# Overview of FOCUS:
# Towards a National Program on Critical Loads Program

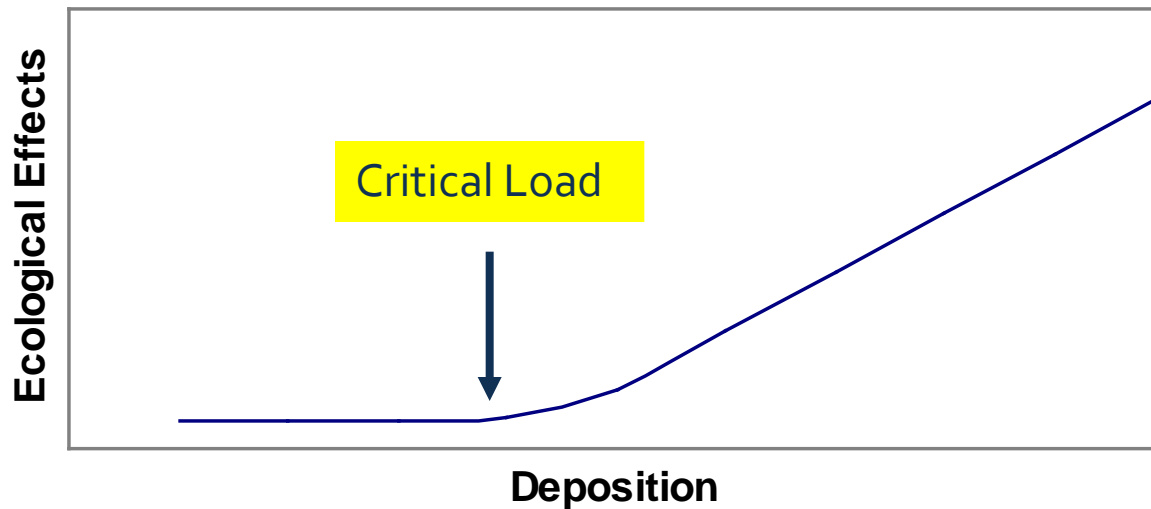Cindy Huber, FOCUS Project Manager
Linda Pardo, USFS Burlington VT

# Outline

+ Background on Critical Loads, CLAD and FOCUS

+ FOCUS Phase I

+ FOCUS Phase II

+ Workgroups

+ Next steps

# Critical Load

***Critical load*** of nitrogen is the level of deposition below which no harmful ecological effects occur for an ecosystem

# Exceedance of critical load

**Exceedance =**

**Actual N deposition – Critical load**

**Communicates extent of risk to ecosystems**

# Critical Loads Ad-Hoc Committee (CLAD)

+ NADP sub-committee

+ forum for exchange on CL information (since 2006)

+ Consistent approach to CL calculation and mapping

+ National-scale database

+ Workgroups

# What is FOCUS?

+ Project of CLAD

+ Multi-stakeholder effort

+ Synthesis of multiple CL research efforts

+ Consistent approach to CL calculation and mapping
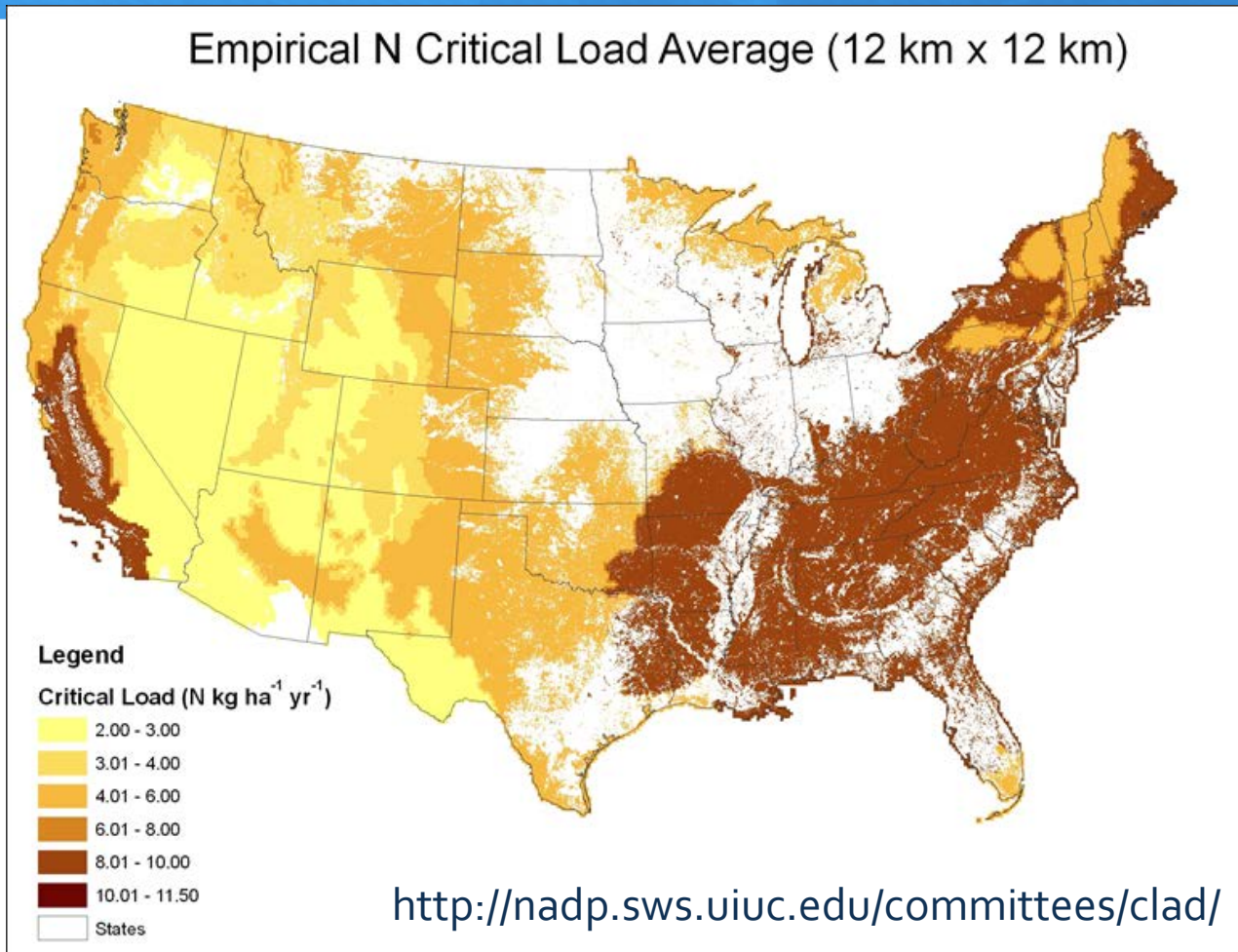
+ Products for policy and land management decision making

# What has FOCUS Accomplished?

Phase I:

Preliminary National Database of CLs

+ CLs of Acidity - Forested Ecosystems

+ CLs of Nutrient Nitrogen - Forested Ecosystems

+ CLs of Acidity - Surface Waters

+ Empirical Critical Loads of Nitrogen - Fungi, Lichens, Herbs and Shrubs, Forests

# FOCUS Phase I accomplishments



Empirical N Critical Load Average (12 km x 12 km)

Legend
Critical Load (N kg ha$^{-1}$ yr$^{-1}$)
- 2.00 - 3.00
- 3.01 - 4.00
- 4.01 - 6.00
- 6.01 - 8.00
- 8.01 - 10.00
- 10.01 - 11.50
- States

http://nadp.sws.uiuc.edu/committees/clad/

## FOCUS Phase II

- Needs Identified and Prioritized in Phase II Workplan

## GOALS

+ Refine national-scale CLs

+ Evaluate CL quality

+ Standardize methods and protocols

+ Reduce uncertainty in CL estimates

# FOCUS Phase II Activities

+ Bring together scientists and practitioners to improve modeling and empirical critical loads estimates.

+ Identify data gaps.

+ Strategize, prioritize and initiate ways to address these gaps.

+ Locate and incorporate new datasets

+ Make database publically available

# FOCUS Work Groups

# Base Cation Weathering (Work Group A)

Leader:  Jennifer Phelan

+ Evaluate approaches for estimating mineral weathering rate

+ Identify data gaps.

+ Strategize, prioritize and initiate ways to address these gaps.

+ Locate and incorporate new datasets

+ Make database publically available

# Base Cation Weathering (Work Group A)

Leader: Jennifer Phelan

Active Members:

Tim Sullivan, Salim Belyazid, Todd McDonnell, Julian Aherne, Shaun Watmough, Harald Sverdrup, Rich Scheffe, Max Posch, Alan VanArsdale, Wim deVries, Steve McNulty

- Group Findings:
  - Multiple suitable methods exist for US.
  - Soil profile and catchment methods considered best options.
  - Selection of best method determined by data availability.

- Recommendation:
  - Produce map(s) showing data availability for PROFILE and MAGIC models
  - Identify data gaps
  - Determine ways to extrapolate between data points

# SSMB for Nitrogen (Work Group B)

Leader:  Mark Fenn

Members: Gary Lovett, Julian Aherne, Jim Galloway, Peter Groffman,, Steve McNulty, Linda Pardo, Tim Sullivan, Harald Sverdrup, Shaun Watmough, Alan VanArsdale, Christine Goodale, Rich Pouyat, Derek Wiggam, Drew Bingham

+ Improve values currently used in CL calculations:

  + acceptable soil N immobilization (accumulation)

  + denitrification

  + acceptable N leaching rate

  + $[NO_3^-]_{acc}$

+ Literature review underway

# Relationship between soil solution chemistry and plant response (Work Group C)

Leaders:  Richard Warby, Linda Pardo, Paul Shaberg

Members: Scott Bailey, Chris Clark, Mark Fenn, Greg Lawrence, Erik Lilleskov, Jen Phelan, Sam Sinclair, Erica Smithwick, Quinn Thomas, Shaun Watmough

+ Objective: assemble current data from US + Canada to identify response thresholds

+ Literature Review in Progress

+ Next steps: data synthesis…

# Epiphytic Lichen CLs (Work Group D)

Leader: Linda Geiser

Active Members: Sara Jovan, Doug Glavich, Jenny Moore, Marilyn Erway

+ Refine lichen empirical CL N for each forested US Level I EcoRegion in using FIA data.

+ Existing reliable CL:
  + Marine West Coast Forests
  + NW Forested Mountains
  + Mediterranean CA

+ Revising
  + Northern Forests
  + Eastern Forests
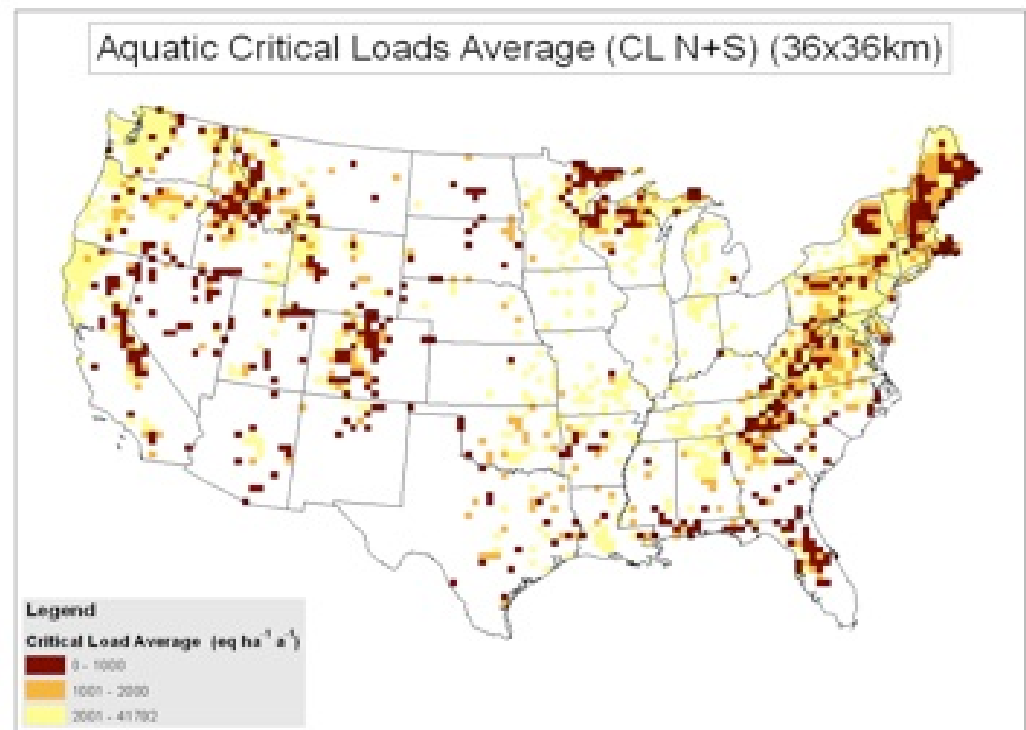
# Empirical N CLs (Work Group E)

Leaders: Linda Pardo

Members: Claire O'Dea, Molly Robin-Abbott

+ Refine spatial resolution of empirical CLs of nitrogen from Ecoregion scale to 4 km² gridscale

+ Incorporate climate change interactions (and pest disturbance)

# Surface Water CLs
## (Work Group F)

Leaders: Jason Lynch and Jack Cosby

+ Compare modeling approaches - focus on weathering component

+ Quantify uncertainty



Aquatic Critical Loads Average (CL N+S) (36x36km)

Legend
Critical Load Average (eq ha⁻¹ a⁻¹)
0 - 1000
1001 - 2000
2001 - 41792

# Maintain and Expand Database
# (Work Group G)

Leader:  Jason Lynch

**+** Technical documentation

**+** Mapping

**+** Incorporate new datasets

If you are interested in participating in FOCUS, or contributing information to the effort, please contact:

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# Improve Forest Ecosystem Critical Loads

- Simple Mass Balance (SMB) models.

  - $CL(S+N) = BC_{dep} - Cl_{dep} + \mathbf{BC_w} - BC_{upt} + \mathbf{N_{imacc}} + N_{upt} + \mathbf{N_{de}} - \mathbf{nANC_{crit}}$

  - $CL_{nut}(N) = \mathbf{N_{imacc}} + N_{upt} + \mathbf{N_{de}} + \mathbf{N_{le}}$