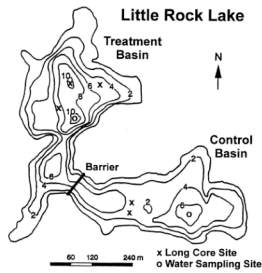


Case Study: Little Rock Lake Acidification



Case Study: Little Rock Lake Acidification

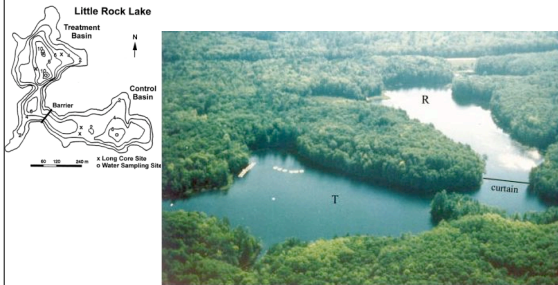


Fig. 1. Aerial photograph of Little Rock Lake in the Northern Highland Lake District of Wisconsin (Vilas County). Treatment basin (T) was acidified experimentally from 1985 to 1991. Reference basin (R) not acidified. Impermeable curtain divides the two basins.

Acid rain background

Acid rain definition?

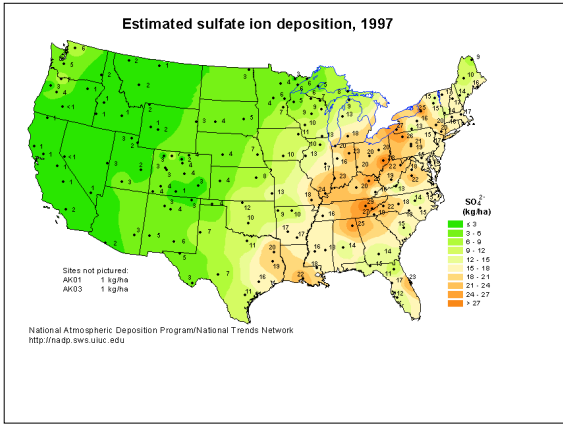
Pure rain water:

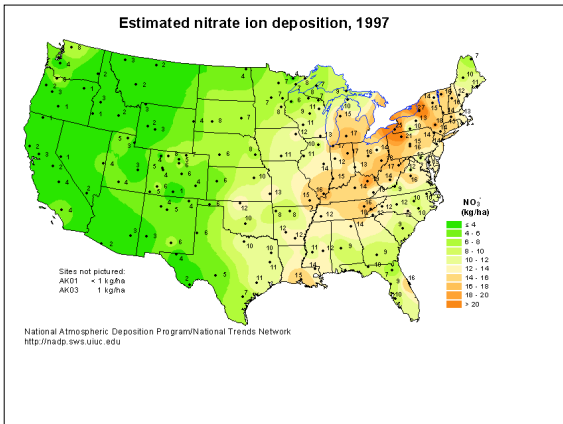
Acid rain:

What causes acid rain? What chemicals?

What counteracts acidification? What chemicals?

In addition to lowering pH, how else does acid rain influence water chemistry?





Alkalinity - the number of moles (or equivalents) required to neutralize H⁺ additions.

So it is a measure of the ability of a water sample to resist acidification.

total alkalinity = 2 [CO₃²⁻] + [HCO₃⁻] + [OH⁻] - [H⁺]

Initial alkalinity of LRL = 25 ueq / L (also ANC)

Little Rock Lake

Initial pH = 6.1

What was manipulated?

What variables were addressed?

What characteristics make LRL suitable for this type of study?

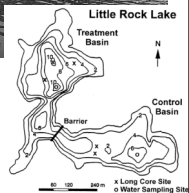
What predictions were made?

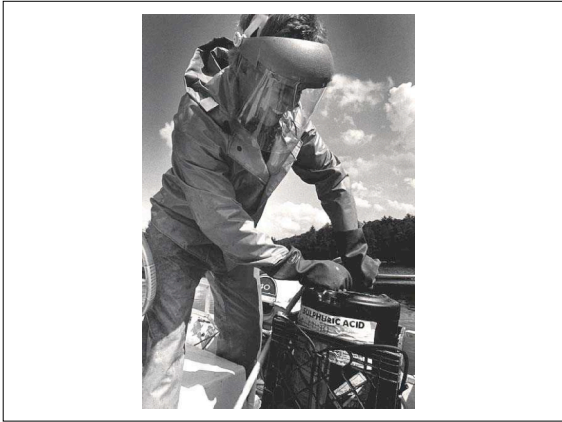
TABLE I. CHEMICAL CHARACTERISTICS OF LITTLE ROCK LAKE*

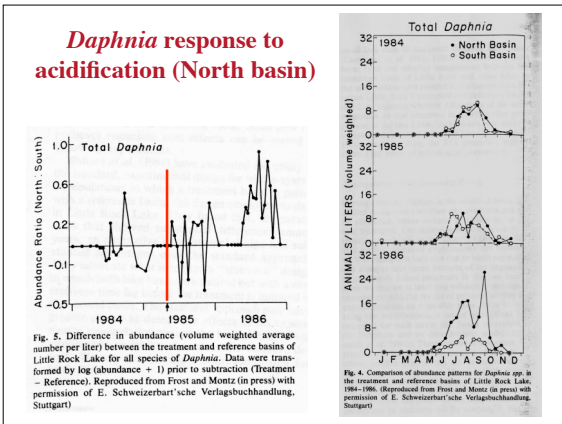
Variable	North Basin		South Basin	
	X	Range	X	Range
Sp. cond.	11.3	10.6-17.4	12.6	10.3-16.8
Color Pt-Co units	9	2-20	12	3-27
pH	6.04	5.76-6.33	6.04	5.93-6.27
Alkalinity ueq/L	25.2	13.9-31.1	25.8	21.3-28.7
Ca ²⁺ mg L ⁻¹	0.89	0.76-1.04	0.86	0.71-1.02
Mg ²⁺ "	0.30	0.28-0.41	0.29	0.27-0.41
K ⁺ "	0.57	0.49-0.65	0.55	0.48-0.64
Al ⁺ ug L ⁻¹	5.2	2.6-7.2	7.1	3.4-9.5
Cl ⁻ mg L ⁻¹	0.27	0.20-0.30	0.28	0.20-0.33
F ⁻ "	0.02	0.01-0.03	0.01	<0.01-0.02
SO ₄ ²⁻ "	2.56	2.30-3.14	2.61	2.30-3.44
NH ₄ ⁺ + NO ₃ ⁻ ug N L ⁻¹	15.6	<1-109	11.8	<1-63
TN ug/L	190	90-390	210	60-300
SRP "	1.2	0-2	1.1	0-2
TP "	8.5	5-20	9.0	5-24
DOC mg L ⁻¹	2.9	2.3-3.7	2.8	2.2-3.6
Chl a ug L ⁻¹	2.5	0.4-5.4	2.2	1.1-6.6

*Values are for surface water samples from mid lake station in each basin for period Sept. 1983 to Dec.1984.

Vinyl curtain







Assignment

Approx. 1-2 page write up (typed), due Fri. 2/13.

Address in paragraphs:

- 1) Introduce problem (acid rain, what is it, causes?)
 - 2) LRL experiment (why/how was it done, why chosen, what was monitored?)
 - 3) Pick 1 chemical and 1 biological indicator (use and address authors' predictions from original paper, Brezonik et al. 1986)
 - 4) Discuss results (were the predictions correct?)
- Include references used (at least 2).

Eight papers are on reserve in library:

Watras and Frost. 1989. Little Rock Lake (Wisconsin): perspectives on an experimental ecosystem approach to seepage lake acidification.

Eaton et al. 1992. A field and laboratory investigation of acid effects on largemouth bass, rock bass, black crappie and yellow perch.

Brezonik et al. 1990. Effects of acidification on minor and trace metal chemistry in Little Rock Lake Wisconsin.

Fischer and Frost. 1997. Indirect effects of lake acidification on *Chaoborus* population dynamics: the role of food limitation and predation.

Frost et al. 1998. Zooplankton community responses during recovery from acidification in Little Rock Lake, Wisconsin.

Sampson et al. 1995. Experimental acidification of Little Rock Lake, Wisconsin: the first four years of chemical and biological recovery.

Frost et al. 1999. Multiple stresses from a single agent: diverse responses to the environmental acidification of Little Rock Lake, Wisconsin.

Frost et al. 1998. Rotifer responses to increased acidity: long-term patterns during the experimental manipulation of Little Rock Lake.
