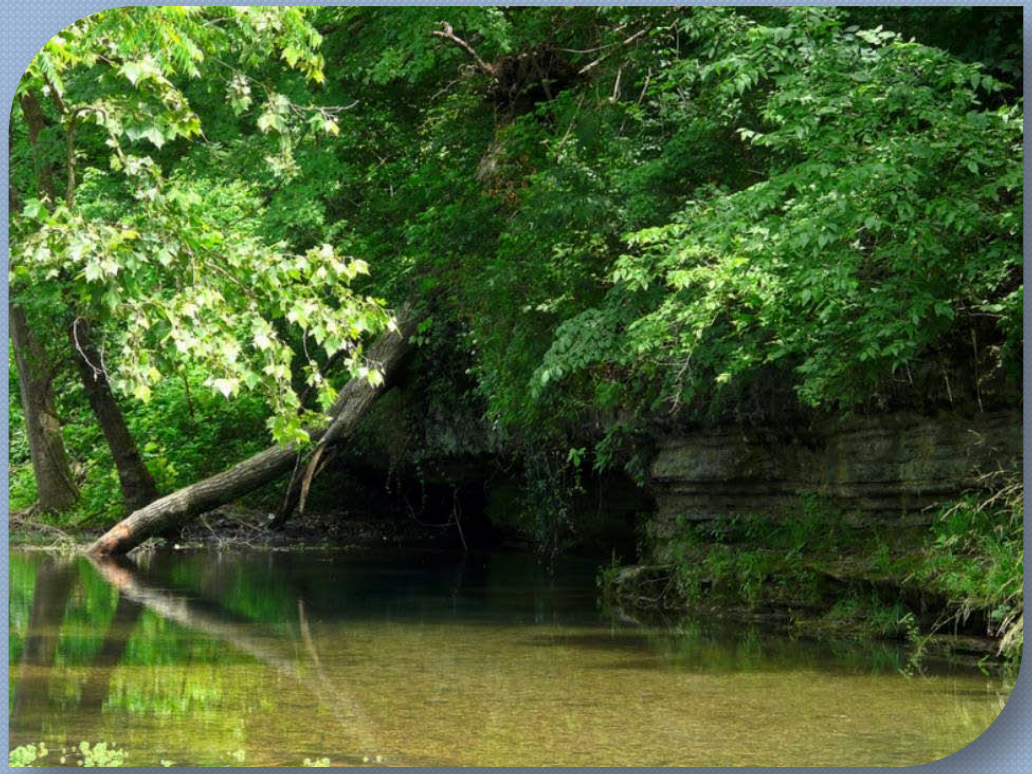
Water Quality Monitoring and Constituent Load Estimation in the Upper White River Basin, 2009



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Funding provided by ANRC
through Beaver Water District

2009 Summary

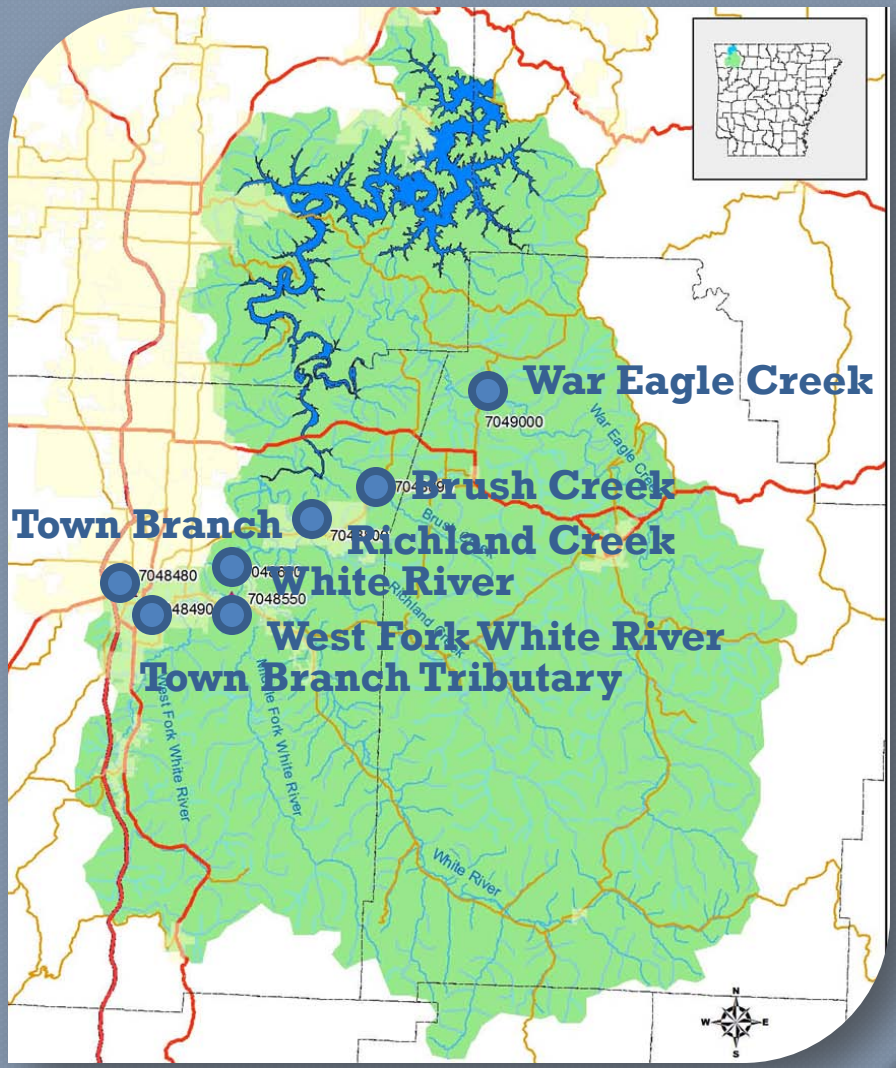
Loads and Flow-Weighted Concentrations

Site	Cl^-	SO_4	NH_3-N	NO_3-N	SRP	TN	TP	TSS
Brush Creek	153,000	313,000	1,200	41,000	1,000	48,000	5,400	3,031,000
Richland Creek[A]	--	--	--	--	--	--	--	--
Town Branch	22,000	47,000	330	1,300	130	1,900	360	213,000
Town Branch Tributary	74,000	148,000	1,300	14,000	150	15,000	480	129,000
War Eagle Creek	1,947,000	2,610,000	37,000	501,000	17,400	582,000	78,000	37,803,000
West Fork White River	844,000	3,280,000	18,000	91,000	3,200	136,000	30,000	12,697,000
White River	2,024,000	6,815,000	71,000	313,000	12,000	442,000	98,000	35,851,000

Site	Cl^-	SO_4	NH_3-N	NO_3-N	SRP	TN	TP	TSS
Brush Creek	7.52	14.03	0.06	2.03	0.05	2.38	0.27	149
Richland Creek[A]	--	--	--	--	--	--	--	--
Town Branch	15.06	31.92	0.22	0.87	0.07	1.29	0.26	145
Town Branch Tributary	16.26	32.76	0.28	3.00	0.03	3.38	0.11	29
War Eagle Creek	4.31	5.77	0.08	1.11	0.04	1.29	0.17	84
West Fork White River	4.09	15.88	0.09	0.44	0.02	0.66	0.14	61
White River	2.84	9.55	0.10	0.44	0.02	0.62	0.14	50

Water samples were collected at seven sites within UWRB

- Stage recorded in 30 minute intervals by USGS to estimate discharge.
- Water samples were collected once a week and storm events were targeted
- Water samples were analyzed at the AWRC Water Quality Lab for:
  - Chloride
  - Sulfate
  - Nitrate-N
  - Ammonia-N
  - Soluble reactive P
  - Total N
  - Total P
  - Total Suspended Solids



Load Determination and Mean Concentration

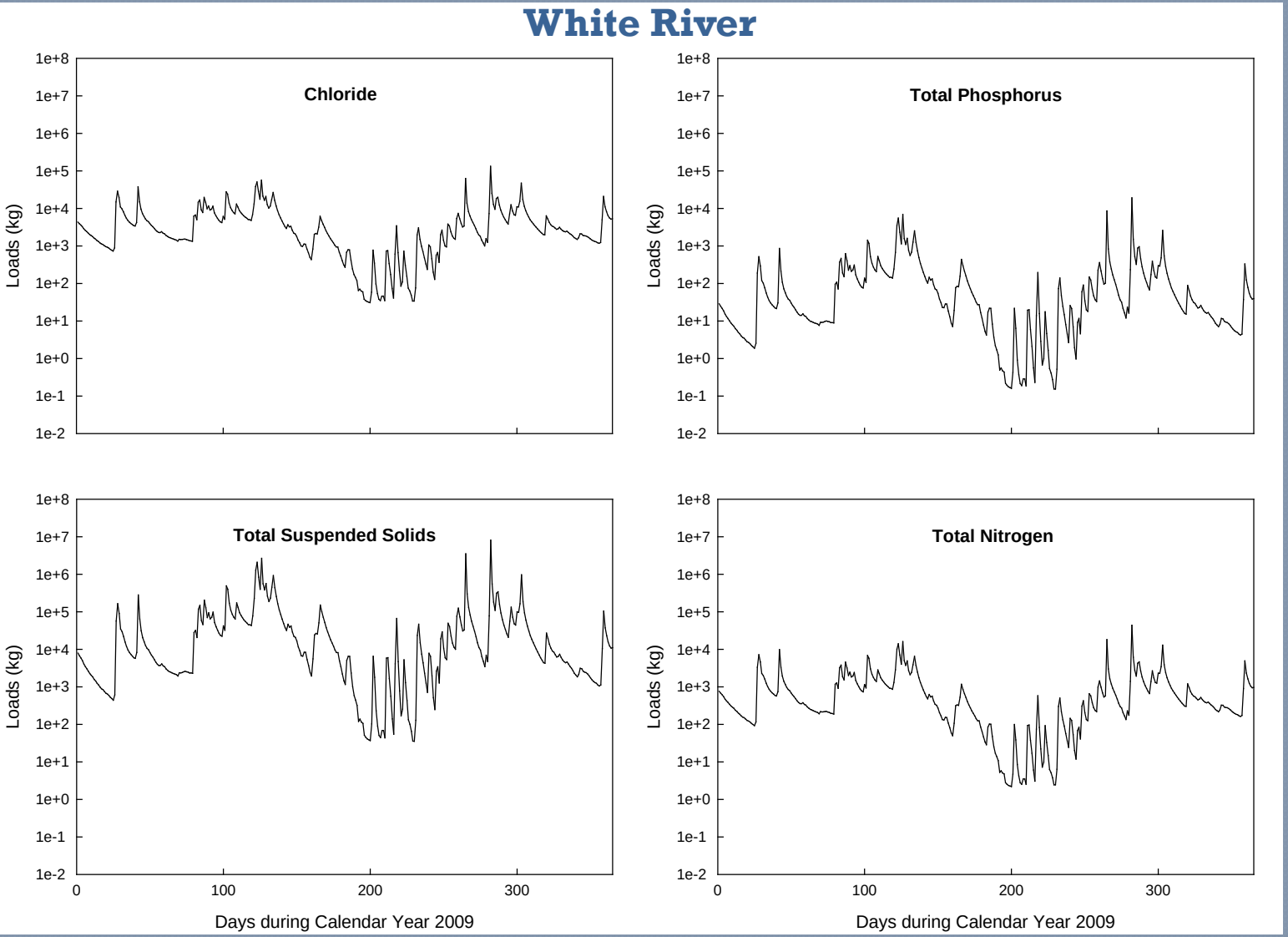
- Linear regression was used to determine the relationship between daily load, flow, and even seasonal factors:
  - $\ln(L_d) = \beta_o + \beta_1 \ln(Q_d)$ —*or*—
  - $\ln(L_d) = \beta_o + \beta_1 \ln(Q_d) + \beta_2 \sin(2\pi T) + \beta_3 \cos(2\pi T)$
- BCF was used to remove bias from log transformations:

$$\mathbf{BCF} = \frac{\sum e^r}{n}$$

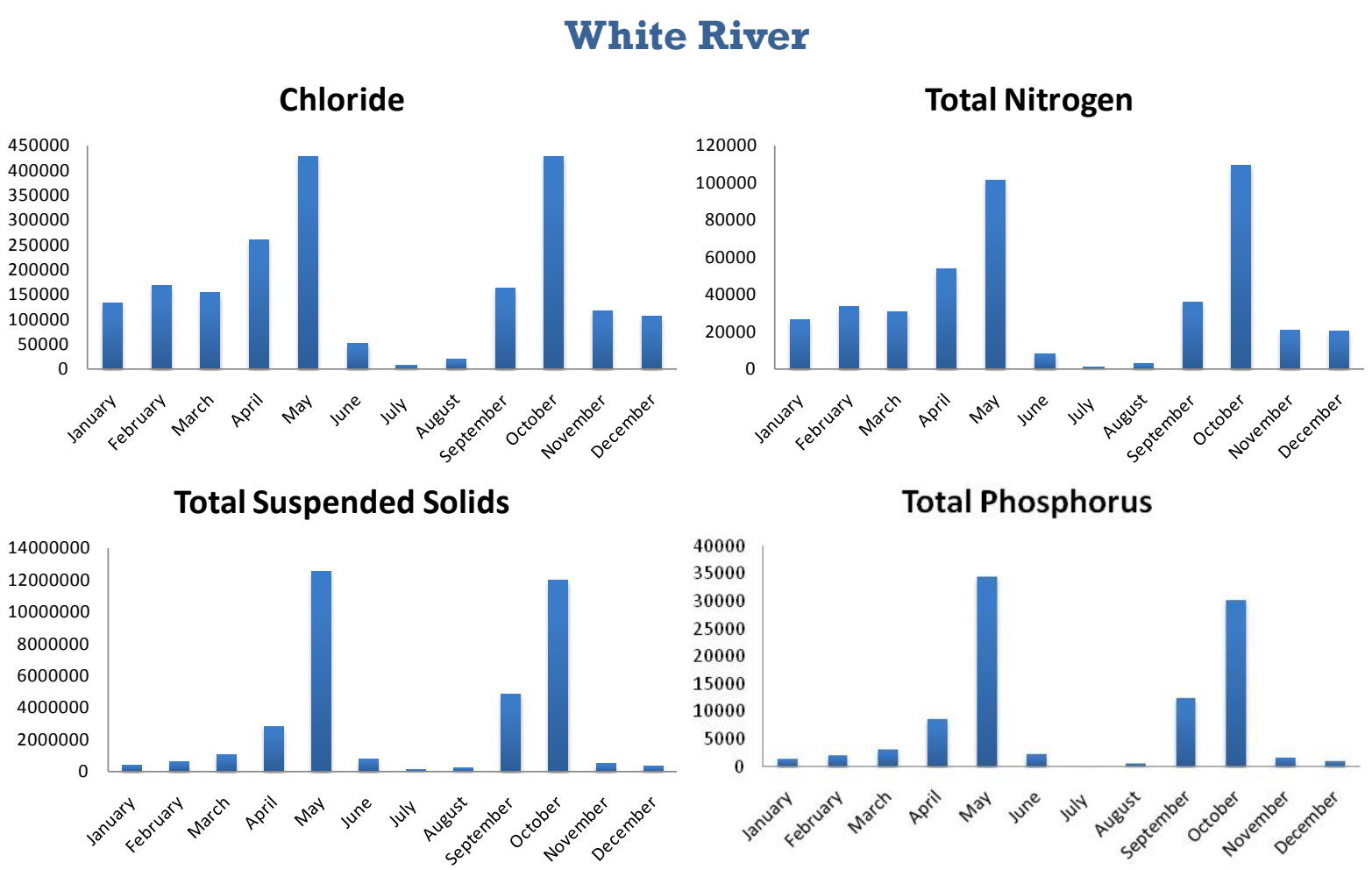
Load Determination and Mean Concentration

	BCF	R^2
NH_3	1.27-1.94	0.79-0.93
Cl	1.03-1.28	0.80-0.97
NO_3	1.02-1.35	0.83-0.98
SRP	1.15-1.67	0.74-0.96
SO_4	1.02-1.22	0.71-0.99
TN	1.01-1.24	0.88-0.99
TP	1.13-1.62	0.83-0.96
TSS	1.16-4.14	0.82-0.96

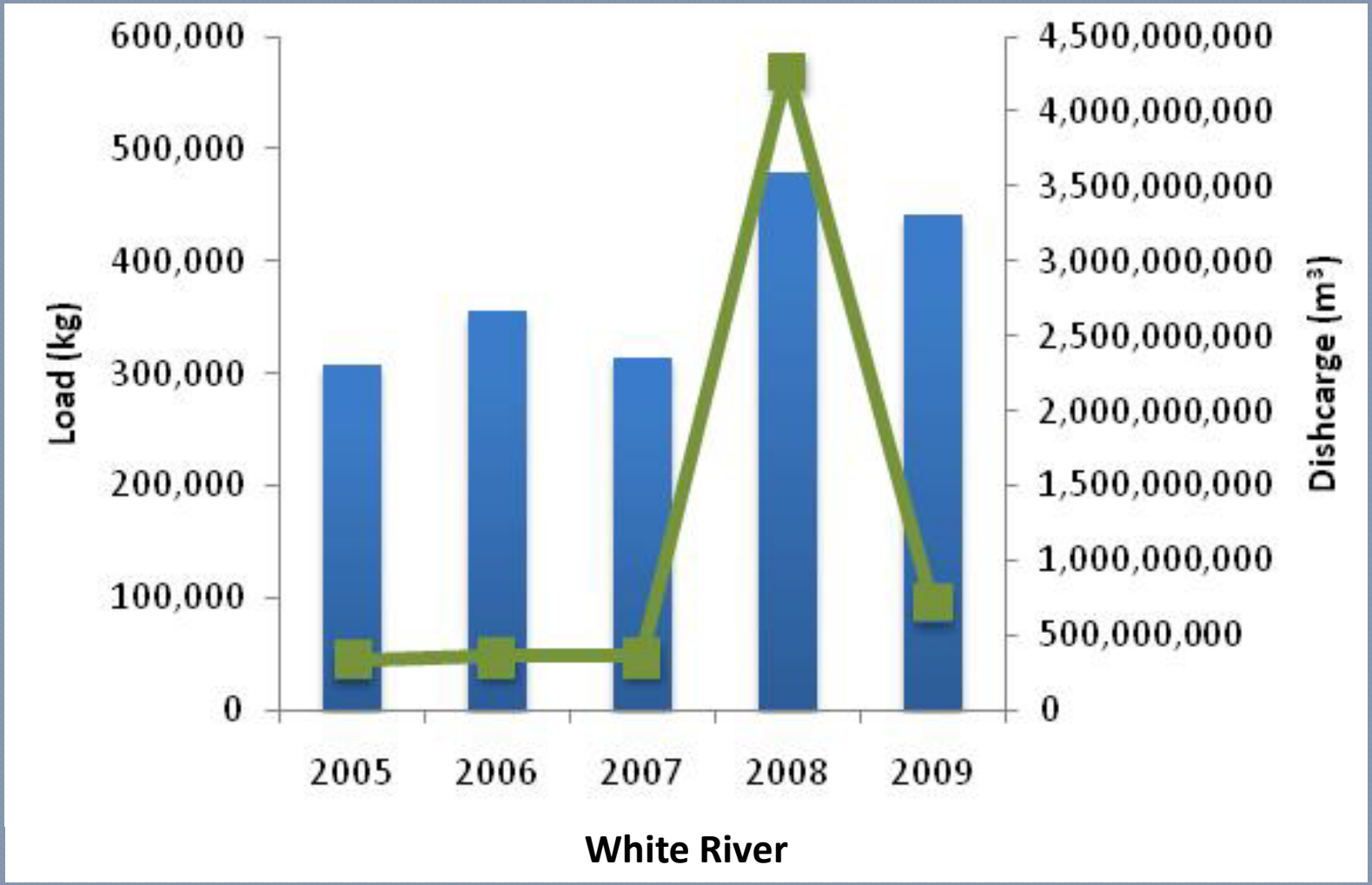
Daily loads were variable…



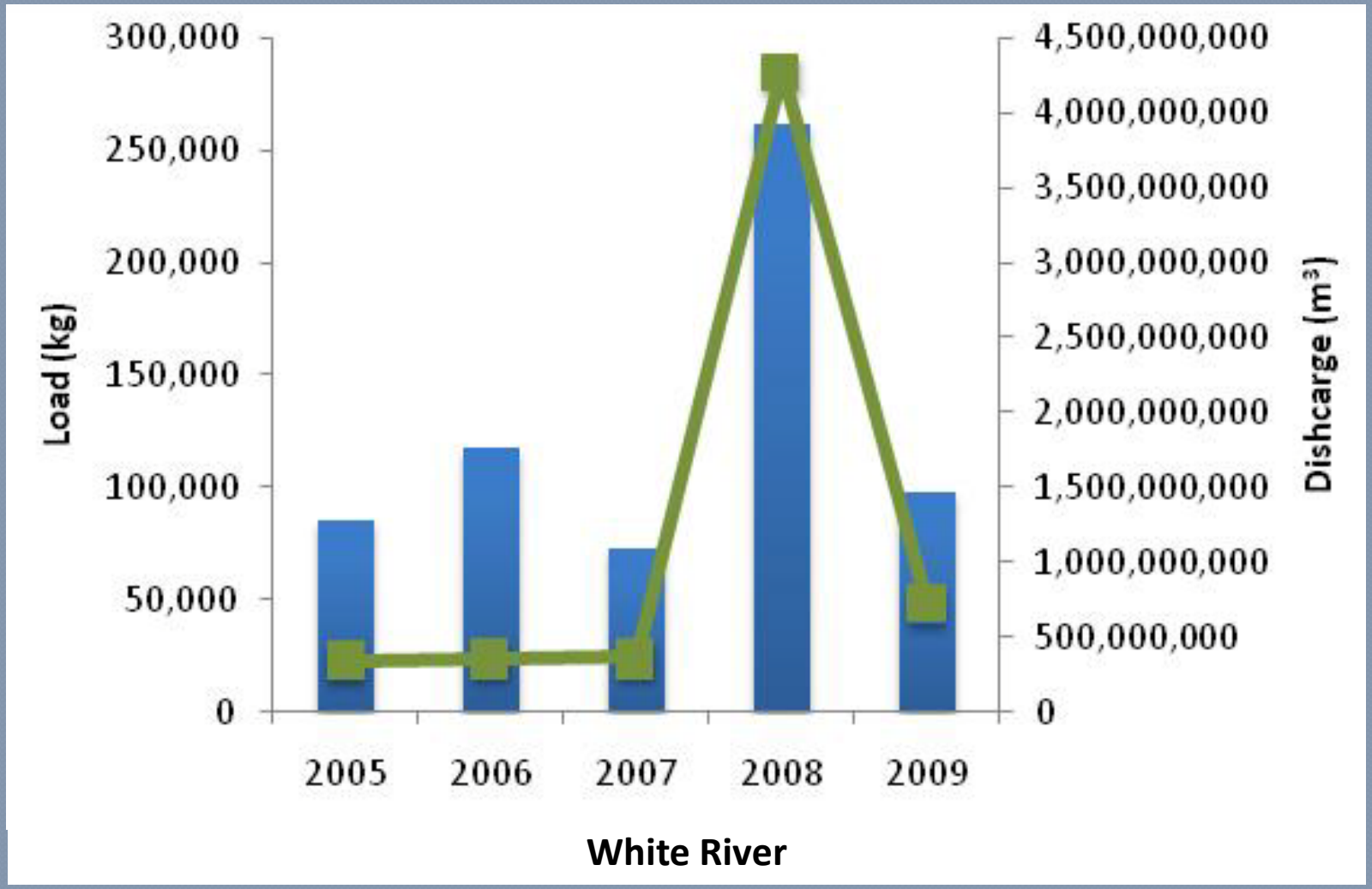
Monthly loads were least during drier, summer months…



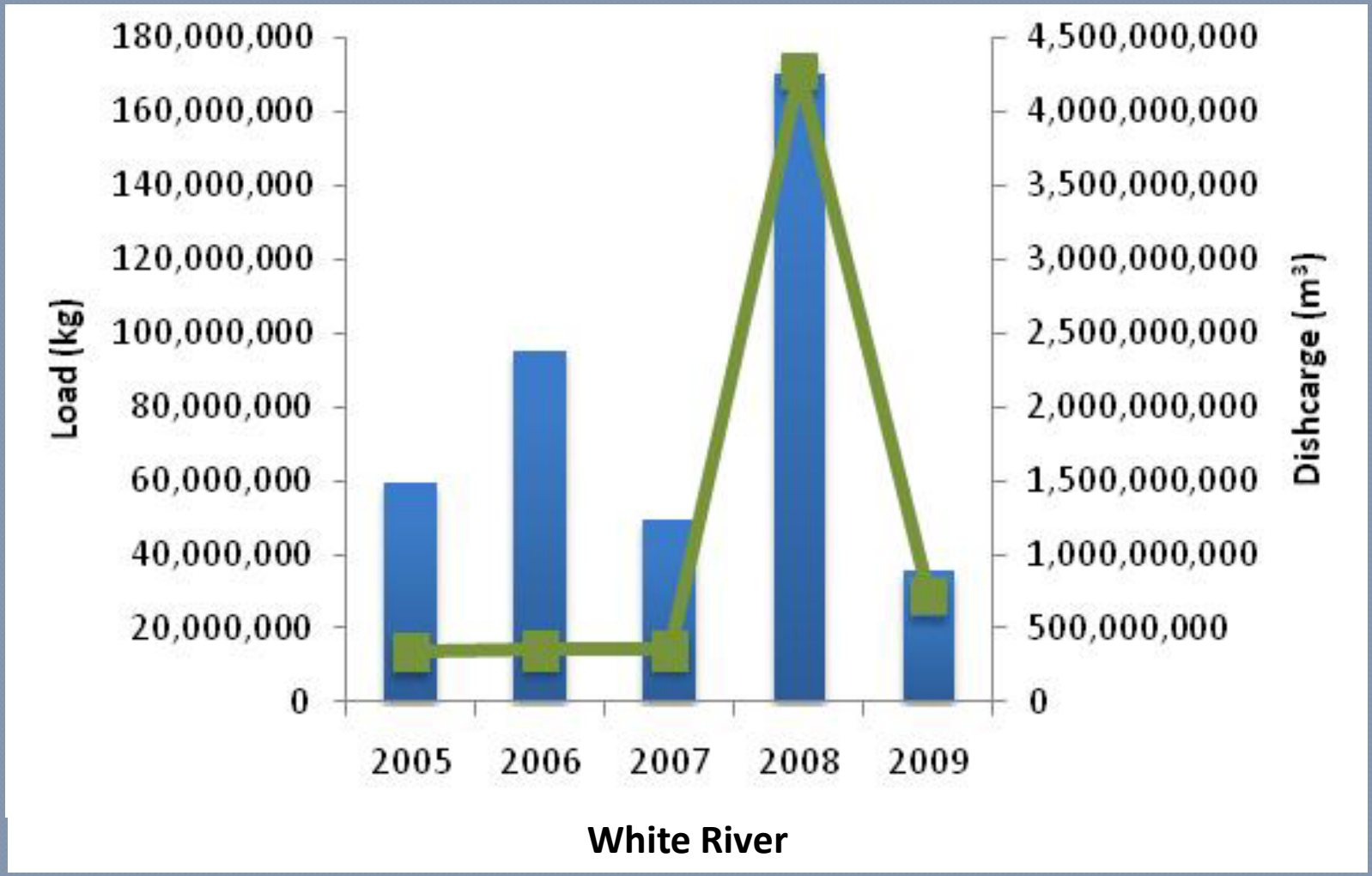
Annual Total Nitrogen Loads



Annual Total Phosphorus Loads

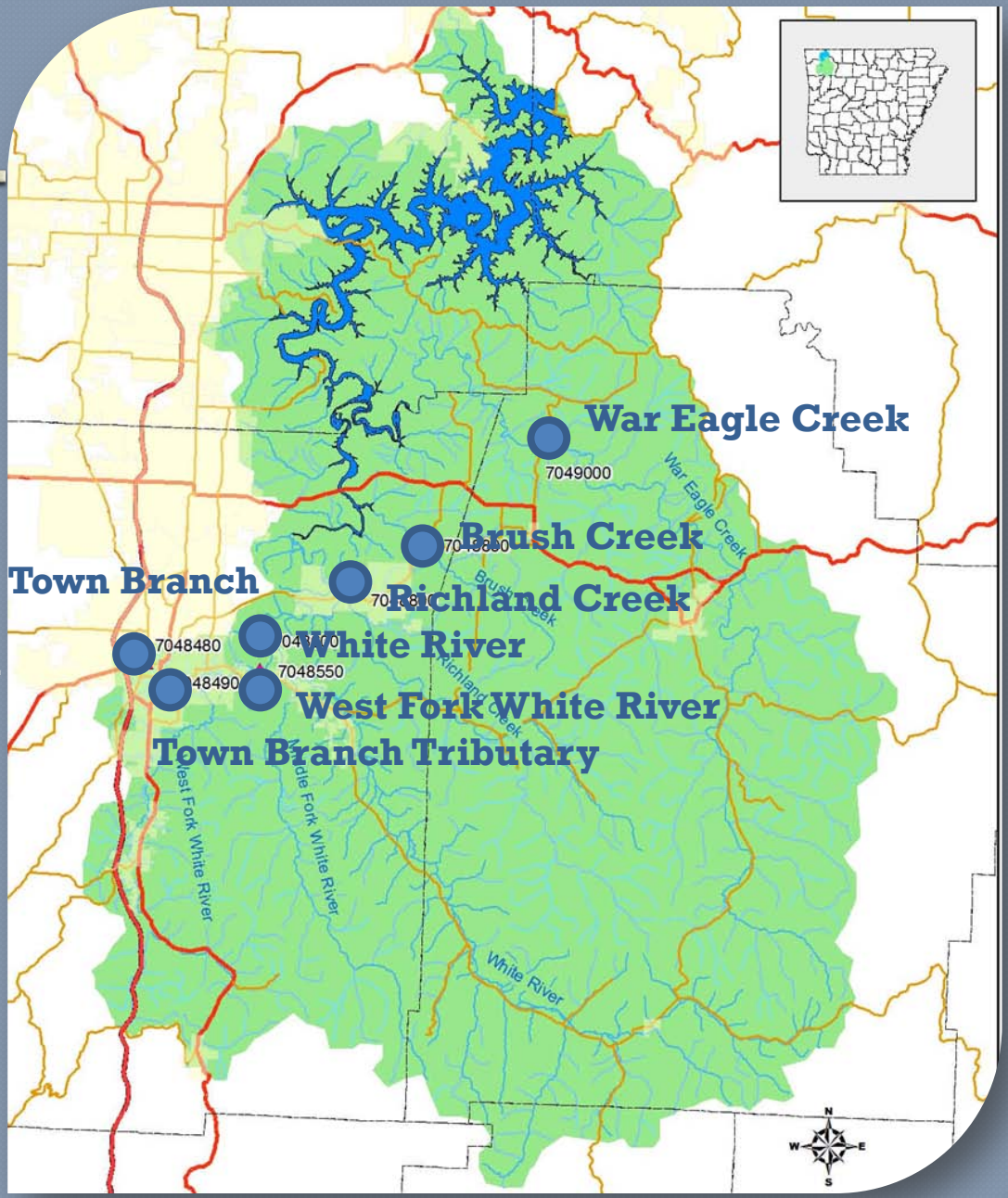


Annual Total Suspended Solids Loads

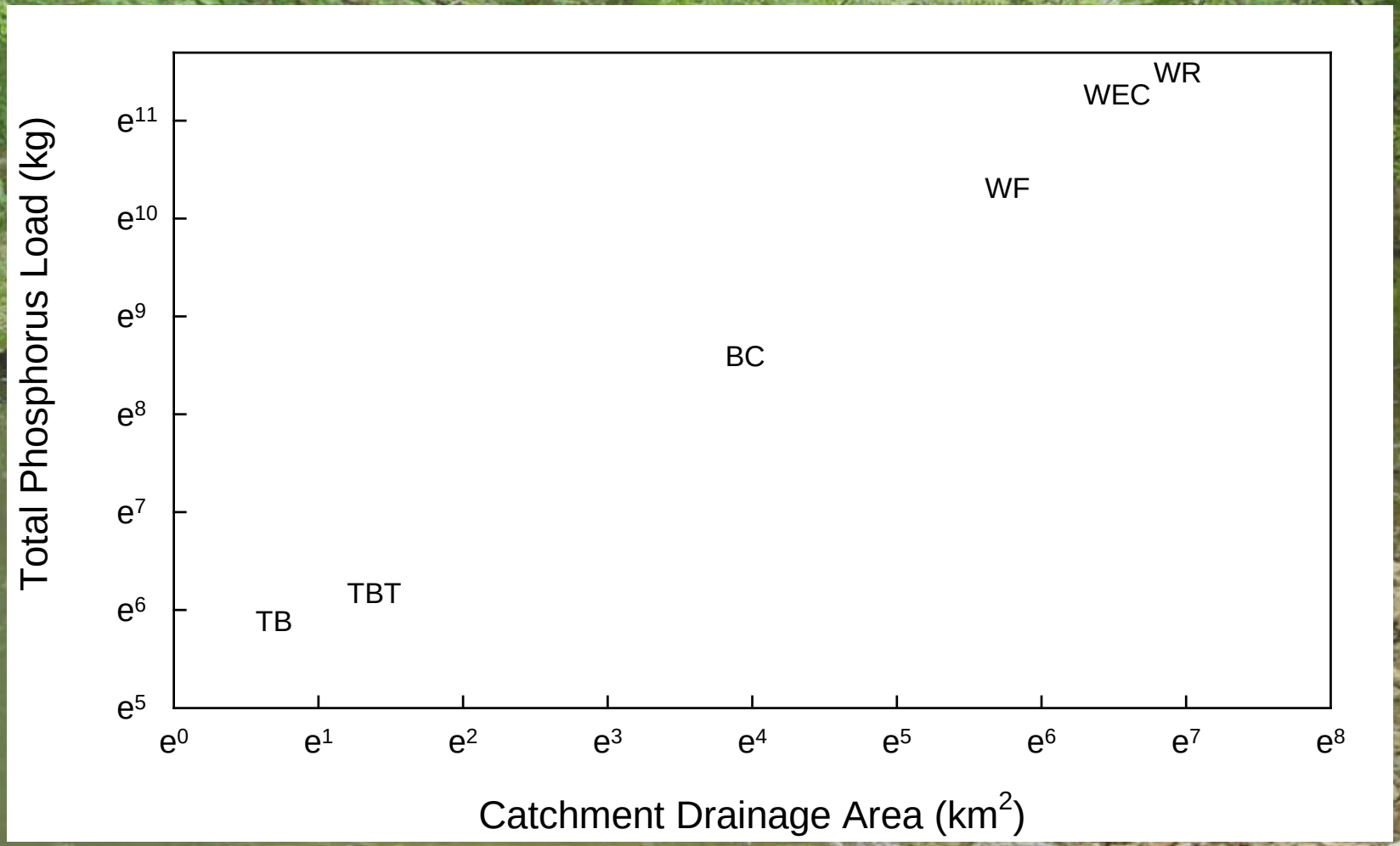


At UWRB…

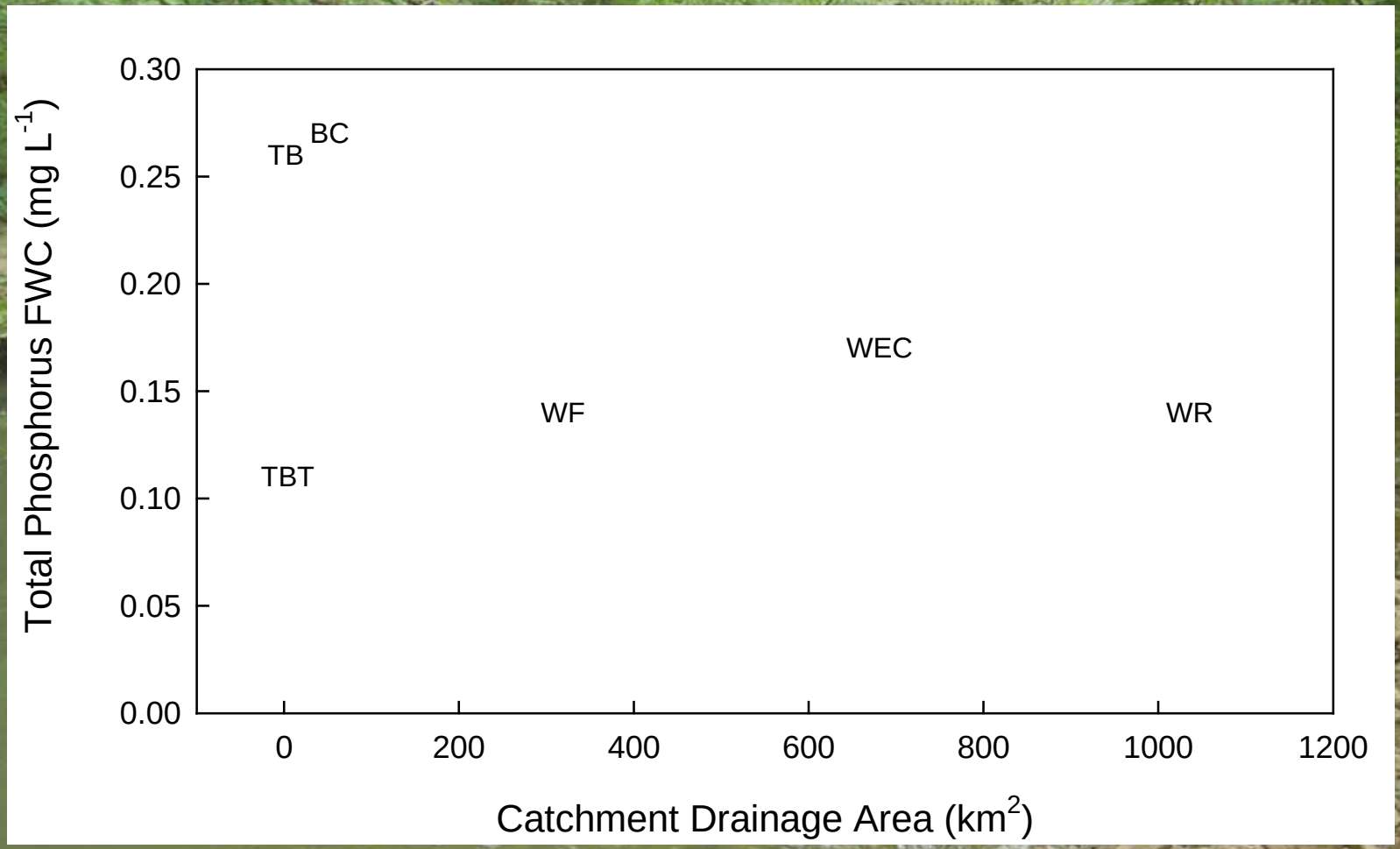
- We looked at how loads changed across these sites
- We also looked at how flow-weighted concentrations changed across these sites



Catchment area is related to annual phosphorus loads…



But, FWC were greater from two urban and agricultural streams



The monitoring program design was successful at estimating loads across these sites

- This monitoring program allowed us to sample several more sites, including some urban streams
- It would be possible to reduce the sampling frequency to estimate loads…
  - REDUCE COSTS