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Comments on the Final Policy Assessment Document in the Review of the Secondary NAAQS for SOx and NOx

Eladio M. Knipping, Ph.D.

Senior Technical Manager, Environment

Electric Power Research Institute

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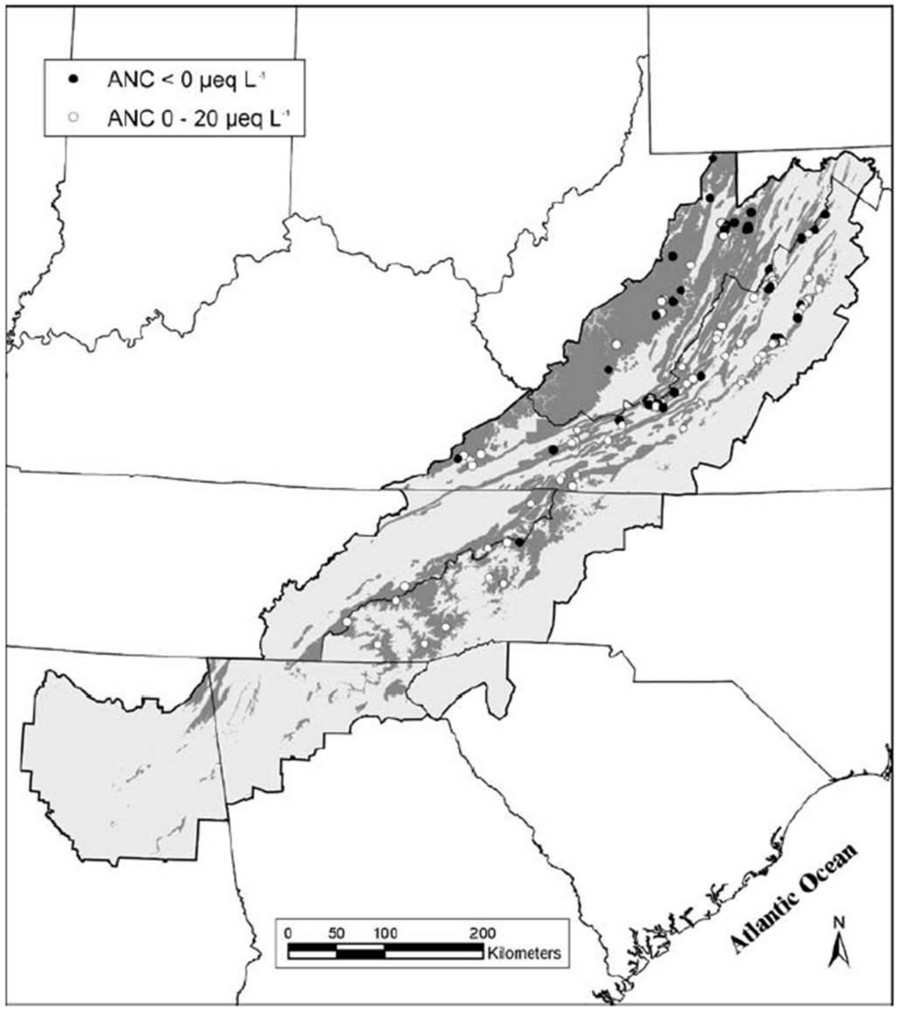
Chapel Hill, NC

Regional Interspersion of Sensitive and Non-Sensitive Regions

Fig. 4 Final area delimited by the acidification sensitivity classification scheme within the SAMI study area. The *darkly shaded area* includes the siliceous geologic sensitivity class surrounded by a 750 m buffer. In addition, all areas less than 400 m elevation have been deleted and areas greater than 1,000 m elevation have been added. The area thus circumscribed includes 95% of the known acidic streams and 88% of the known streams having ANC ≤20 μeq l^{-1} within the region. Furthermore, all known streams having ANC ≤20 μeq l^{-1} are in close proximity to the final mapped area

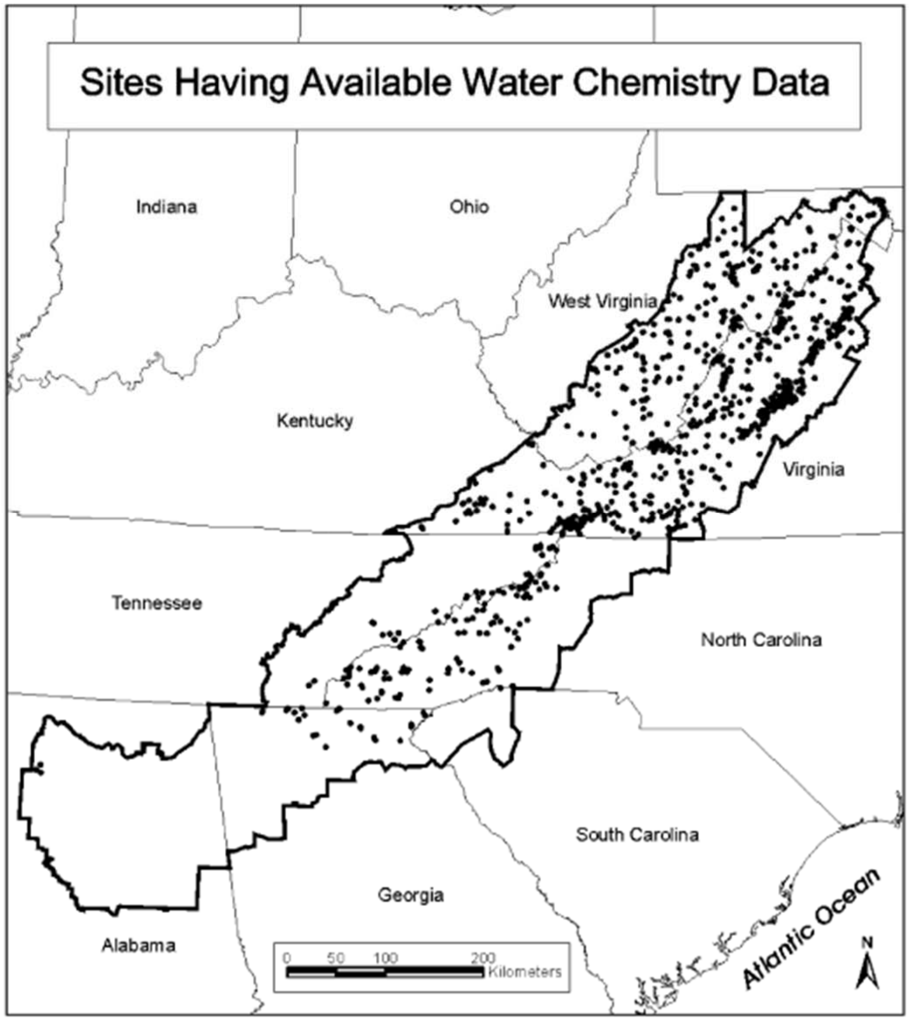


The Southern Appalachians are a marbled assembly of siliciclastic, granitic and basaltic watersheds.

Sullivan, TJ; et al.. Spatial Distribution of Acid-sensitive and Acid-impacted Streams in Relation to Watershed Features in the Southern Appalachian Mountains. *Water, Air and Soil Pollution, 182*, 57-71, 2007

Regionalization: Representativeness of Data

Fig. 2 Water chemistry sampling sites used for evaluation of landscape classification. The SAMI region boundary and state boundaries are also shown



The Southern Appalachians is a marbled assembly of siliciclastic, granitic and basaltic watersheds.

And waterbodies with available data are not representative of the overall population but rather are preferentially located in the most sensitive regions.

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Regionalization: Representativeness of Data

The STREAM SITE NUMBER distribution is not representative of the STREAM LENGTH distribution

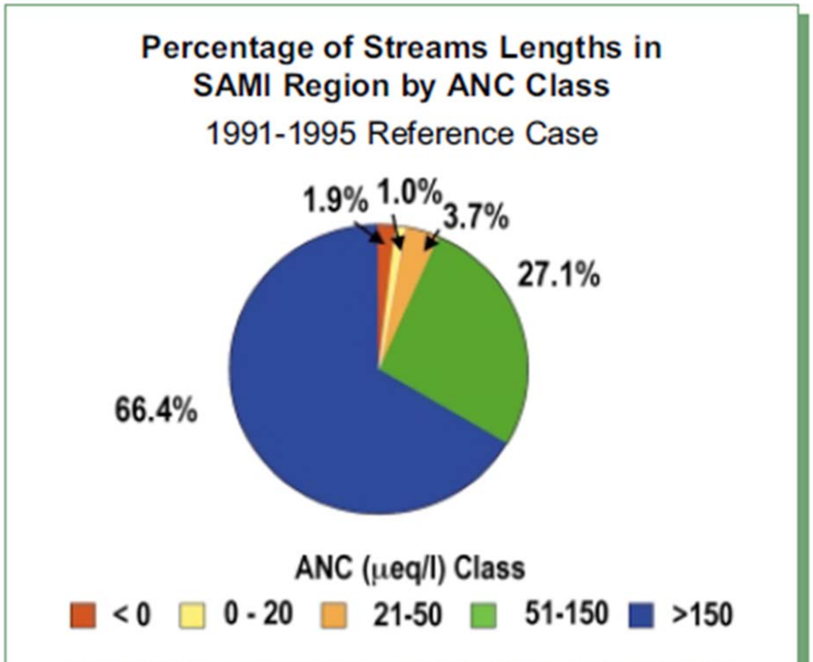

FIGURE 6.3: Percentage of stream lengths in SAMI region in each of five classes of Acid Neutralizing Capacity (ANC), based on 1985-1986 National Stream Survey (Turner, et al., 1990).

Southern Appalachian Mountain Initiative, Final Report. Based on Turner, R.S., et al. 1990. *Watershed and Lake Processes Affecting Surface Water Acid-Base Chemistry.* Report 10. In: *National Acid Precipitation Assessment Program, Acidic Deposition: State of Science and Technology. Volume II.*
National Acid Precipitation Assessment Program, Washington, D.C.

Shenandoah N. Park: Fish in Sensitive Habitats (SNP:FISH): Not Acidic → > 50 μeq L^{-1}

Table 1. Brook trout stream categories, ANC classes, and ANC thresholds for brook trout responses to acidification in forested headwater catchments in western Virginia (Bulger et al. 1999).

Brook trout stream category	ANC class	ANC range (μequiv.$\cdot L^{-1}$)	Brook trout response
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http://www.nps.gov/nero/science/FINAL/Shen%20Fish/Shen%20Fish.htm

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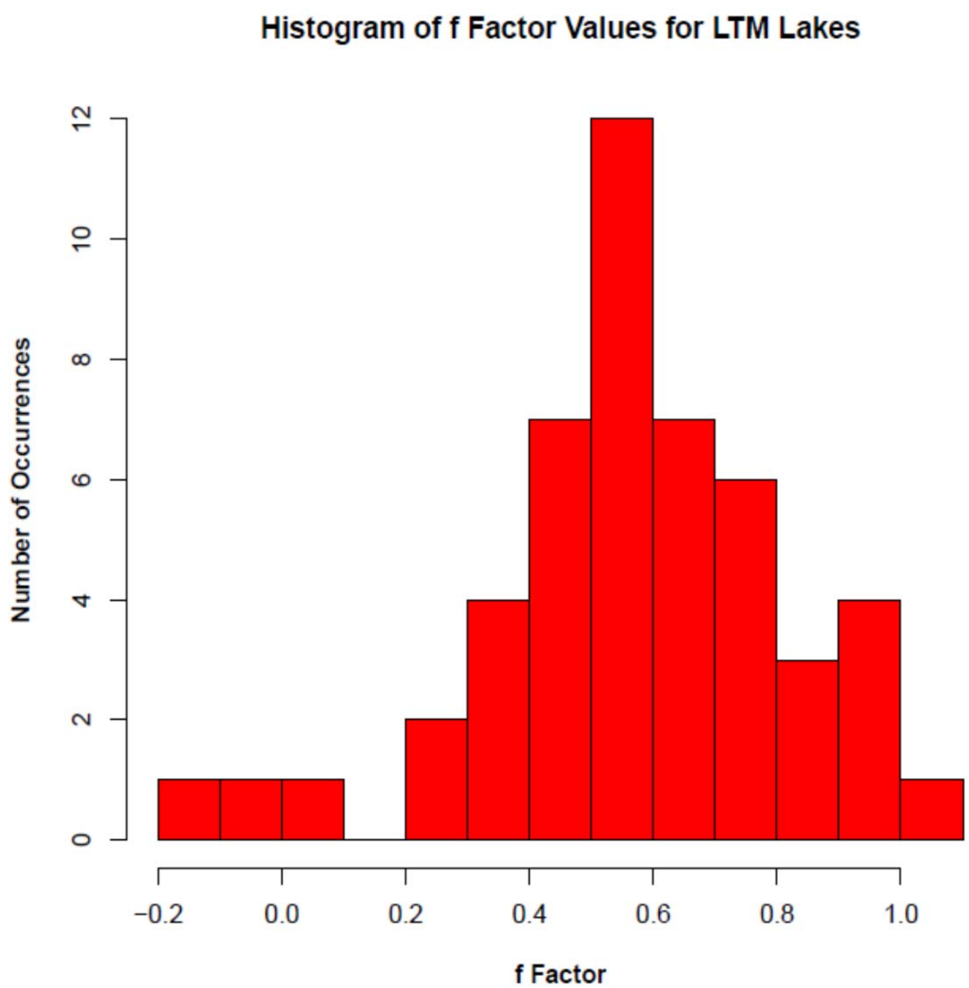
Regionalization: Representativeness of Data

Ecoregion	Num. of Lakes	Total Area	% Number	% Area	Mean; Median; Std. Dev.; Geo Std. Dev.	Vintage; Source
All						
ANC data						
ANC data; ANC<100						
CL data						
CL data; ANC<100						

Ecoregion	Num. of Stream Segments	Total Length	% Number	% Length	Mean; Median; Std. Dev.; Geo Std. Dev.	Vintage; Source
All						
ANC data						
ANC data; ANC<100						
CL data						
CL data; ANC<100						

Basic data such as these are not provided by EPA. Some of this information may be covered in figures, but it is not tabulated or summarized in this fashion.

Critical Loads F-Factor

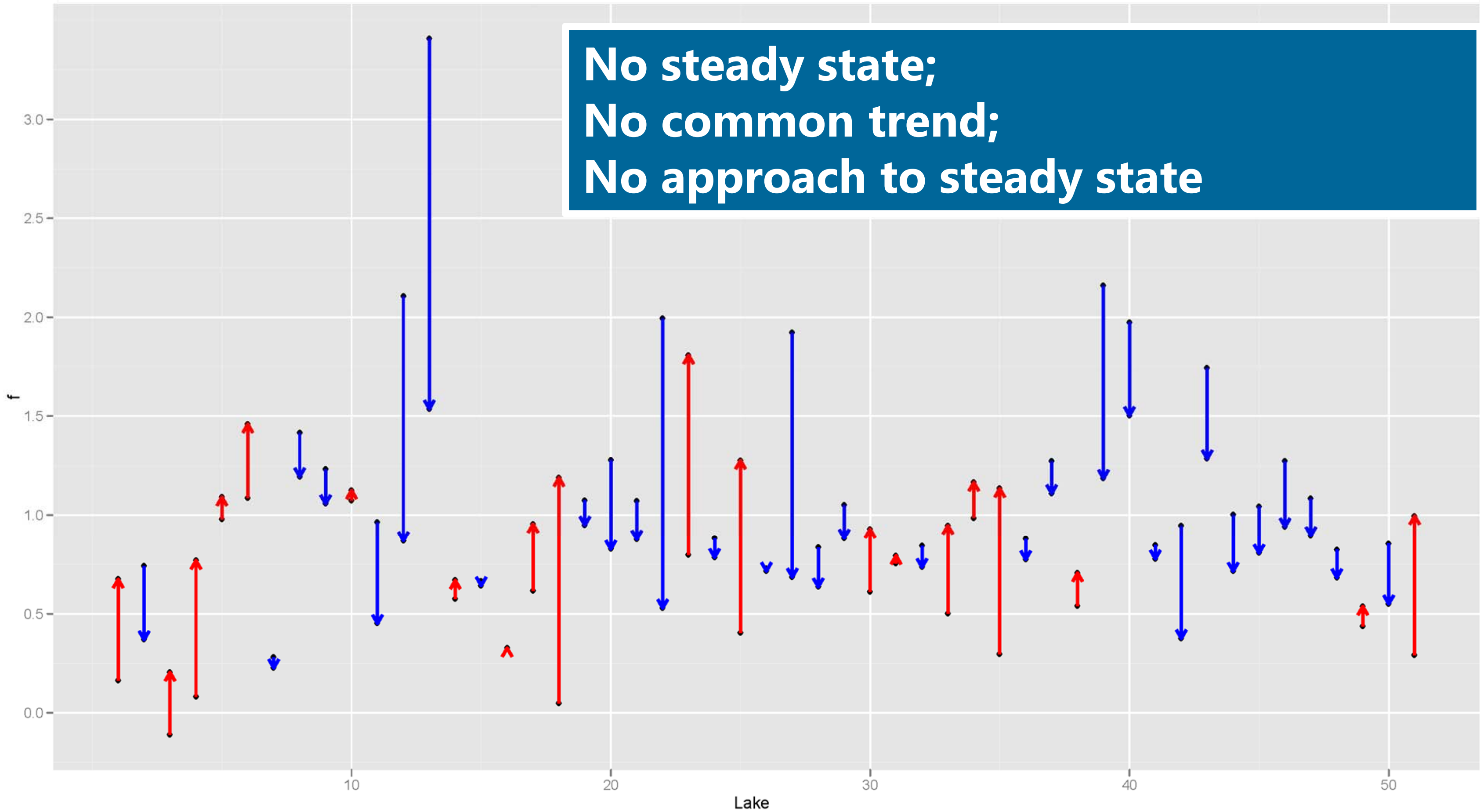


EPA states that the "F" factor values are between 0.2 and 0.4 for the Adirondacks.

Using actual Adirondacks data, the range in "F" is much larger, with the mode near 0.6.

Critical Loads F-Factor: Changes on Decadal Scales

Changes in F factor from first half (9 years) to second half (9 years) of ALTM data set



No steady state;
No common trend;
No approach to steady state

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Changes in Solute Concentration in Adirondack Lakes, 1990-2006, Measured vs. MAGIC

Measured

Solute	1990	2006	Delta
SO_4^{2-}	107	73	-34
ANC	25	30	+5
NO_3^-	19	14	-5
$\sum C_A$	126	87	-39
$\sum C_B$	151	117	-34

$\sum C_B / \sum C_A = 0.87$

MAGIC

Solute	1990	2006	Delta
SO_4^{2-}	115	68	-47
ANC	33	61	+28
NO_3^-	5	5	0
$\sum C_A$	120	75	-45
$\sum C_B$	153	134	-19

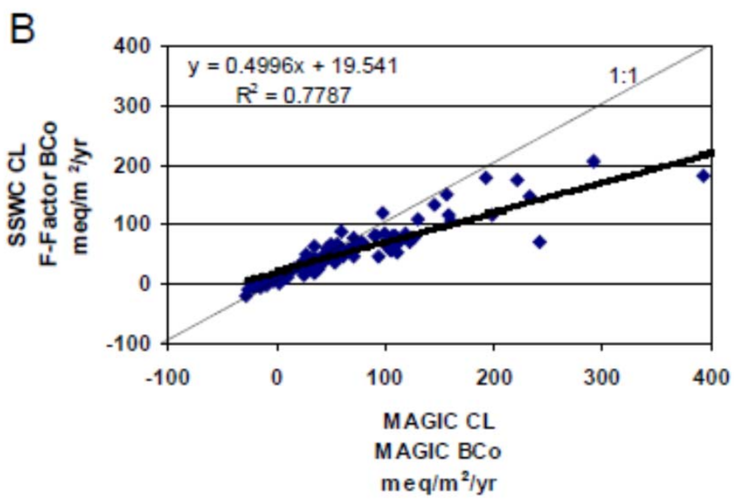
$\sum C_B / \sum C_A = 0.42$

here, $\sum C_A = SO_4^{2-} + NO_3^-$

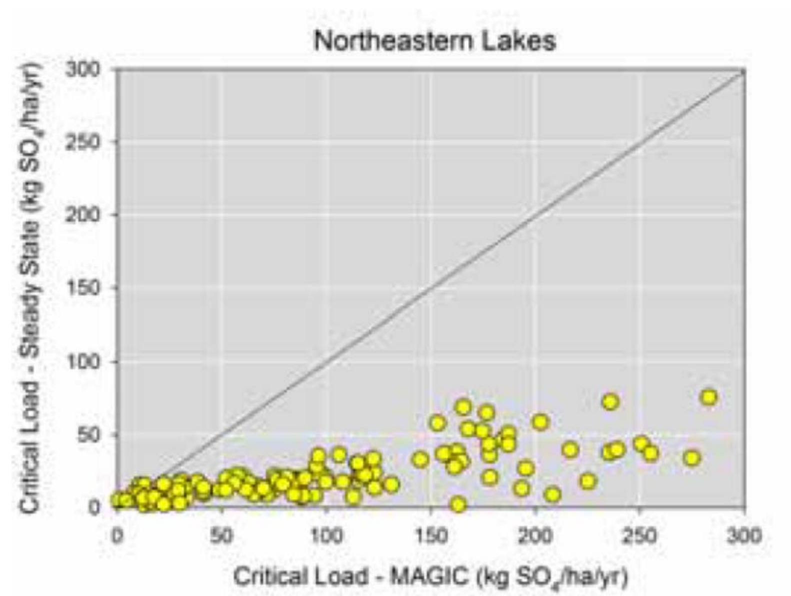
A similar comparison for the Shenandoah area shows MAGIC having some trends in the wrong direction, bringing into question the use of MAGIC to extrapolate forward from 150 years in the past

Critical Loads: MAGIC v. SSWC

- MAGIC consistently produces higher (less-stringent) critical loads than the Henriksen F-factor approach
- EPA explains the effect by discussing the "average" difference (which is influenced by the higher number of data points on the lower end of the distribution) rather than the trend (**slope of 0.5,** intercept 20)
- Other studies have shown this departure (even at low CLs) more clearly



Policy Assessment Document, v2011-Jan-14, Appendix B



Multiagency Workshop on Critical Loads, Final Report

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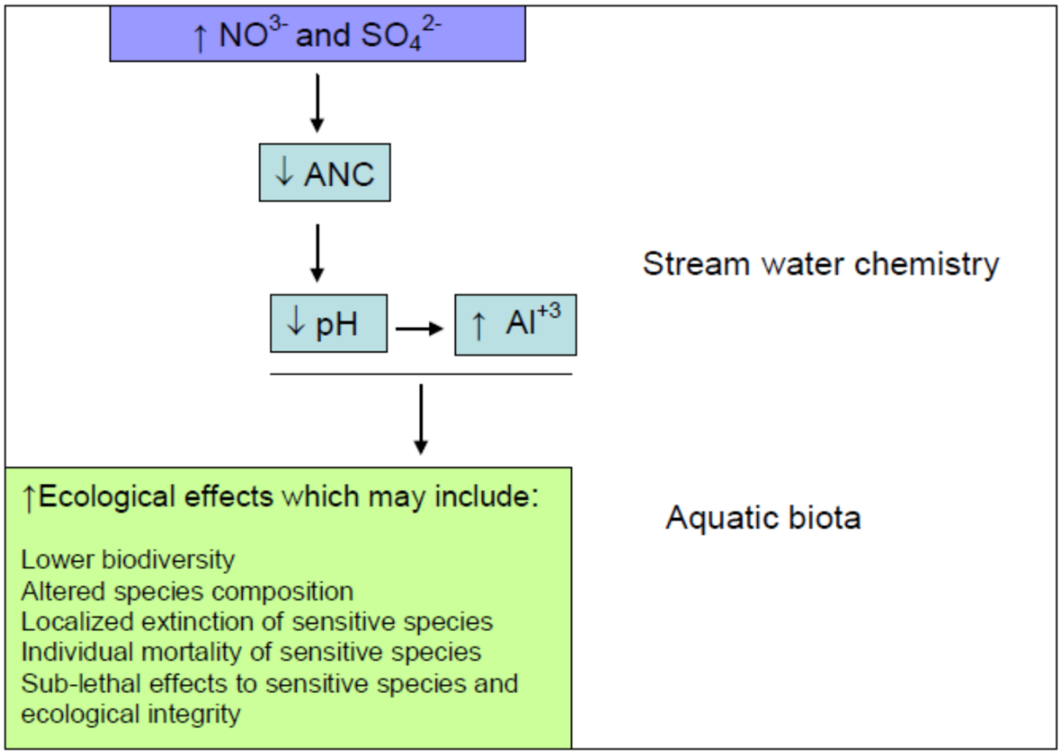
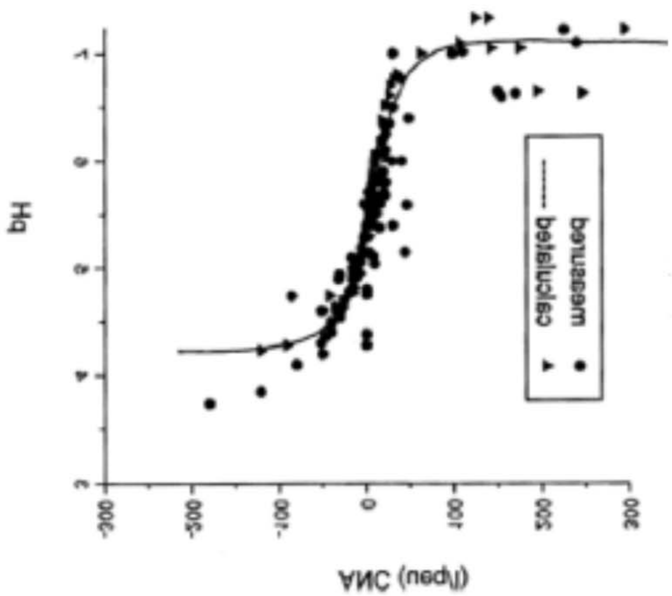
True Indicators: pH or Al_{im}

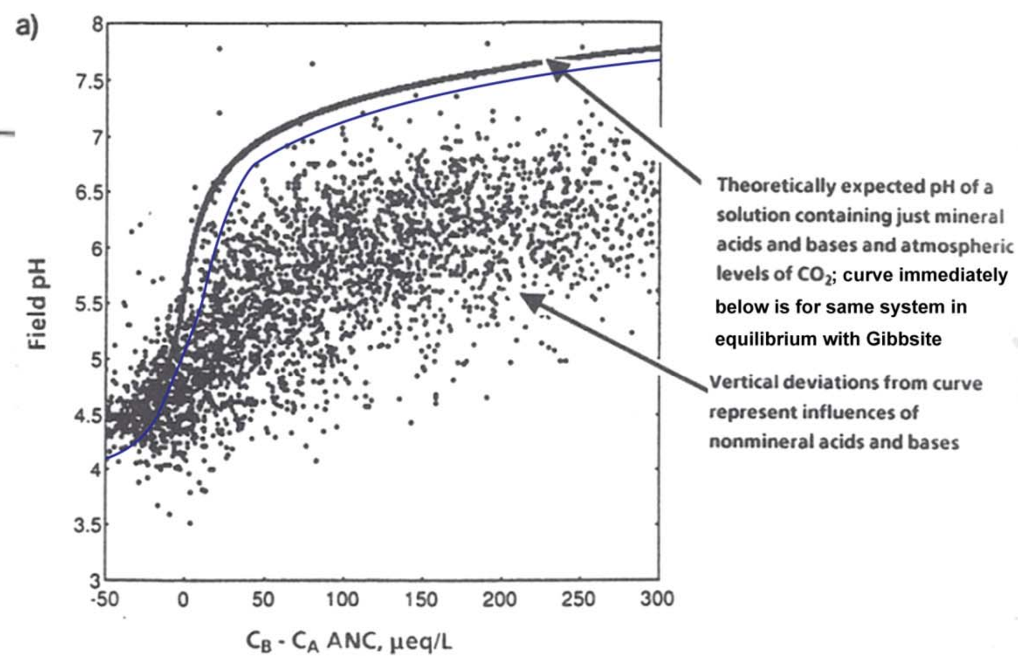


Source: EPA

Relation of ANC with pH is NOT Universal



Source: EPA



Baker and Gherini, 1990

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Response of Fish Species

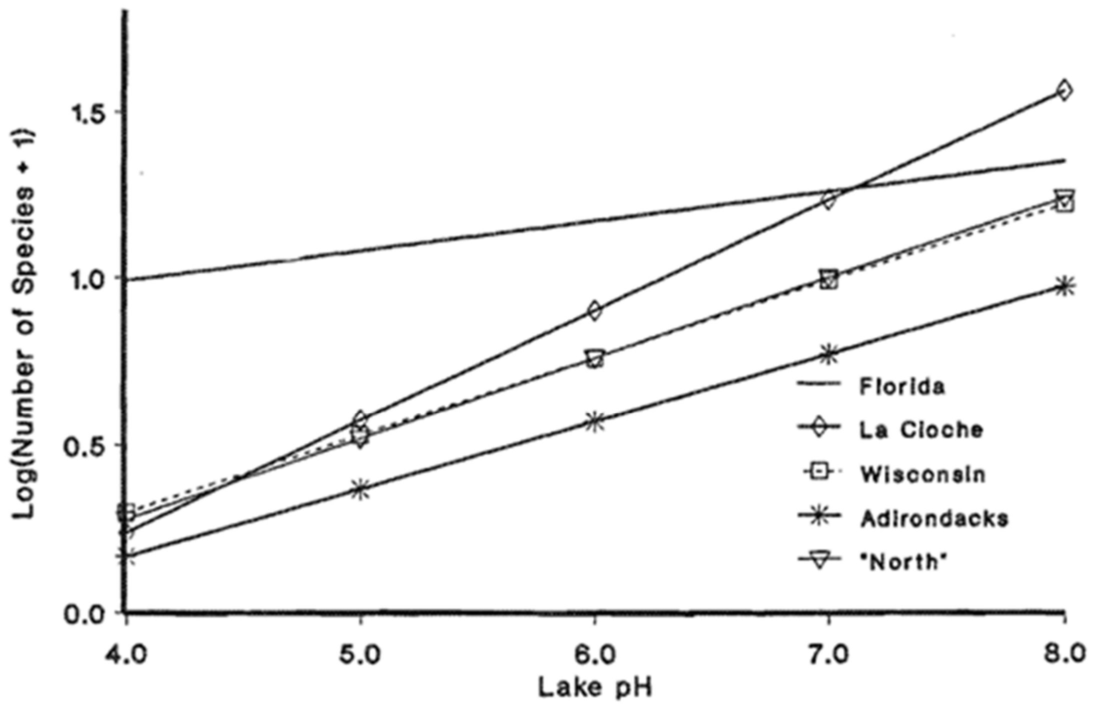

FIG. 1. Regression lines for number of fish species vs. pH for Florida, Wisconsin (Rahel 1982), La Cloche (Harvey 1975), Adirondack Mountain (Adirondack Lake Survey Corp. 1989) lakes, and the merged north-temperate data "North." All are significant ($P \leq 0.05$). F: $Y = 0.09\ (\mathrm{pH}) + 0.63$; $R^2 = 0.33$. C: $Y = 0.33\ (\mathrm{pH}) - 1.08$; $R^2 = 0.35$. W: $Y = 0.23\ (\mathrm{pH}) - 0.62$; $R^2 = 0.50$. NY: $Y = 0.20\ (\mathrm{pH}) - 0.63$; $R^2 = 0.43$. N: $Y = 0.24\ (\mathrm{pH}) - 0.68$; $R^2 = 0.38$.

Shenandoah N. Park: Fish in Sensitive Habitats (SNP:FISH): Not Acidic → > 50 μeq L^{-1}

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Shenandoah N. Park: Fish in Sensitive Habitats (SNP:FISH): Response of Blacknose Dace

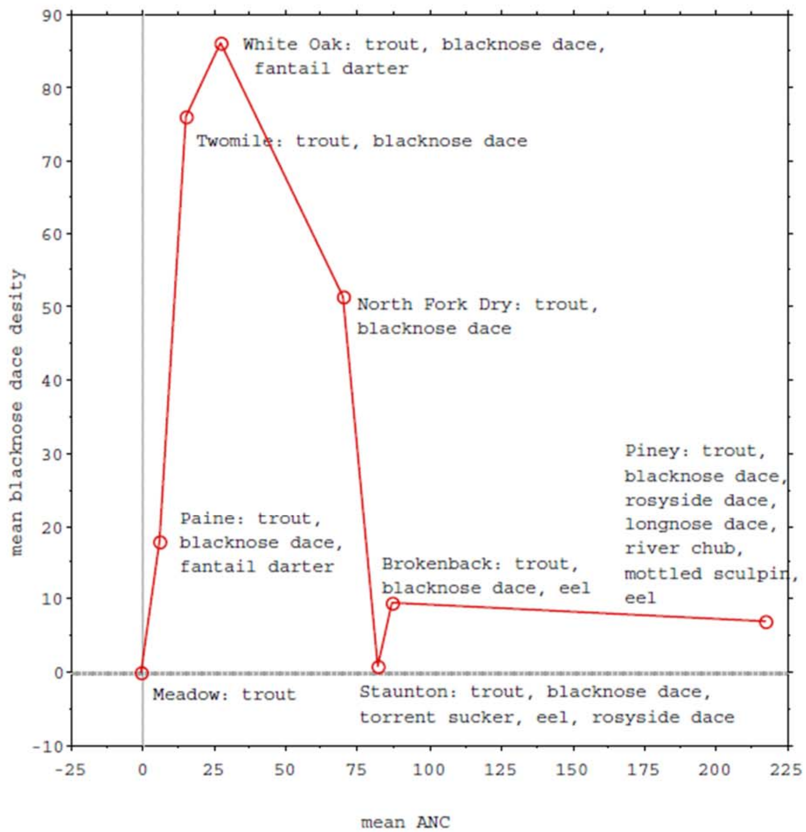

Figure E-4. Blacknose dace density (number of individuals per 100 m^2 of habitat) in the FISH project's three intensive and five extensive streams, versus mean ANC. Other fish species present in each stream are shown after the stream name on the graph.

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Contact Information

Eladio M. Knipping, Ph.D.

Senior Technical Manager, Environment

Electric Power Research Institute (EPRI)

2000 L Street NW Suite 805, Washington, DC 20036 USA

Phone: 202.293.6343 • **Mobile:** 650.799.7088 • **Fax:** 202.293.2697

Email: eknippin@epri.com