January 30, 2013

Published Sources of Dynamic Modeling with Target Loads for the US

Eastern US

Pardo, L. 2007. Assessment of Effects of Acidic Deposition on Forested Ecosystems in Great Smoky Mountains National Park using Critical Loads for Sulfur and Nitrogen. 141 p. http://www.nature.nps.gov/air/Pubs/pdf/GSMN_CL_Report_080830.pdf

- Calculate critical loads for sulfur (S) and nitrogen (N) deposition to forested ecosystems in Great Smoky Mountain National Park based on existing data using Steady State Mass Balance and Very Simple Dynamic models.

Sullivan, T.J., B.J. Cosby, and W.A. Jackson. 2011. Target loads of atmospheric deposition for the protection and recovery of acid-sensitive streams in the Southern Blue Ridge Province. Journal of Environmental Management 30: 1-8. http://www.treesearch.fs.fed.us/pubs/38762

- Study includes calibration and application of the watershed model, MAGIC, to estimate the target sulfur deposition load for protection of aquatic resources at several future points in time in 66 generally acid-sensitive watersheds in the Sothern Blue Ridge province of NC and two adjoining states.

Sullivan, T.J., B.J. Cosby, T.C. McDonnell, E.M. Porter, T. Blett, R. Haeuber, C.M. Huber, and J. Lynch. 2012. Critical loads of acidity to protect and restore acid-sensitive streams in Virginia and West Virginia. Water, Air and Soil Pollution 223 (9): 5759-5771. http://link.springer.com/article/10.1007%2Fs11270-012-1312-4

- Results from the dynamic model, MAGIC, were used to extrapolate weathering estimates across the landscape and support calculation of critical loads of acidity in three ecoregions.

Sullivan, T.J., B.J. Cosby, C.T. Driscoll, T.C. McDonnell, A.T. Herlihy, and D.A. Burns. 2012. Target loads of atmospheric sulfur and nitrogen deposition for protection of acid sensitive aquatic resources in the Adirondack Mountains, New York. Water Resource Research 48 (W01547): 1-16. http://www.springerlink.com/content/05840545m5354163/

- The dynamic model, MAGIC, was used to calculate target loads of S and N deposition for lakes in the Adirondack ecoregion of New York. Regional deposition was combines with TL to calculate exceedances. Results were extrapolated to the regional population of Adirondack lakes.

Western US

Baron, J.S. 2006. Hindcasting nitrogen deposition to determine an ecological critical load. Ecological Applications 16: 433-439. http://www.fort.usgs.gov/products/publications/pub_abstract.asp?PubID=21484

- Estimates a CL for changes in diatom assemblages in lakes based on hindcasting past deposition and may be useful in setting target loads for high elevation lakes.

Baron, J.S., D.S. Ojima, E.A. Holland, and W.J. Parton. 1994. Analysis of nitrogen saturation potential in Rocky Mountain tundra and forest: implications for aquatic systems. Biogeochemistry 27: 61-82. http://www.jstor.org/stable/1469302

- N saturation responses using the Century model.

Fenn, M.E., S. Jovan, F. Yuan, L. Geiser, T. Meixner, and B.S. Gimeno. 2008. Empirical and simulated critical loads for nitrogen deposition in California mixed conifer forests. Environmental Pollution 155: 492-511. http://www.treesearch.fs.fed.us/pubs/38900

- Using Daycent (the daily time step of the Century model) l NO_3 leaching and nitrogenous trace gas losses are modeled from California mixed conifer forests. Historic and future responses and dose response to varying N deposition were modeled. Empirical CLs for NO3 leaching are also compared.

Gimeno, B.S., F. Yuan, M.E. Fenn, and T. Meixner. 2009. Management options for mitigating nitrogen (N) losses from N saturated mixed conifer forests in California. pp 425-455, In: A. Bytnerowicz, M.J. Arbaugh, A.R. Riebau, and C. Andersen. (eds.) *Wildland Fires and Air Pollution*. Developments in Environmental Science, Volume 8. Elsevier. Amsterdam. http://www.treesearch.fs.fed.us/pubs/34275

- Daycent simulations used in this study. This study is even more applicable than the Fenn et al. 2008 to target loads because authors look at various percent reductions of N deposition (starting with deposition of 25 kg N/ha/yr) and varying intervals of prescribed fire to see how this leads to reductions in NO_3 leaching losses or N trace gas losses from soil.

Hartman, M.D., J.S. Baron, D.W. Clow, I.F. Creed, C.T. Driscoll, H.A. Ewing, B.D. Haines, J. Knoepp, K. Lajtha, D.S. Ojima, W.J. Parton, J. Renfro, R.B. Robinson, H. Van Miegroet, K.C. Weathers, and M.W. Williams. 2009. DayCent-Chem simulations of ecological and biogeochemical processes of eight mountain ecosystems in the United States: U.S. Geological Survey Scientific Investigations Report 2009–5150, 174 p. http://www.fort.usgs.gov/products/publications/pub_abstract.asp?PubID=22618

Hartman, M.D., J.S. Baron, and D.S. Ojima. 2007. Application of a coupled ecosystem-chemical equilibrium model, Daycent-Chem, to stream and soil chemistry in a Rocky Mountain watershed. Ecological Modeling 200: 493-510. http://pubs.er.usgs.gov/publication/70033030

- The first publication by Hartman et al. shows DayCent-Chem simulations and empirical data on stream water chemistry from recent years at 8 montane ecosystems across the U.S.; the second one focuses on a Rocky Mt watershed in Colorado. However, they do not look at the effects of increased or decreased N inputs, so the data don't directly help in determining target loads.

Sullivan, T.J., B.J. Cosby, K.A. Tonnessen, and D.W. Clow. 2005. Surface water acidification responses and critical loads of sulfur and nitrogen deposition in Loch Vale watershed, Colorado. Water Resources Research 41, W01021, doi:10.1029/2004WR003414. http://co.water.usgs.gov/lochvale/pdfs/Sullivan_2005_WRR.pdf

- The focus of this modelling paper is on surface water acidification, but the model does look at future streamwater NO_3 concentrations with increases in S and N deposition. Unfortunately, scenarios of decreases in N deposition are not shown.

Sverdrup, H., T.C. McDonnell, T.J. Sullivan, B. Nihlgård, S. Belyazid, B. Rihm, E. Porter, W.D. Bowman, and L. Geiser. 2012. Testing the feasibility of using the ForSAFE-VEG model to map the critical load of nitrogen to protect plant biodiversity in the Rocky Mountains region, USA. Water, Air, and Soil Pollution 223: 371-387. http://link.springer.com/article/10.1007%2Fs11270-011-0865-y?LI=true

- This paper looks at very long term (centuries) responses of plant biodiversity in the Rockies to N deposition. The model includes 4 scenarios: background deposition; current controls; no controls; and no controls, high deposition.