

# Developing the Critical Loads for the Acidification of Lake- Watersheds in the Adirondack Region of New York

Qingtao Zhou (qzhou01@syr.edu), Charles T. Driscoll, Afshin Pourmokhtarian, Department of Civil & Environmental Engineering, Syracuse University, Syracuse, 13210  
 Timothy J. Sullivan, E&S Environmental Chemistry, Corvallis OR 97339,  
 Bernard J. Cosby, Department of Environmental Sciences, University of Virginia, Charlottesville VA 22904

## ABSTRACT

Critical loads are a useful tool to guide emission control strategies that will lead to the recovery of ecosystems in response to decreases in atmospheric deposition. The ongoing project involves examining critical and target loads for 20 lake-watersheds in the Adirondack region of NY. For this presentation we present results for Constable Pond, a chronically acidic, thin till drainage lake and Arbutus Lake, a moderate ANC, medium till drainage lake as case studies. The project was conducted with the dynamic watershed model PnET-BGC. We ran the model under different scenarios of combinations of decreases in atmospheric nitrate and sulfate deposition ranging from 0% to 100% that was ramped down from 2008 to 2020 and remained constant thereafter until steady-state was attained. Critical loads were determined from steady-state values, while target loads were determined for various years approaching steady-state. As a result the ANC of the lake-watersheds has been increased with the following decreases in acidic deposition. The target and critical loads of Adirondack lakes greatly depend on rates of base cation supply, the resulting initial ANC and soil base status. The recovery of lake ANC is accomplished most effectively by equivalent decreases in sulfate deposition compared to nitrate deposition.

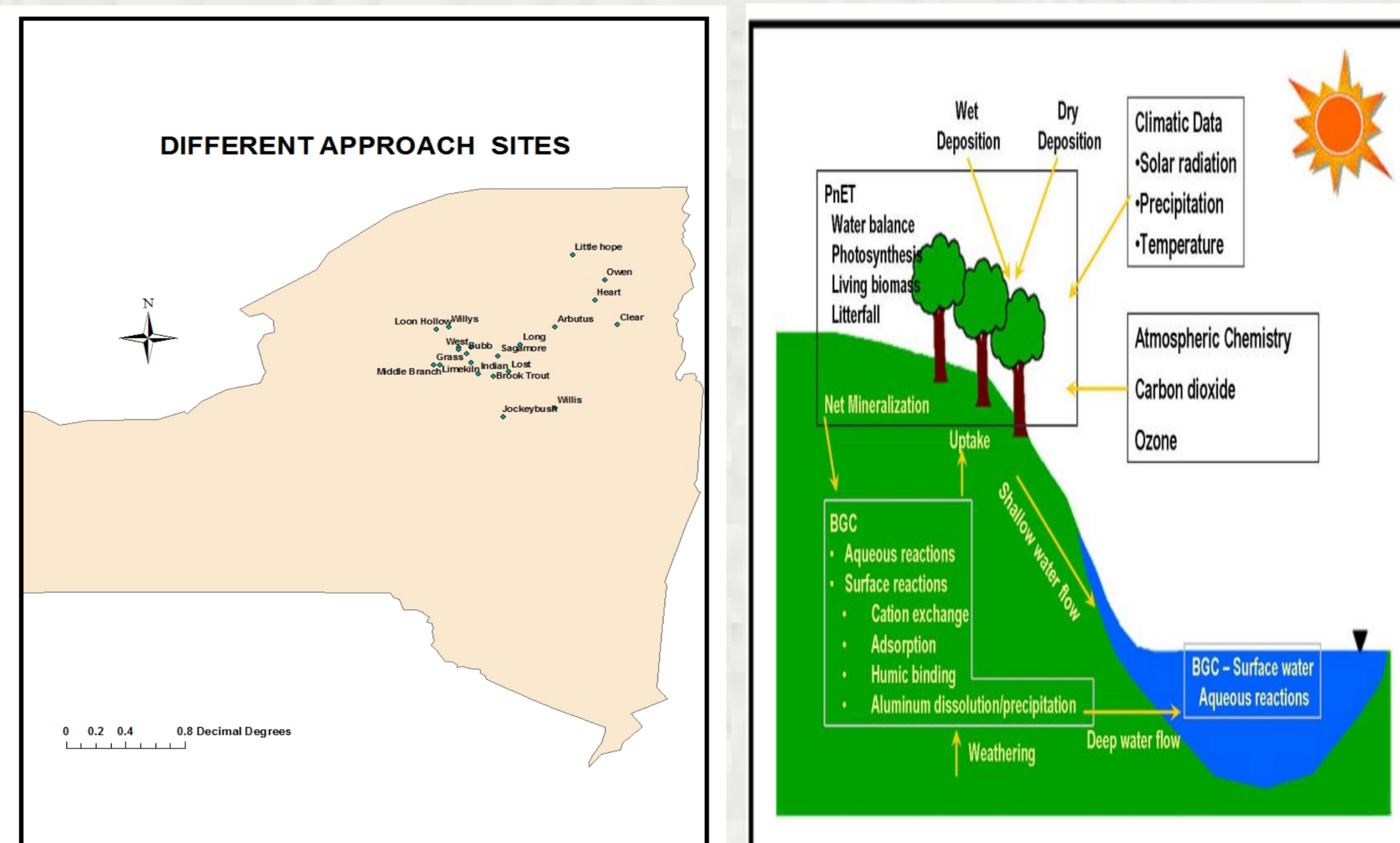
## BACKGROUND

- Although there has been some recovery of lakes in response to decreases in acidic deposition, current deposition results in soil acidification which impairs tree health and may ultimately limit surface water recovery.
- In 1982, Canada proposed a critical load of 20 kg S/ha-yr to protect all but the most sensitive areas.

## OBJECTIVES

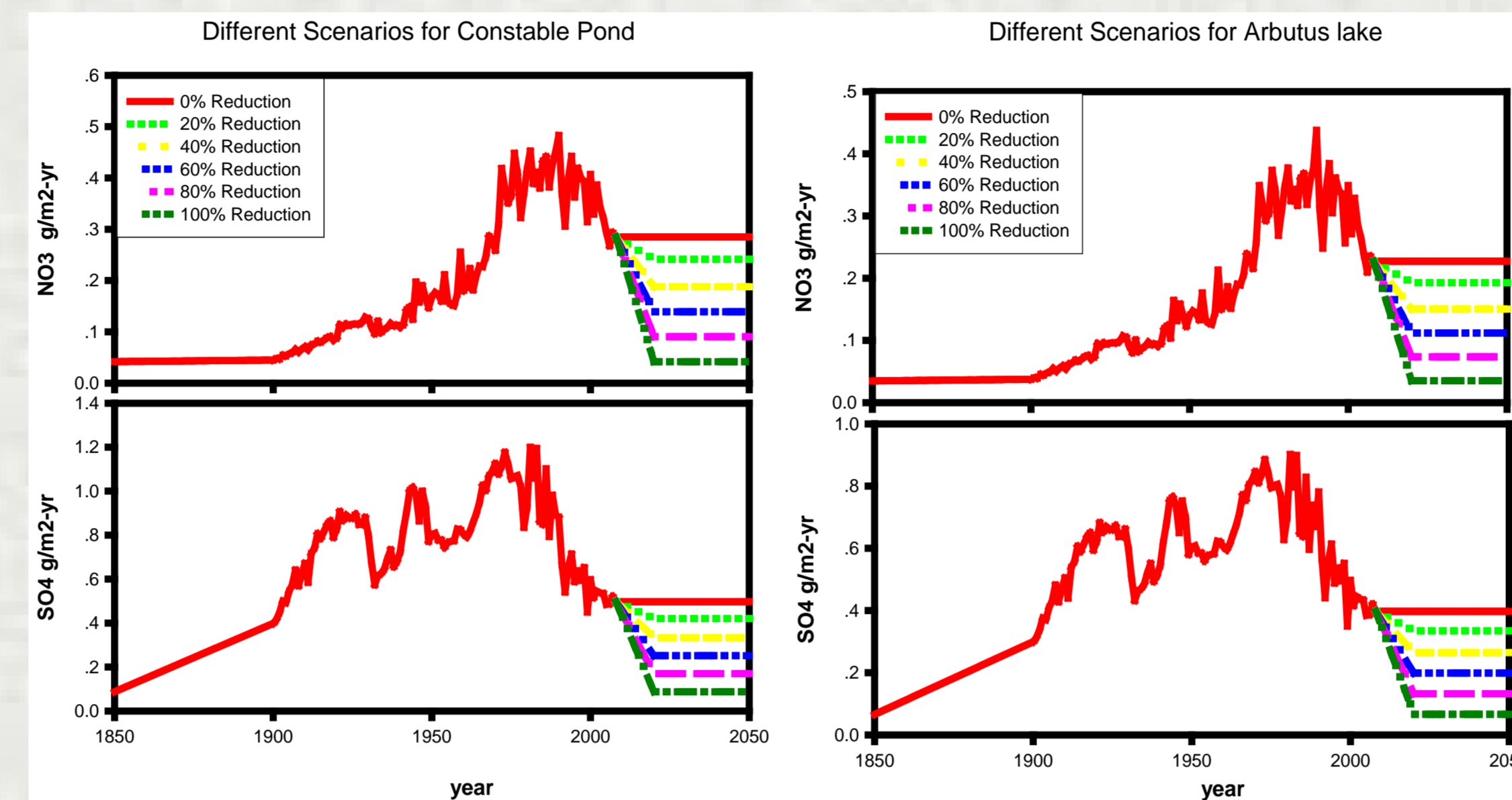
- To determine critical loads and target loads for N and S deposition in 20 watersheds of the Adirondacks.
- To evaluate the role of increasing DOC supply in response to decreases in acidification in critical load calculations.
- To evaluate biological indicators of acidification stress.

## APPROACH SITES AND METHODS



## HINDACAST AND FUTURE SCENARIOS

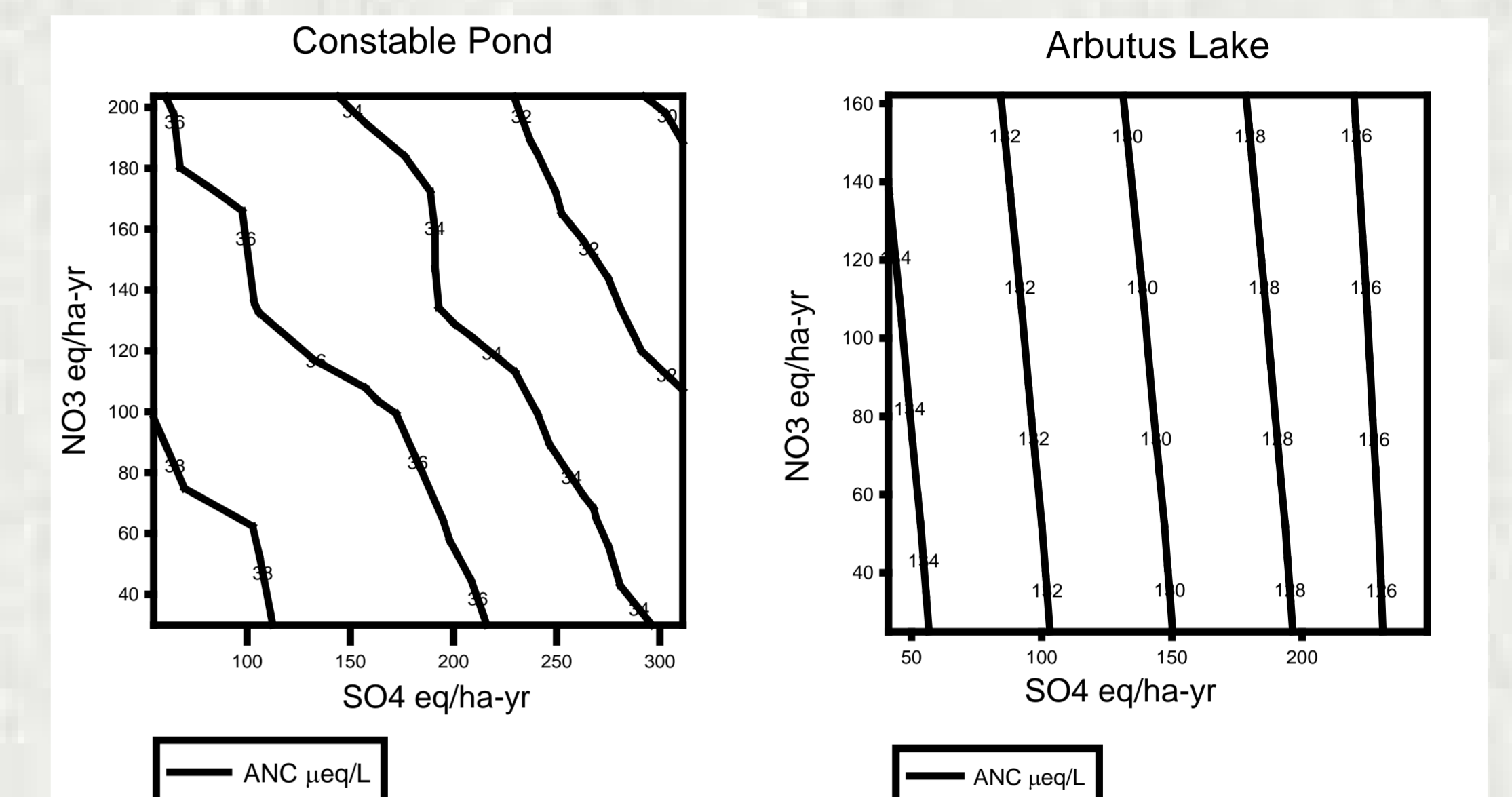
### NO3 and SO4 deposition



## PRELIMINARY RESULT:

showing level of NO3 and SO4 deposition which produce different values of ANC for constable pond and Arbutus lake

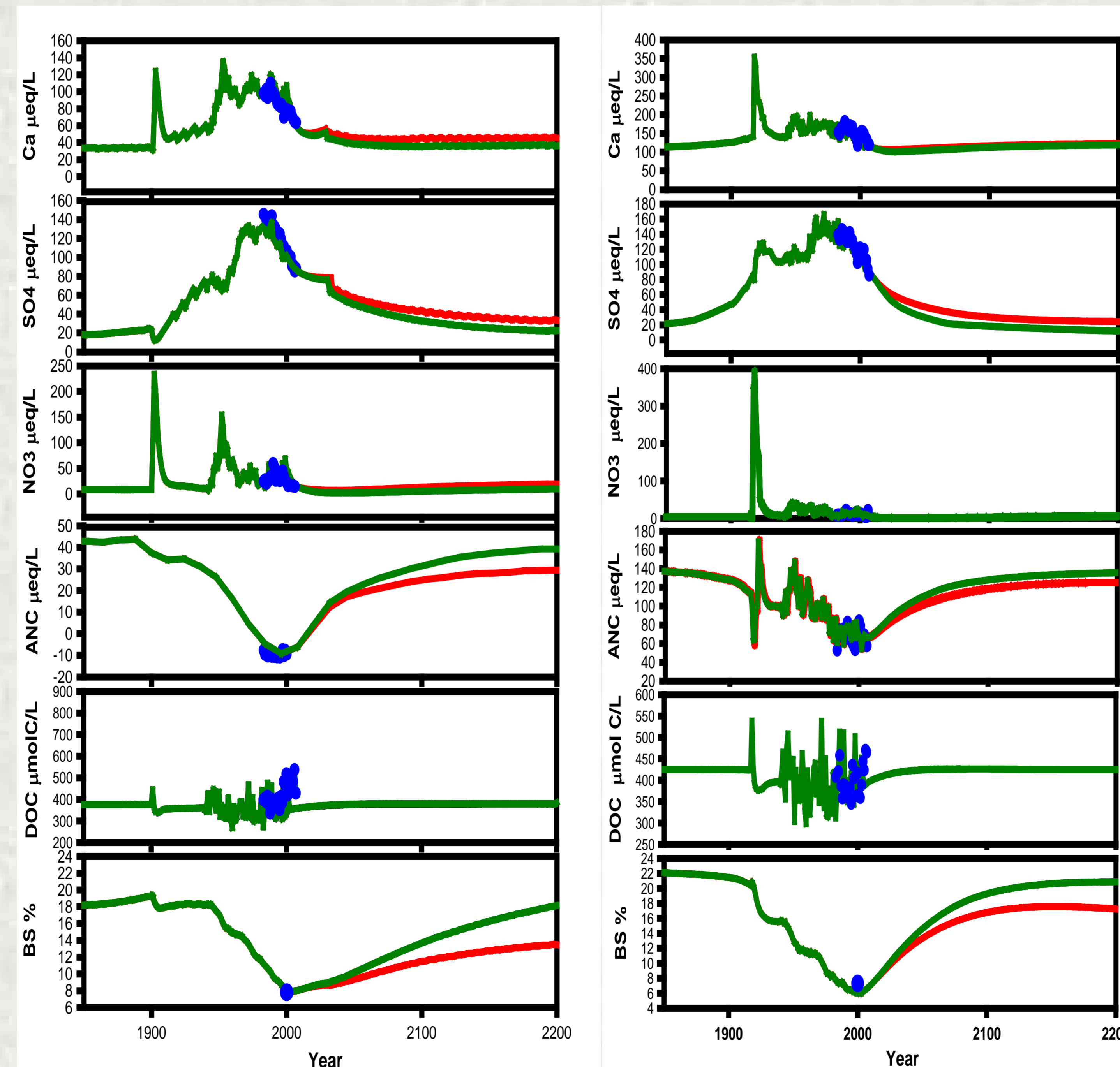
### Critical Load (steady-state 2190-2200)



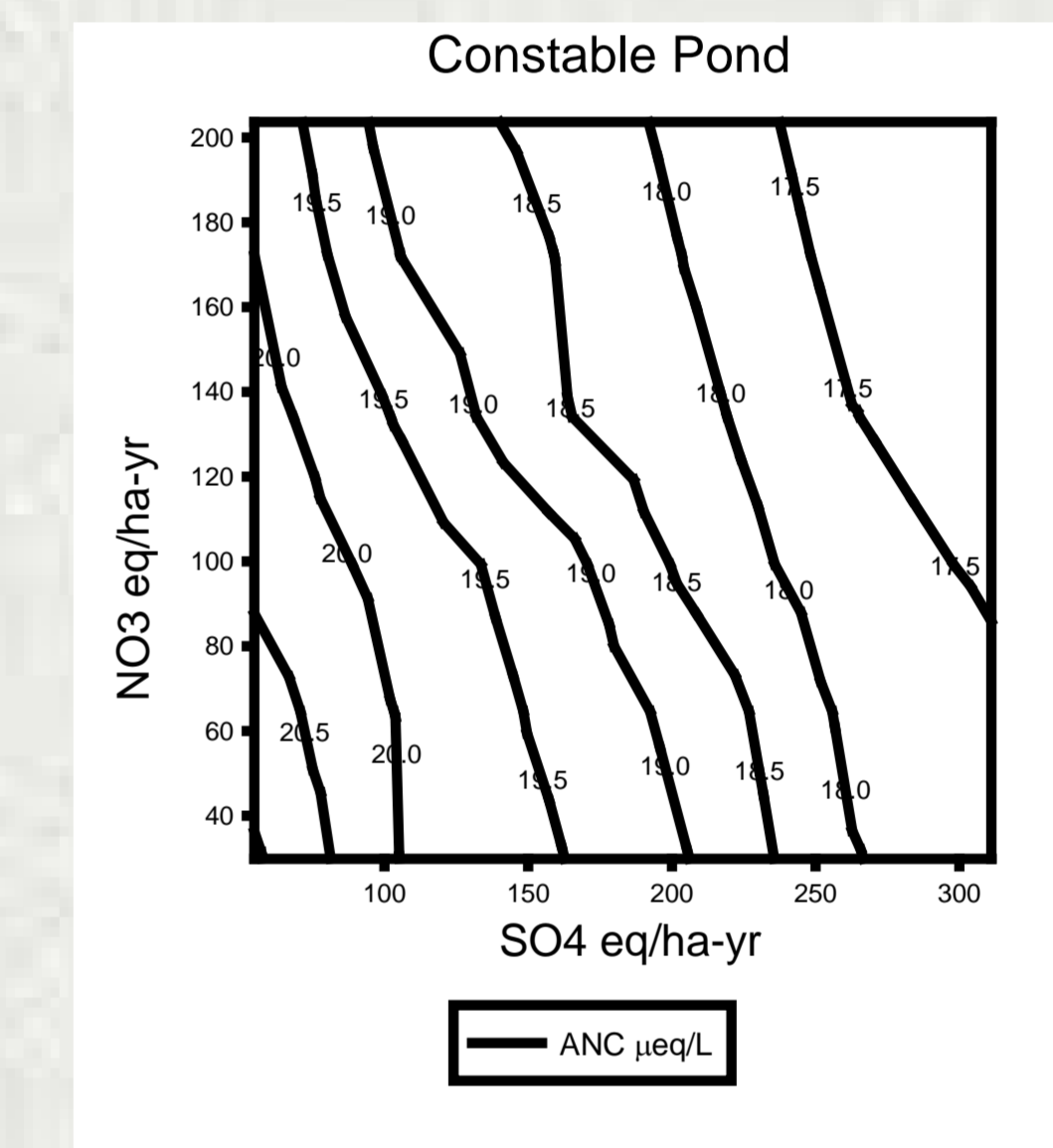
## MODEL RESULTS - TIME SERIES

### Constable Pond (thin till low ANC)

### Arbutus Lake (medium till moderate ANC)



### Target Load (2040-2050)



## CONCLUSION

- Critical load depends on the initial status of the watersheds and watersheds characteristics.
- ANC as the chemical indicator is driven by Ca, SO4 and NO3 and affected more by equivalent decreases in sulfate deposition compared to nitrate deposition.

## FUTURE WORK

- Determine critical loads/target loads at additional lake-watersheds in the Adirondacks.
- Develop and test a new algorithm for DOC response to acidification.
- Evaluate the use of biological indicators (fish and zooplankton species richness, foliar chemistry, soil chemistry).

## FUNDING SUPPORT

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- The watershed model PnET-BGC is applied to 20 sites in the Adirondack.

