



# National Atmospheric Deposition Program

## Critical Loads of Atmospheric Deposition Science Committee

### CLAD 4-year Accomplishments (2015-2019)

Direct and indirect accomplishments where CLAD initiated, supported, or funded the work.

1. Sponsored a critical load session at Acid Rain 2015 (October 2015)
2. Attendance at CLAD meetings during the Spring and Fall NADP meetings is between 18 and 41 participants
3. Published NCLD Critical Load Map Summary (October 2015)
4. Used NSF Research Coordination Network award to support a workshop on Air Quality and Ecosystem Services General Technical Report and Ecosphere special issue (2015)
5. Produced Air Quality and Ecosystem Services General Technical Report and Ecosphere special issue (in progress)
6. CLAD-approved critical load definitions (in progress)

### CLAD 4-year Accomplishments (2011-2015)

Direct and indirect accomplishments where CLAD initiated, supported, or funded the work.

1. Sponsored a critical load session at the Fall NADP Scientific Symposia for the past 4 years - 2011 to present
2. Attendance at CLAD meetings during the Spring and Fall NADP meetings is between 18 and 41 participants
3. Represented CLAD at the UNECE ICP Modelling and Mapping Task Force Meetings: L. Pardo and J. Phelan (2011), J. Lynch (2012), C. Clark (2014)
4. Supported and funded (NPS and EPA) Rocky Mountain ForSAFE-Veg Workshop 2011 (T. Sullivan, H. Sverdrup) and publication [Sverdrup et al. 2012](#), [McDonnell et al. 2014](#)
5. CLAD-FOCUS submission of compiled U.S. critical load data to the UNECE in 2011 (T. Moore, J. Lynch)
6. CLAD-FOCUS completed 1.0v National Critical Load database (NCLD) and FOCUS Phase I Report 2011 (T. Moore, J. Lynch)
7. Funded (EPA) the development of empirical nitrogen critical loads for ecoregions of the United States (L. Pardo) and publications Pardo, et al. 2011 a, b



## National Atmospheric Deposition Program

### Critical Loads of Atmospheric Deposition Science Committee

8. CLAD developed a NADP Critical Loads Brochure 2011 (T. Blett)
9. CLAD Webinar - NADP-CLAD National Critical Load Database (NCLD) of Empirical and Modeled Critical Loads of Nitrogen and Sulphur 2012 (J. Lynch)
10. CLAD connected critical loads to AQ management in several EPA products/processes (Acid Rain and CAIR Annual Reports for 2010 to present, US-Canada Reports 2013 and 2015) (R. Haeuber and J. Lynch)
11. Funded (EPA and USGS), contributed critical loads and support to the NAPAP 2011 (D. Burns, R. Haeuber)
12. Funded (EPA and USFS) the development of Steady-state sulfur critical loads and exceedances for protection of aquatic ecosystems in the U.S. southern Appalachian Mountains 2012-2014 (T. Sullivan and W. Jackson) and publication [McDonnell et al. 2014](#), [Povak et al. 2014](#) & other publications
13. CLAD-FOCUS Phase II Workplan Completed, establishing five “workgroups” to review specific critical load issues and research needs. These group include: a) Improve the Forest Ecosystem Critical Load Estimates, b) Improve the CLs of Nutrient Nitrogen for Epiphytic Lichens, c) Improve Empirical CLs of Nitrogen, d) Improve Surface Water CL Calculations and Uncertainty, and e) Maintain and Expand the CL Database 2012 (C. Huber)
14. CLAD-FOCUS completed a review of the methodologies and identification of potential approaches to improve the base cation weathering (BCw) and ANC leaching (ANCLeach) parameters of the Simple Mass Balance (SMB) model/equation used to calculate terrestrial/forest ecosystem CLs in the U.S. 2012 (J. Phelan)
15. CLAD-FOCUS completed improvements of the CL model for lichens by calibrating it for each EcoRegion in the US. Linda Geiser and the USFS are utilizing the Forest Inventory and Analysis (FIA) lichen species, as well as associated tree species, information from plots across the country to expand the lichen dataset for the CL model 2012 (L. Geiser)
16. CLAD provided scientific information and critical load data for review of the NAAQS Secondary Standard for NO<sub>x</sub> and SO<sub>x</sub> 2013 (J. Lynch and R. Scheffe) and publication - [Scheffe et al. 2014](#)
17. Funded (EPA) the development and test of a national methodology to estimate Soil Base Cation Weathering Rates with the PROFILE model to support terrestrial/forest ecosystem CLs 2013 (J. Phelan and R. Waite) and publication [Phelan et al. 2014](#)
18. CLAD-FOCUS added a workgroup to address biodiversity and critical loads. The group will respond, informally, to the UNECE-CCE “Call for Data” (C. Clark)



## National Atmospheric Deposition Program

### Critical Loads of Atmospheric Deposition Science Committee

19. CLAD-FOCUS publication of the National Critical Load database (NCLD) 2013 (T. Blett) and publication [Blett et al. 2014](#)
20. CLAD-FOCUS sponsored [John Wesley Powell Center for Analysis and Synthesis Project](#) - Forecasting Forest Response to N Deposition: integrating data from individual plant responses to soil chemistry with a continental-scale gradient analysis 2013-present (L. Pardo, T. Blett, C. Huber)
21. CLAD-FOCUS completed 2.0v National Critical Load database (NCLD) 2013 (J. Lynch and C. Huber)
22. Supported the John Wesley Powell Center Analysis and Synthesis Project - Nitrogen Meta-analysis of impacts of N deposition on understory species composition 2013- present (C. Clark)
23. CLAD Webinar - National Ecosystem Services Classification System (NESCS) 2014 – (P. Sinha and G. V. Houtven, RTI). Attended by 30 participants.
24. CLAD Webinar/Discussion - Critical Loads of Hg Deposition in the US: Overview and Some Considerations 2014 (D. Burns). Attended by 45 participants.
25. CLAD Webinar/Discussion - [Critical Load and Uncertainty](#) 2014 (L. Pardo). Attended by 15 participants.
26. CLAD Workshop - [Very Simple Dynamic Model \(VSD\)](#) by Dr. Reinds, Senior Scientist at Wageningen University & Research Centre 2014 (J. Phelan, T. Blett)
27. Contributed to the Development and release of the [Air Quality Portal](#) for Land Management Planning: The application and use of critical loads for management and policy decisions 2013-ongoing (C. O'Dea)
28. CLAD Webinar/Discussion - National meta-analysis of impacts from nitrogen deposition on terrestrial plant biodiversity: Overview and updates 2015 (C. Clark). Attended by 30 participants.
29. CLAD Workshop - Air Quality and Ecosystem Services Workshop 2015 (T. Blett, J. Phelan, Eric Davidson, Cindy Huber). Attended by 25 participants. February 2015.
30. CLAD Webinar - Critical Load Maps 2015 (J. Lynch). Attended by 35 participants.
31. CLAD completed 2.5v [National Critical Load database \(NCLD\)](#) 2015 (J. Lynch and C. Huber)



# National Atmospheric Deposition Program

Critical Loads of Atmospheric Deposition Science Committee



# National Atmospheric Deposition Program

## Critical Loads of Atmospheric Deposition Science Committee

### References Cited

- Blett, T.F., J.A. Lynch, L.H. Pardo, C. Huber, R. Haeuber, R. Pouyat. 2014. FOCUS: A pilot study for national-scale critical loads development in the United States. *Environmental Science and Policy*. 38: 225-236.
- Burns, D.A., Lynch, J.A., Cosby, B.J., Fenn, M.E., Baron, J.S., US EPA Clean Air Markets Div., 2011, National Acid Precipitation Assessment Program Report to Congress 2011: An Integrated Assessment, National Science and Technology Council, Washington, DC, 114 p.
- McDonnell T.C., S. Belyazid, T.J. Sullivan, H. Sverdrup, W.D. Bowman, E.M. Porter. 2014 Modeled subalpine plant community response to climate change and atmospheric nitrogen deposition in Rocky Mountain National Park, USA. *Environmental Pollution* 187.
- McDonnell, Todd C., Timothy J. Sullivan, Paul F. Hessburg, Keith M. Reynolds, Nicholas A. Povak, Bernard J. Cosby, William Jackson, and R. Brion Salter. 2014. Steady-state sulfur critical loads and exceedances for protection of aquatic ecosystems in the U.S. southern Appalachian Mountains. *Journal of Environmental Management*, Volume 146, 15 December 2014, Pages 407–419.
- Pardo, Linda H.; Fenn, Mark E.; Goodale, Christine L.; Geiser, Linda H.; Driscoll, Charles T.; Allen, Edith B.; Baron, Jill S.; Bobbink, Roland; Bowman, William D.; Clark, Christopher M.; Emmett, Bridget; Gilliam, Frank S.; Greaver, Tara L.; Hall, Sharon J.; Lilleskov, Erik A.; Liu, Lingli; Lynch, Jason A.; Nadelhoffer, Knute J.; Perakis, Steven S.; Robin-Abbott, Molly J.; Stoddard, John L.; Weathers, Kathleen C.; Dennis, Robin L. . 2011a. Effects of nitrogen deposition and empirical nitrogen critical loads for ecoregions of the United States. *Ecological Applications*. 21(8): 3049-3082.
- Pardo, L.H.; Robin-Abbott, M.J.; Driscoll, C.T., eds. 2011b. Assessment of Nitrogen deposition effects and empirical critical loads of Nitrogen for ecoregions of the United States. Gen. Tech. Rep. NRS-80. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 291 p.
- Phelan, Jennifer, Salim Belyazid, Daniel Kurz, Scott Guthrie, James Cajka, Harald Sverdrup, Randall Waite. 2014. Estimation of Soil Base Cation Weathering Rates with the PROFILE Model to Determine Critical Loads of Acidity for Forested Ecosystems in Pennsylvania, USA: Pilot Application of a Potential National Methodology. *Water Air Soil Pollut* (2014) 225: 2109
- Povak, N. A., P. F. Hessburg, T. C. McDonnell, K. M. Reynolds, T. J. Sullivan, R. B. Salter, and B. J. Cosby. 2014. Machine learning and linear regression models to predict catchment-level base cation weathering rates across the southern Appalachian Mountain region, USA, *Water Resour. Res.*, 50.
- Scheffe, R. D J. A. Lynch, A. Reff, J. T. Kelly, B. Hubbell, T. L. Greaver, J. T. Smith. 2014. The Aquatic Acidification Index: A New Regulatory Metric Linking Atmospheric and Biogeochemical Models to Assess Potential Aquatic Ecosystem Recovery. *Water Air Soil Pollution* 225: 1838.
- Sverdrup, H., T.C. McDonnell, T.J. Sullivan, B. Nihlgard, S. Belyazid, B. Rihm, E. Porter, W.D. Bowman, L. Geiser. 2012. Testing the feasibility of using the ForSAFE-VEG model to map the critical load of



## National Atmospheric Deposition Program

### Critical Loads of Atmospheric Deposition Science Committee

nitrogen to protect plant biodiversity in the Rocky Mountains Region, U.S.A. Water Air Soil  
Pollution 223: 371-387.