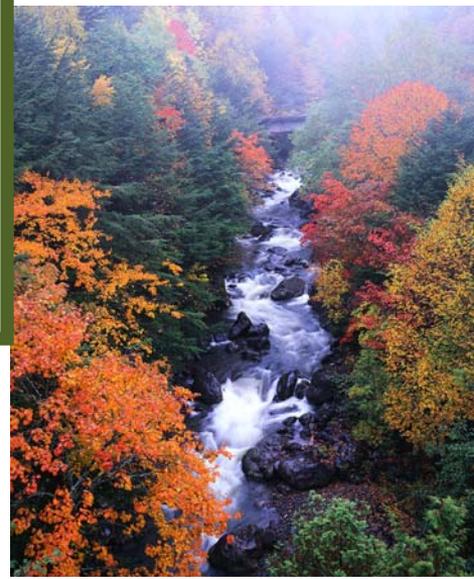
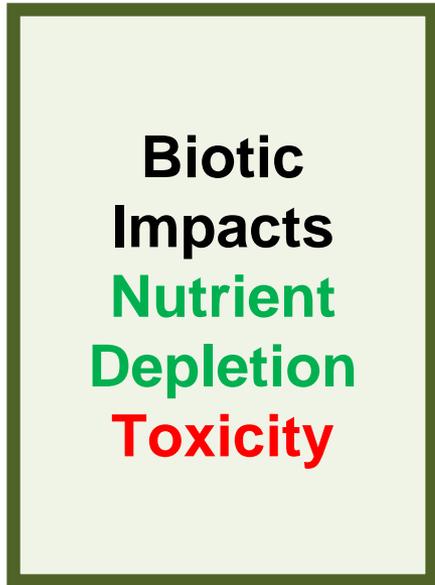
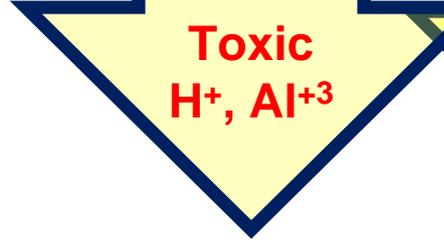
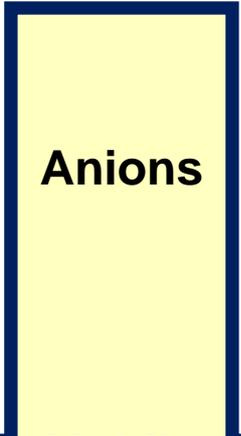
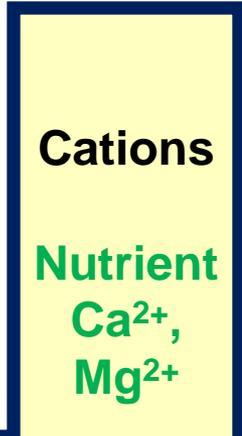
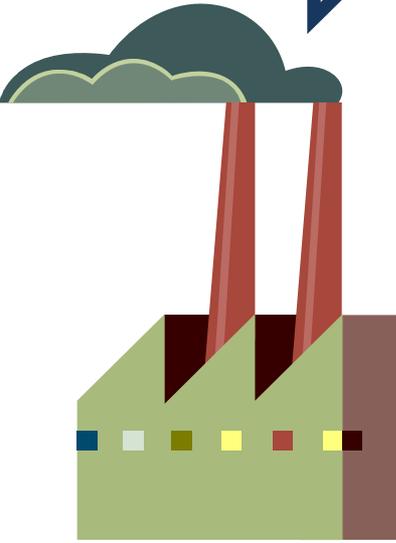
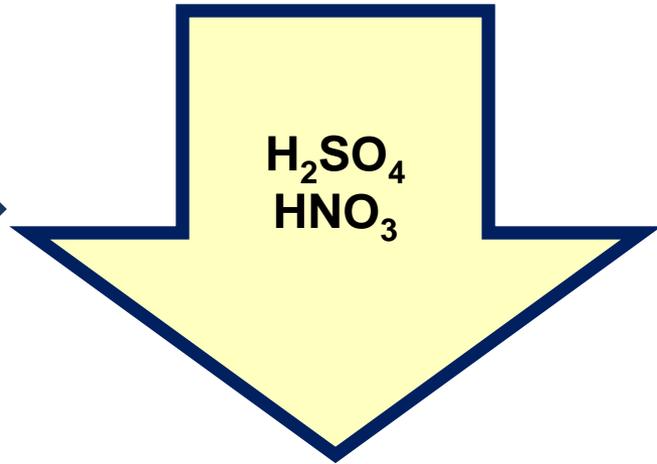
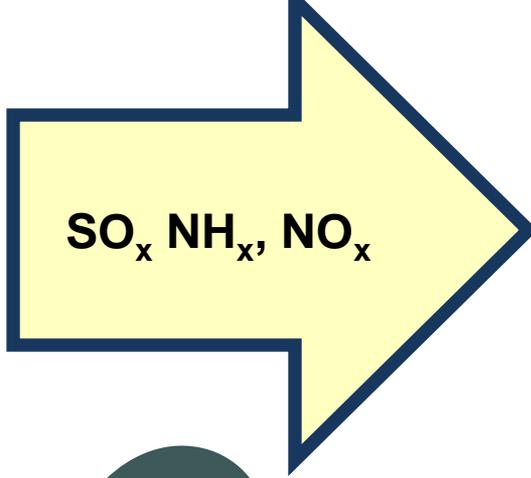


# **Biological and Forest Health Trends**

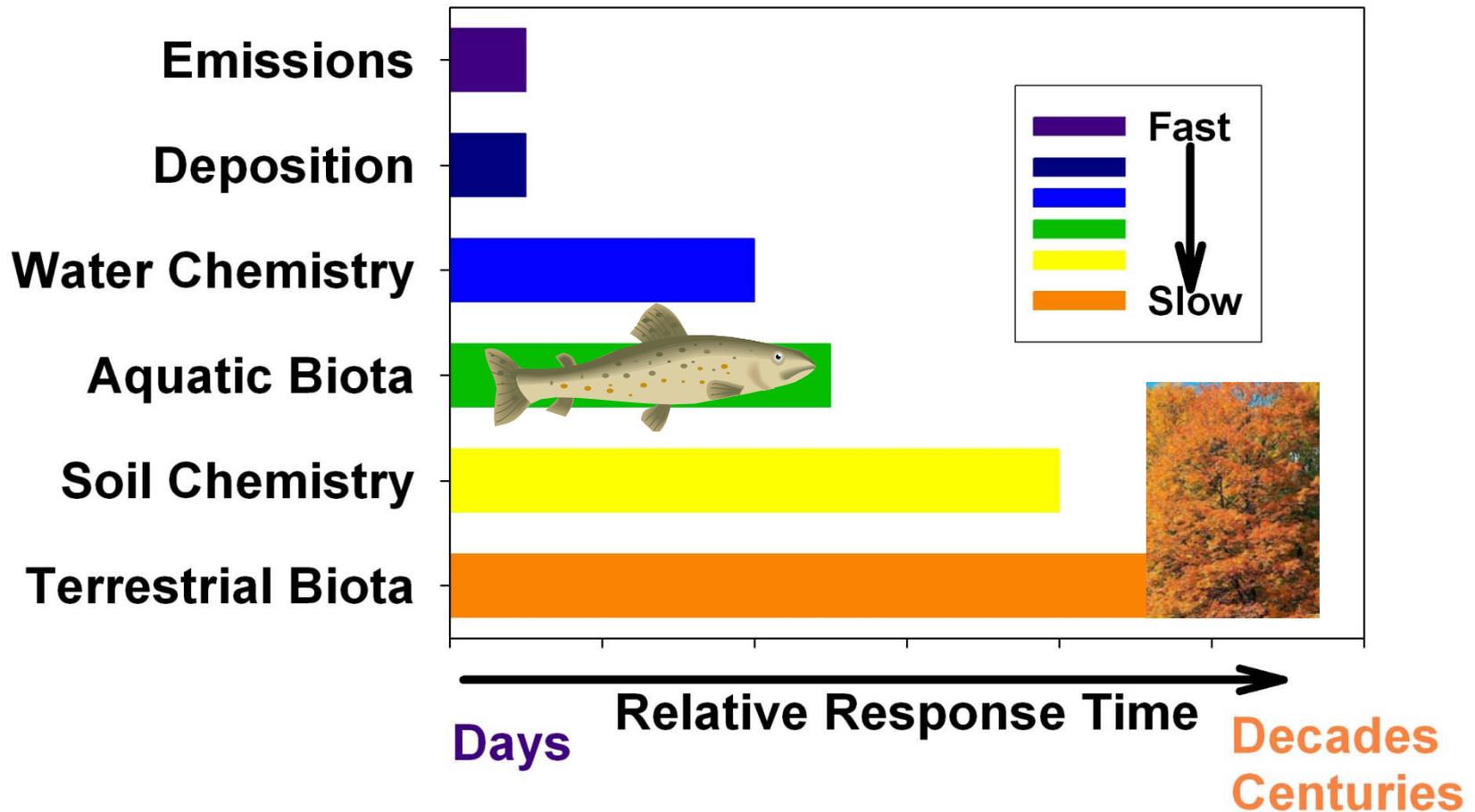
Myron J. Mitchell  
SUNY-Environmental Science and  
Forestry  
Syracuse, New York

# Outline of Presentation

- Chemical versus biological response
- Aquatic biota
  - Fish
  - Other Biota
- Terrestrial biota with emphasis on sugar maple
- Need for integrated approach



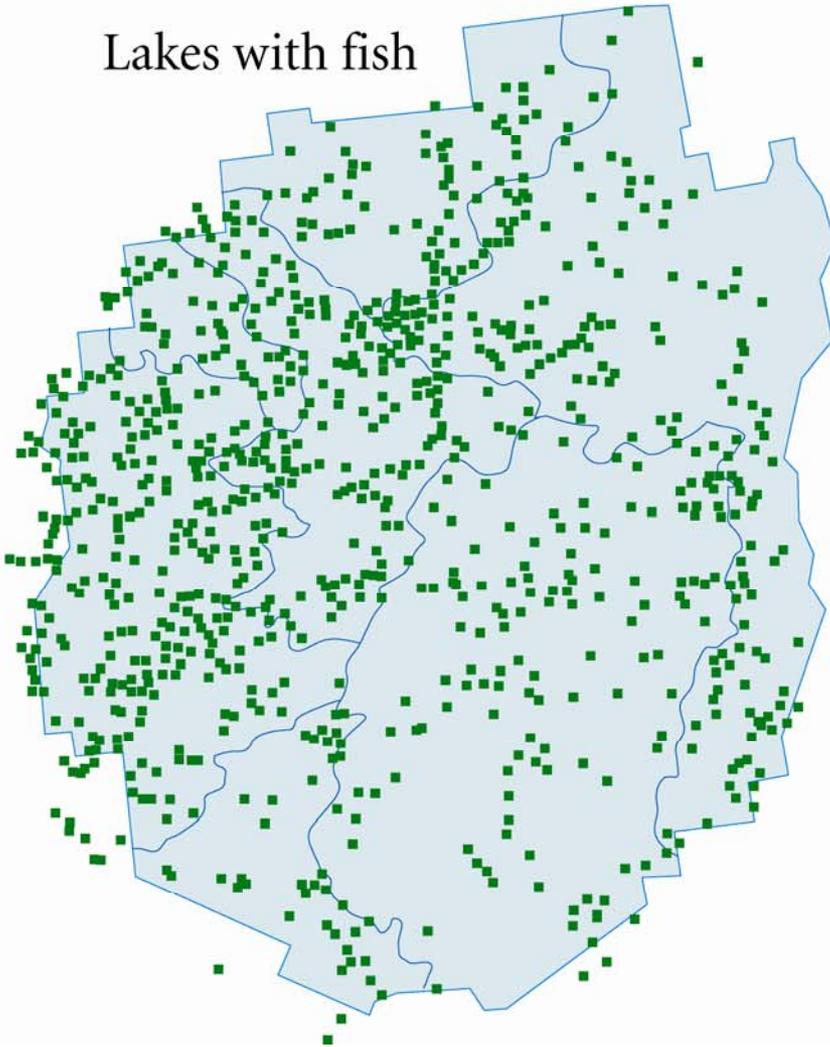
# Major Components Related to Sulfur and Nitrogen Emissions and Ecosystem Effects



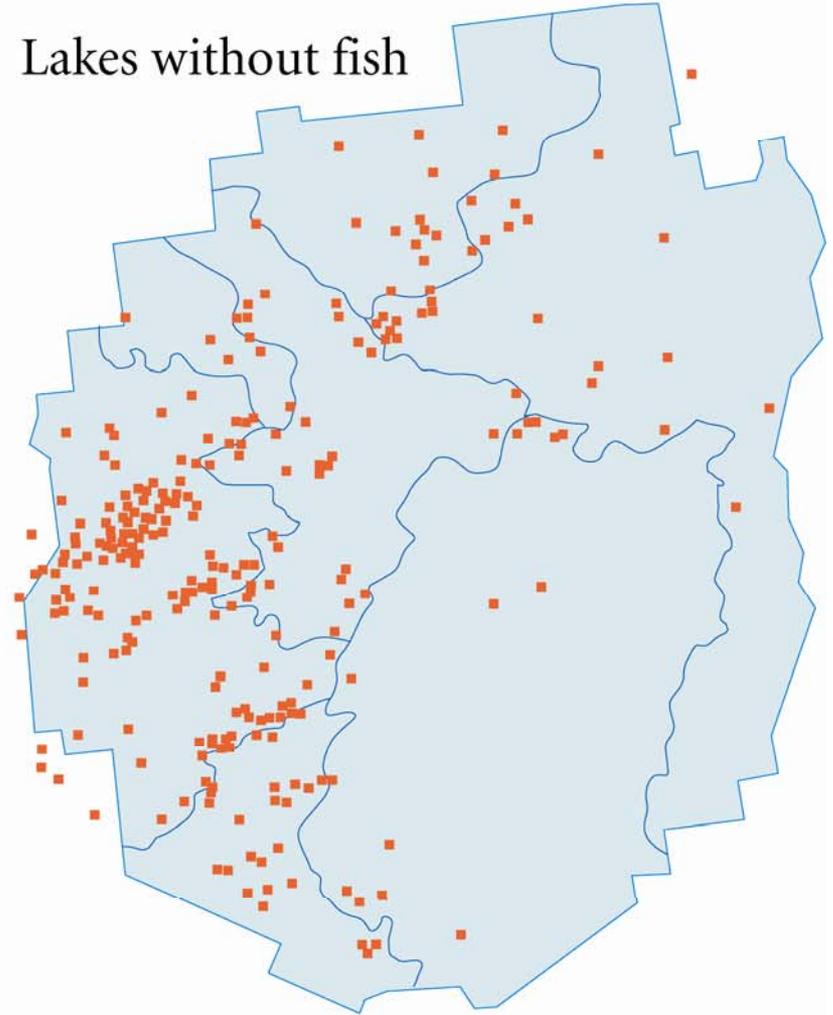
From Adirondack Lake Survey Corporation

LAKES WITH AND WITHOUT FISH

Lakes with fish

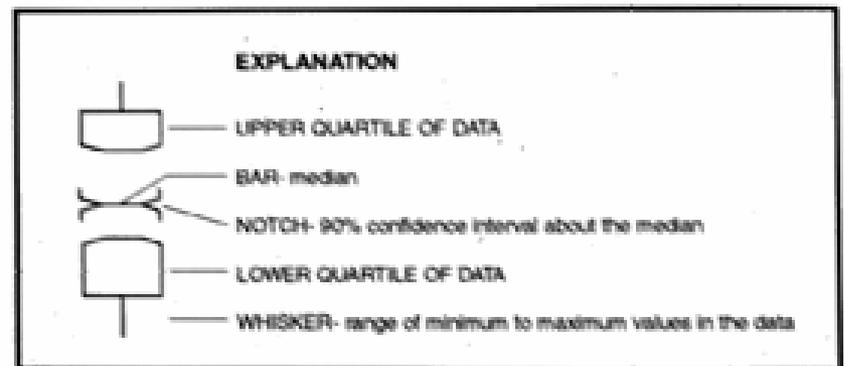
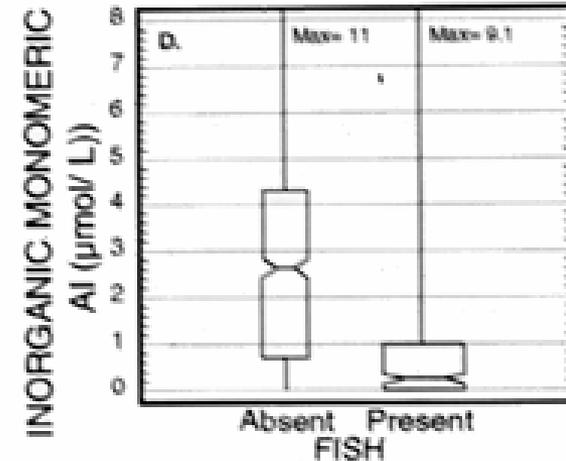
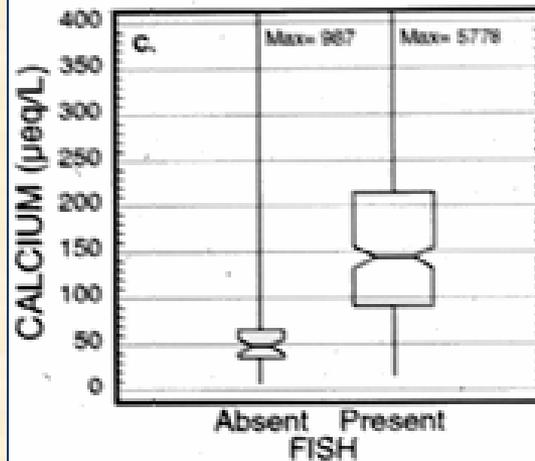
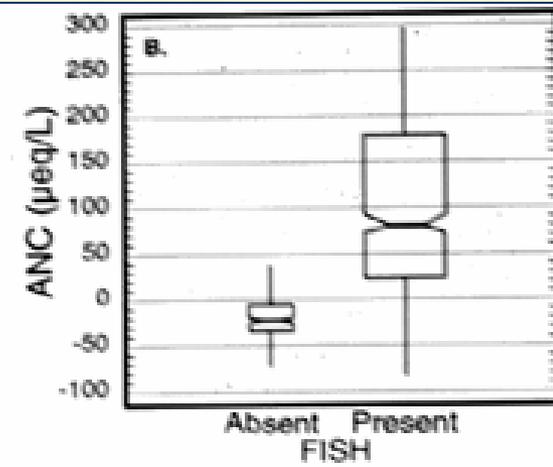
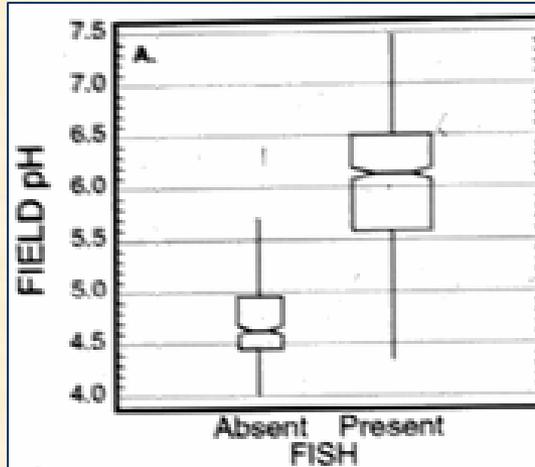


Lakes without fish





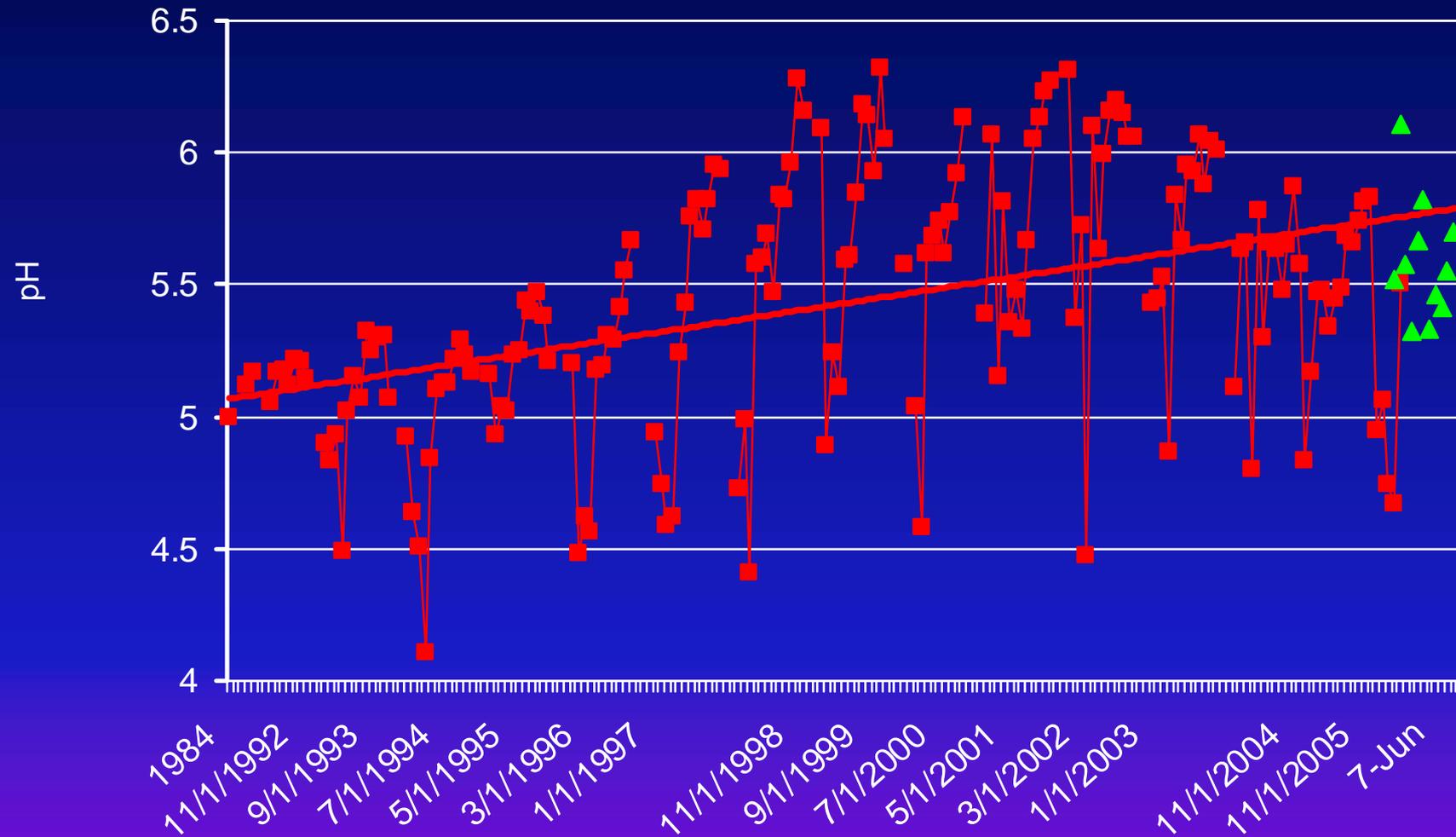
From: Driscoll, C.T.,  
 K.M. Driscoll, M.J.  
 Mitchell and D.J.  
 Raynal. 2003. Effects  
 of acidic deposition  
 on forest and aquatic  
 ecosystems in New  
 York State.  
 Environmental  
 Pollution 123:327-336.



## Other Aquatic Biota

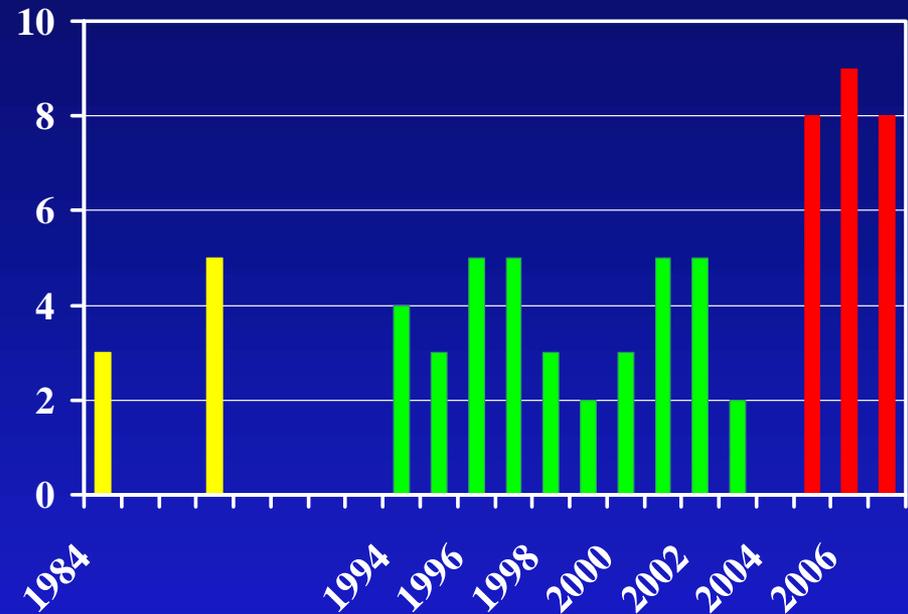
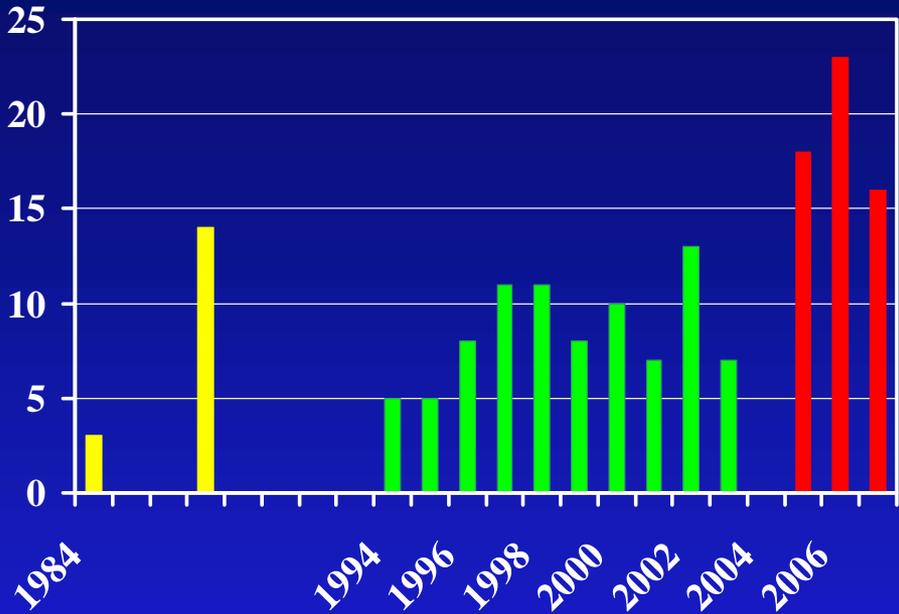
Example of Brooktrout Lake in the  
Adirondack Mountains  
(from Clifford Siegfried)

# Brooktrout Lake -pH; 1984-2006



# Species Richness

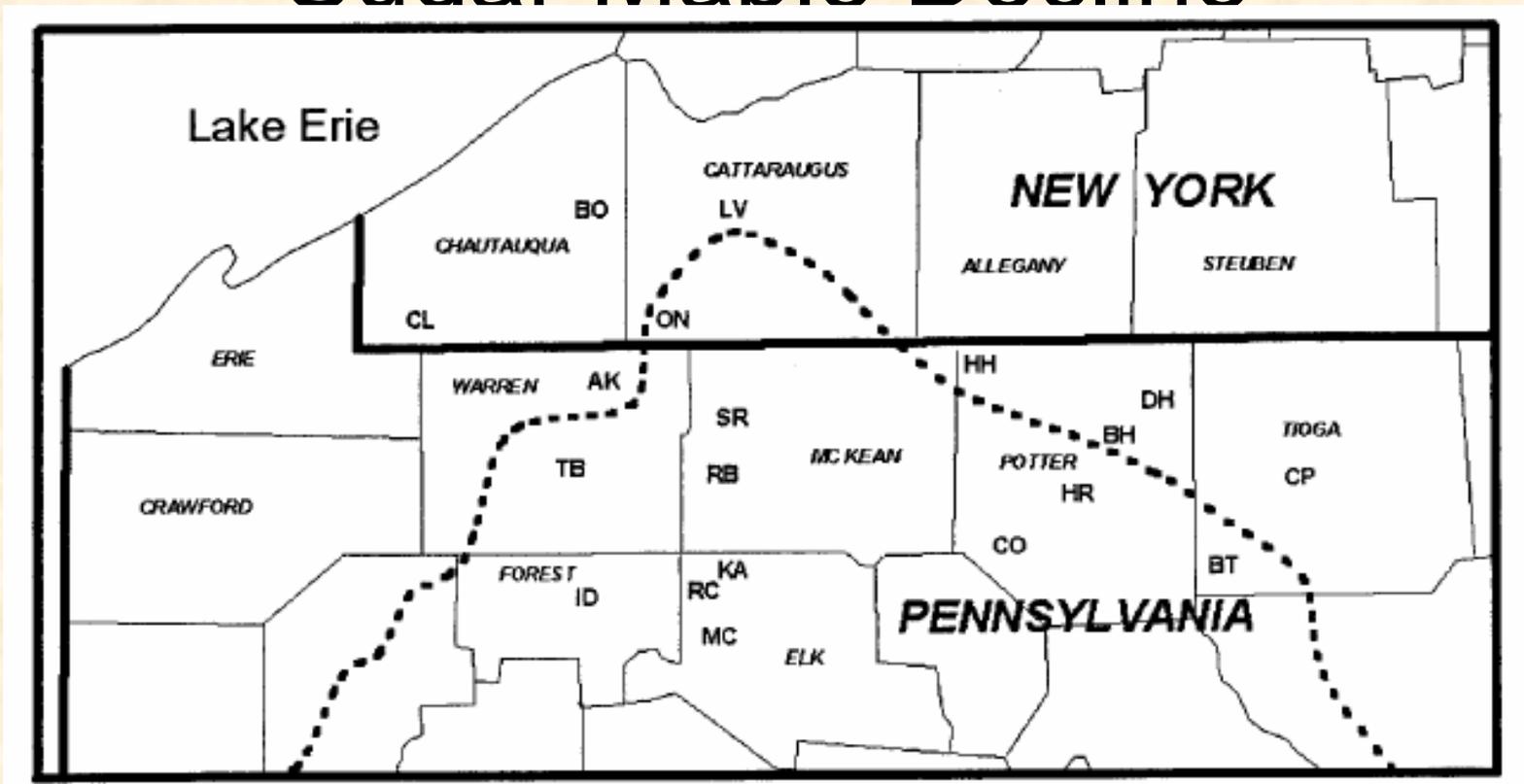
ZOOPLANKTON TAXA - BROOKTROUT LAKE  
 1984, 1987-88, 2005-2007 (preliminary)



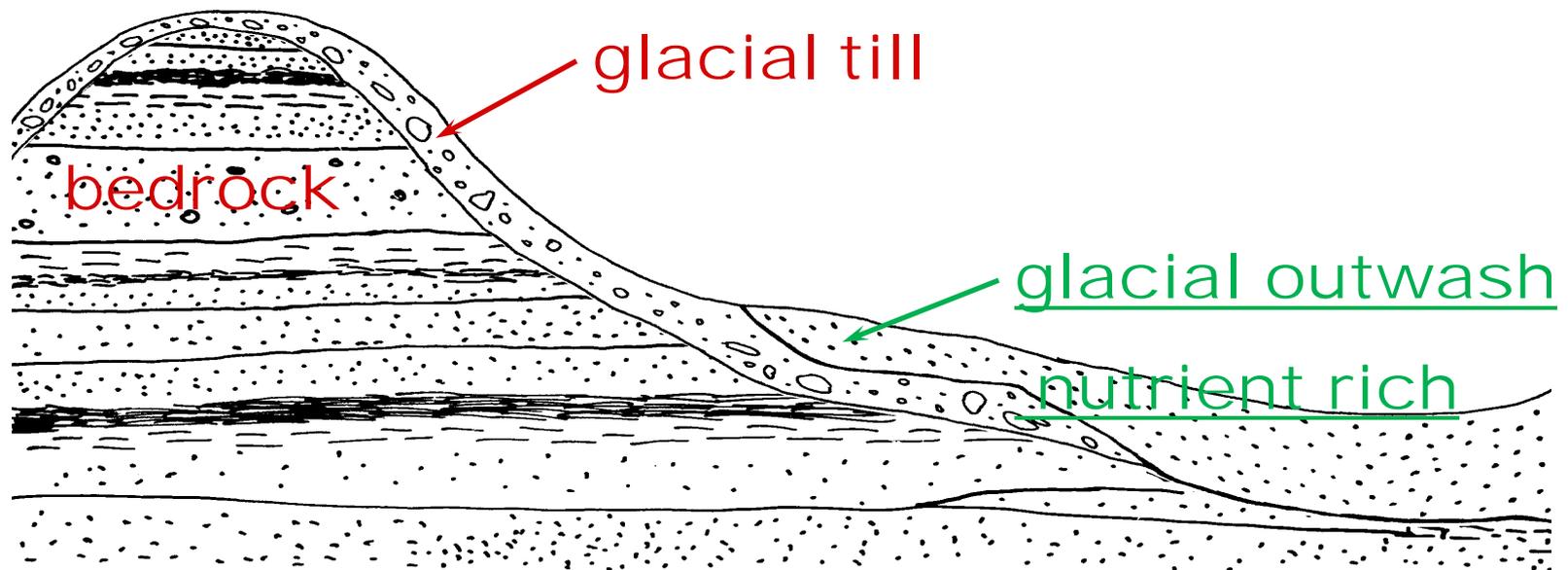
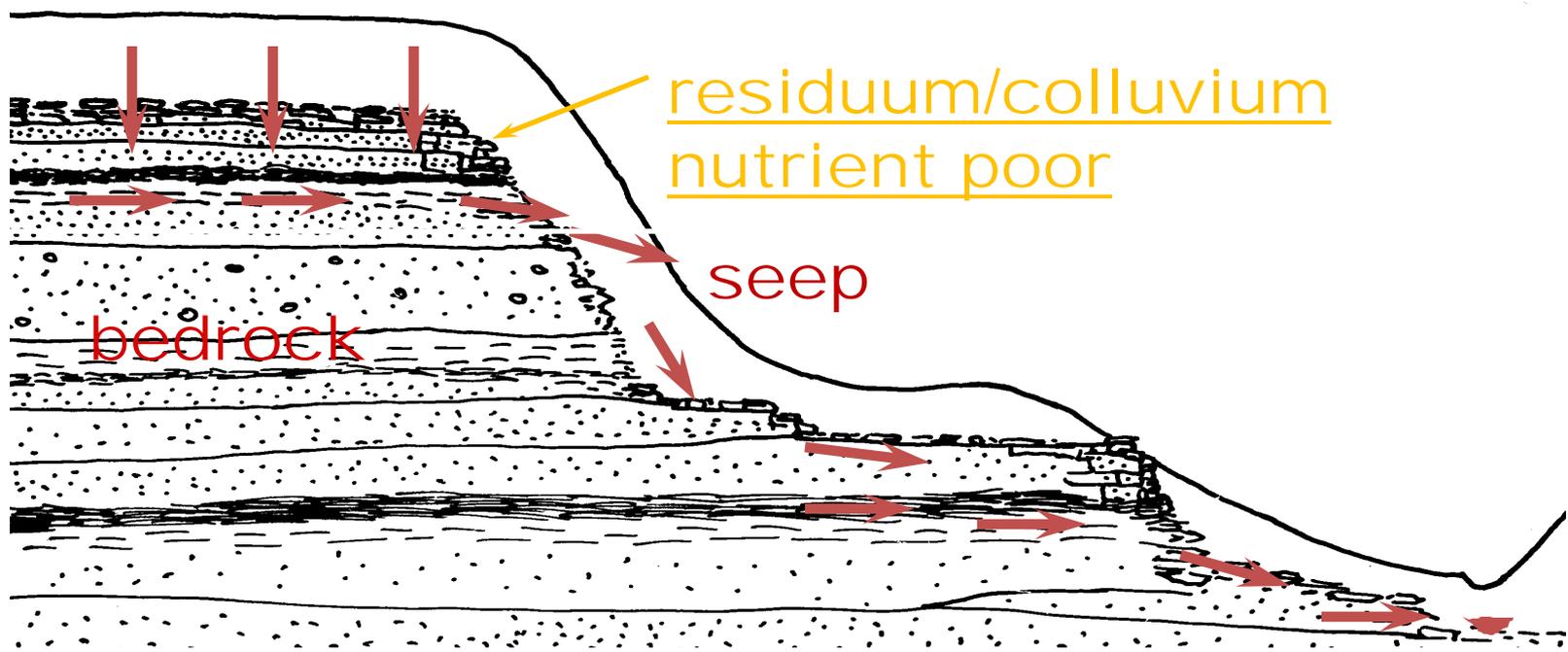
# Forest Ecosystems

## Red Spruce Decline (higher elevations)

## Sugar Maple Decline

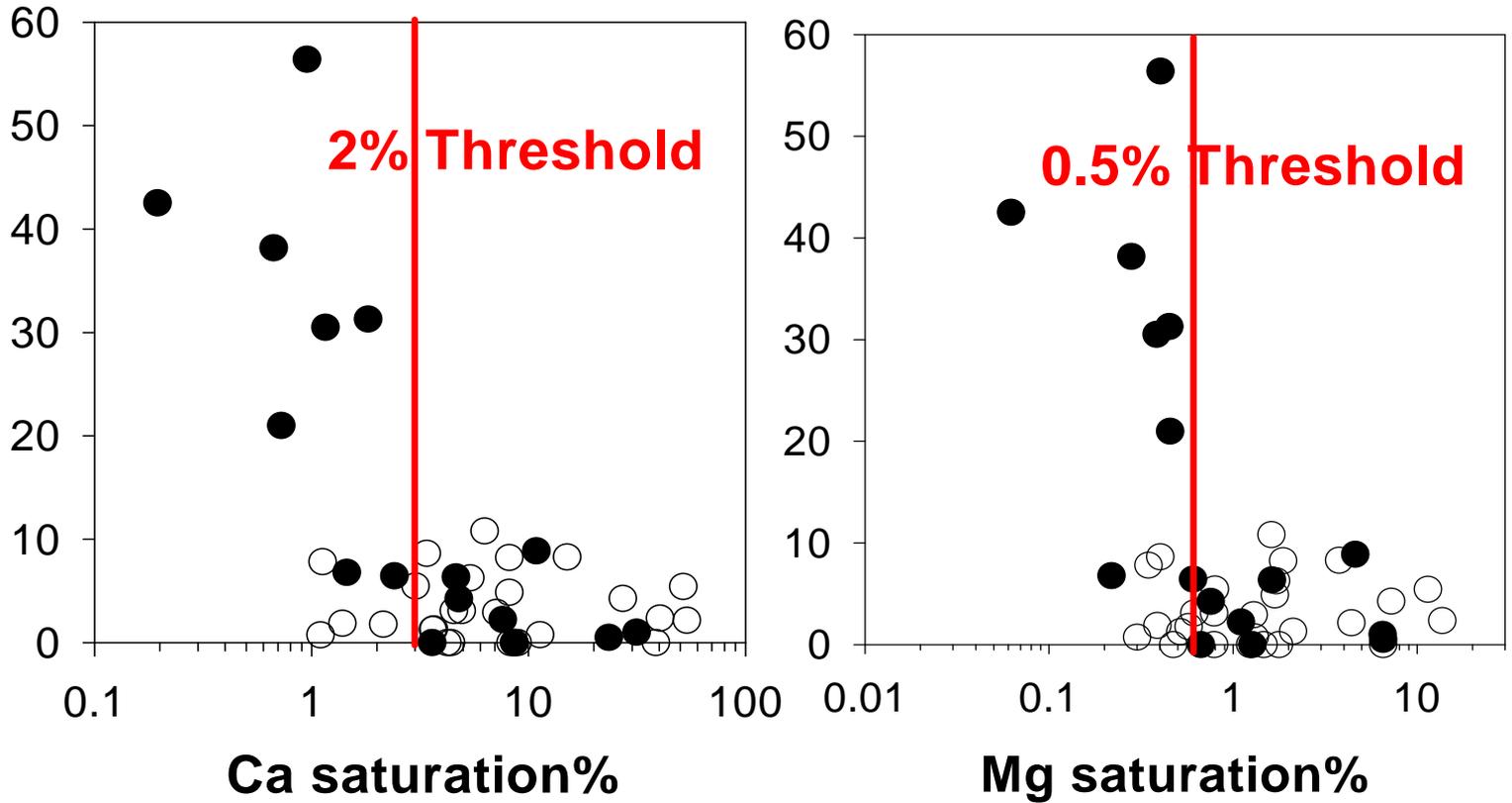


From: Bailey S. W., S. B. Horsley, R. P. Long, and R. A. Hallett. 2004. Influence of Edaphic Factors on Sugar Maple Nutrition and Health on the Allegheny Plateau. *SSSAJ* 68:243–252



**Mortality (% dead basal area)**

## Upper B-horizon



- less severe defoliation
- severe defoliation

# Atmospheric Deposition Major Driver:

## But Other Factors Matter

- Other components of air pollutants including ozone
- Geology (location and substrate)
- Introduction of exotic species
- Herbivory (Deer, Moose, Insects)
- Land use change including forest management
- Climatic effects
- Not only is the biota affected, but the biota can have a marked impact on the chemistry especially N cycling and nitrate in surface waters

# Exotic Pests and Pathogens as Agents of Species Change

Established pests:

Gypsy moth



Hemlock woolly adelgid



Beech scale



New pests & pathogens:

Emerald ash borer



Asian longhorned beetle

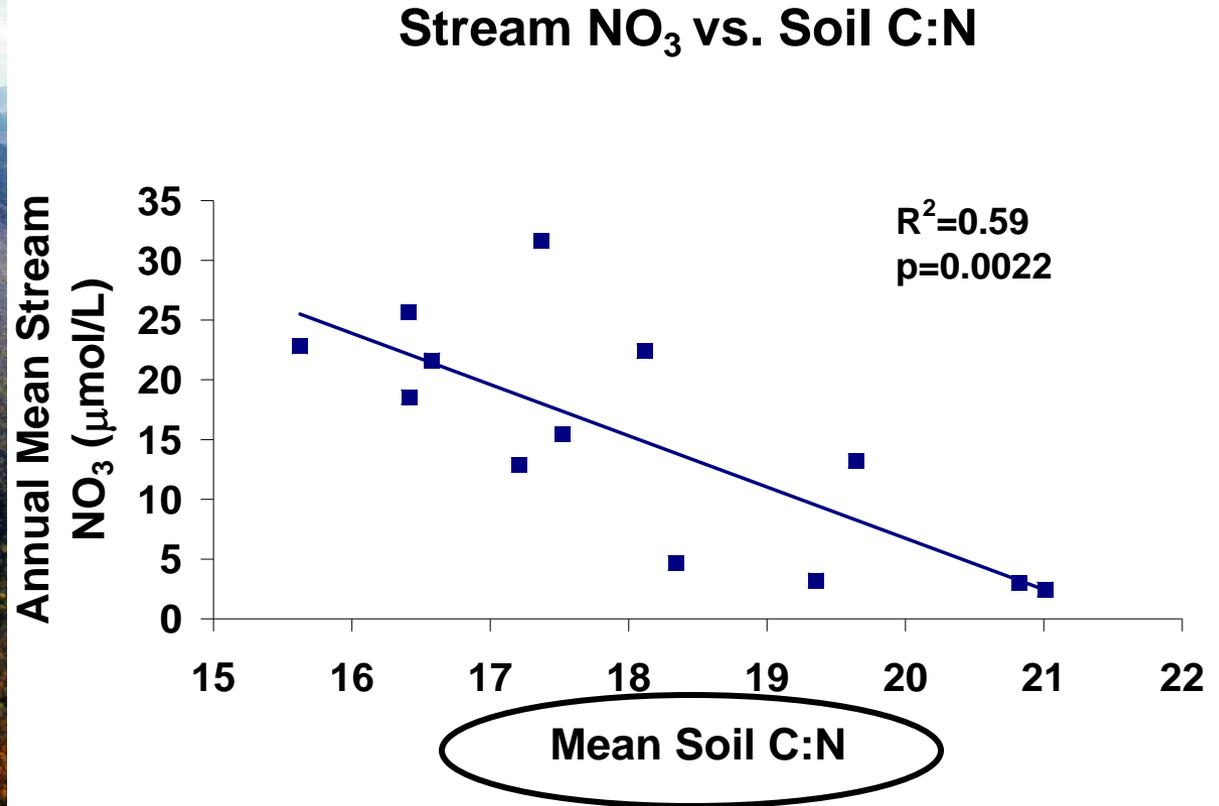


Sudden oak death



From: Lovett, G. M., C. D. Canham, M. A. Arthur, K. C. Weathers, and R. D. Fitzhugh. 2006. Forest ecosystem responses to exotic pests and pathogens in eastern North America. *Bioscience* 56:395-405.

# Control of Nitrate in Catskill Streams

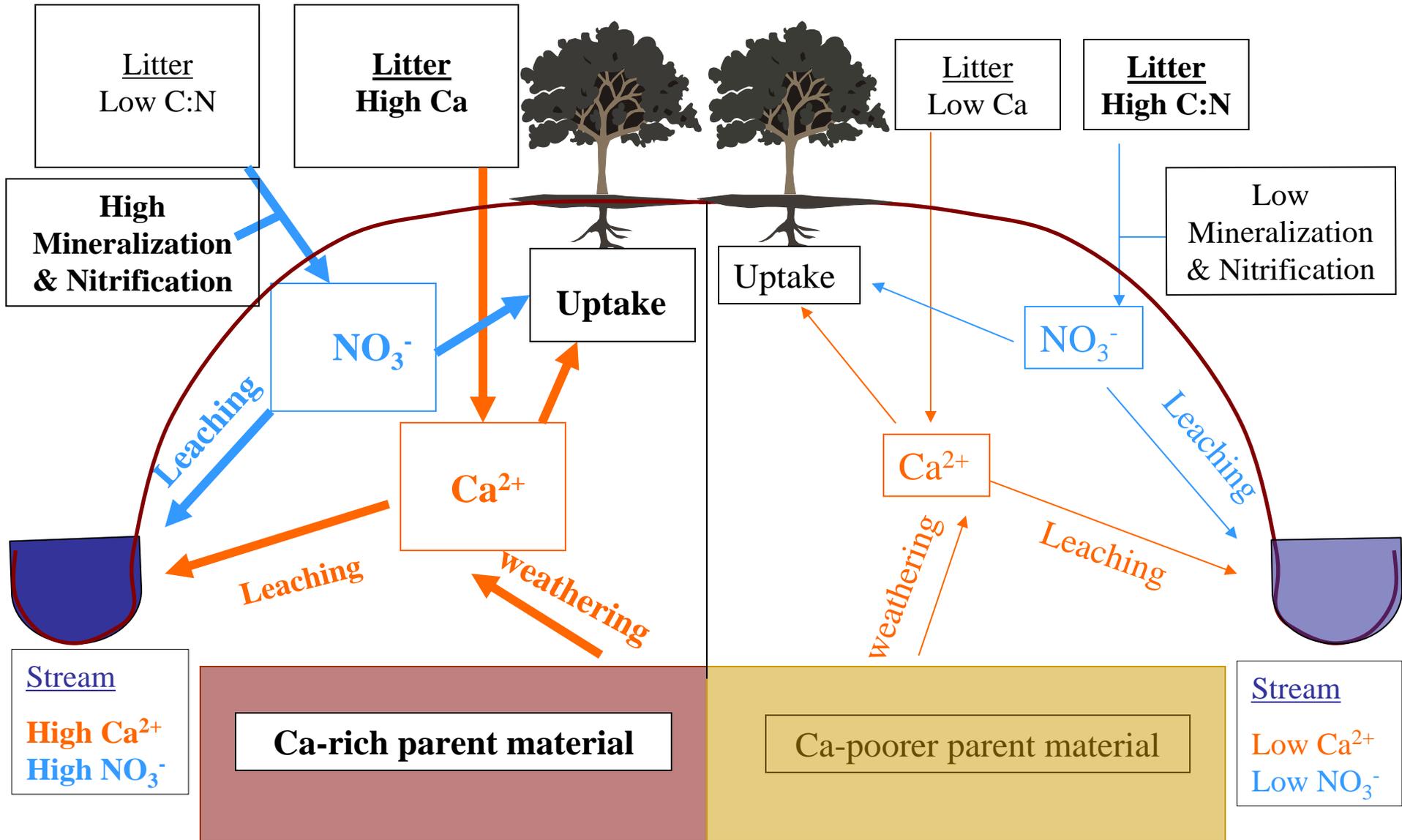


From: Lovett, G. M., K. C. Weathers, and M. A. Arthur. 2002. Control of nitrogen loss from forested watersheds by soil carbon:nitrogen ratio and tree species composition. *Ecosystems* 5:712-718

Variance in soil C:N is primarily explained by species composition, especially sugar maple and red oak

# Ca Rich Site (S14)

# Ca Poorer Site (S15)



From: Christopher, S.F., B.D. Page, J.L. Campbell and M.J. Mitchell. 2006. Contrasting stream water NO<sub>3</sub><sup>-</sup> and Ca<sup>2+</sup> in two nearly adjacent catchments: the role of soil Ca and forest vegetation. *Global Change Biology* 12:364-381.

