

APPOINTMENTS

Assistant Research Professor , SESES/ECOSS, Northern Arizona University	09/2011 – present
Associate Scientist , Woods Hole Research Center	01/2015 – present
Research Fellow , Graduate School of Geography, Clark University	08/2008 – 08/2011
Research Scientist , Minnesota Department of Natural Resources	04/2006 – 03/2009
Research Fellow , Biometeorology Group, University of British Columbia	06/2004 – 06/2006
Junior Scientist , Department of Forest Resources, University of Minnesota	06/2003 – 05/2004

EDUCATION

Ph.D. Natural Resources Science and Management, 2003, Univ. of Minnesota, St. Paul, MN 55108, USA.
M.S. Forest Conservation, 1997, University of Montana, Missoula, MT 59812, USA.
B.A. German & Political Science, 1992, Cleveland State University, Cleveland, OH 44115, USA.

PUBLICATIONS

1. Giffen RA, **Schwalm CR**, Perschel R et al (2017) Seeing Forests for More than Carbon in the Trees: Incentivizing Actions Beyond Carbon Storage to Mitigate Climate Change. *J. For.*, doi.org/10.5849/jof.2016-016.
2. Jung M, Reichstein M, **Schwalm CR** et al. (2017) Compensatory water effects link yearly global land CO₂ sink changes to temperature. *Nature*, doi:10.1038/nature20780.
3. Butterfield BJ, Camhi AL, Rubin RL, **Schwalm CR** (2016) Tradeoffs and compatibilities among ecosystem services: Biological, physical and economic drivers of multifunctionality. *Advances in Ecological Research*, 54, 207-243, doi:10.1016/bs.aecr.2015.09.002.
4. Cao Y, Jones C, Cuevas-Vicentín V, ... , **Schwalm CR** et al. (2016) DataONE: A Data Federation with Provenance Support. Provenance and Annotation of Data and Processes: 6th International Provenance and Annotation Workshop, IPAW 2016, McLean, VA, USA, June 7-8, 2016, Proceedings (pp. 230 - 234). Springer International Publishing, doi:10.1007/978-3-319-40593-3_28.
5. Fisher JB, Sikka M, Huntzinger DN, **Schwalm CR**, Liu J (2016) Technical note: 3-hourly temporal downscaling of monthly global terrestrial biosphere model net ecosystem exchange. *Biogeosciences*, 13, 4271-4277, doi:10.5194/bg-13-4271-2016.
6. Ito A, Inatomi M, Huntzinger DN, **Schwalm CR**, Michalak AM et al. (2016) Decadal trends in the seasonal-cycle amplitude of terrestrial CO₂ exchange resulting from the ensemble of terrestrial biosphere models. *Tellus B*, 68 (28968), doi:10.3402/tellusb.v68.28968.
7. Mekonnen ZA, Grant RF, **Schwalm CR** (2016) Contrasting changes in gross primary productivity of different regions of North America as affected by warming in recent decades. *Agricultural and Forest Meteorology*, 218, 50-64, doi:10.1016/j.agrformet.2015.11.016.
8. Shao J, Zhou X, Luo Y, ... , **Schwalm CR** et al. (2016) Uncertainty analysis of terrestrial net primary productivity and net biome productivity in China during 1901–2005. *J. Geophys. Res.*, 121(5), 1372-1393, doi:10.1002/2015JG003062.
9. Thomas RT, Prentice IC, Graven H, ... , **Schwalm CR** et al. (2016) Increased light-use efficiency in northern terrestrial ecosystems indicated by CO₂ and greening observations. *Geophys. Res. Lett.*, 43(21), doi:10.1002/2016GL070710.
10. Tian H, Lu C, Ciais P, ... , **Schwalm CR** et al. (2016) The terrestrial biosphere as a net source of greenhouse gases to the atmosphere. *Nature*, 531, 225-228, doi:10.1038/nature16946.
11. Tramontana G., Jung M, **Schwalm CR** et al. (2016) Predicting carbon dioxide and energy fluxes across global FLUXNET sites with regression algorithms. *Biogeosciences*, 13, 4291-4313, doi:10.5194/bg-13-4291-2016.
12. Zscheischler J, Mahecha MD, Avitabile V, ... , **Schwalm CR** et al. (2016) An empirical spatiotemporal description of the global surface-atmosphere carbon fluxes: opportunities and data limitations. *Biogeosciences Discuss.*, doi:10.5194/bg-2016-427.

13. **Schwalm CR**, Huntzinger DN, Cook RB et al. (2015) How well do terrestrial biosphere models simulate coarse-scale runoff in the contiguous United States? *Ecological Modelling*, 303, 87-96, doi:10.1016/j.ecolmodel.2015.02.00.
14. **Schwalm CR**, Huntzinger DN, Fisher J et al. (2015) Toward "optimal" integration of terrestrial biosphere models. *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL064002.
15. Anderegg WRL, **Schwalm CR**, Biondi F et al. (2015) Pervasive drought legacies in forest ecosystems and their implications for carbon cycle models. *Science*, 349(6247), 528-532.
16. Camps-Valls G, Jung M, Ichii K, ... , **Schwalm CR** et al. (2015) Ranking drivers of global carbon and energy fluxes over land. *IEEE Transactions on Geoscience and Remote Sensing*, doi:10.1109/IGARSS.2015.7326806.
17. Mao J, Fu W, Shi X, ... , **Schwalm CR** et al. (2015) Disentangling climatic and anthropogenic controls on global terrestrial evapotranspiration trends. *Environ. Res. Lett.*, 10(9), 094008.
18. Mekonnen ZA, Grant RF, **Schwalm CR** (2015) Sensitivity of modeled NEP to climate forcing and soil at site and regional scales: Implications for upscaling ecosystem models. *Ecological Modelling*, 320, 214-257, doi:10.1016/j.ecolmodel.2015.10.004.
19. McPhillips T, Song T, Kolisnik T, ... , **Schwalm CR** et al. (2015) YesWorkflow: A User-Oriented, Language-Independent Tool for Recovering Workflow Information from Scripts. *International Journal of Digital Curation*, 10(1), 298-313, doi:10.2218/ijdc.v10i1.370.
20. Tian H, Lu C, Yang J, Banger, K., Huntzinger DN, **Schwalm CR** et al. (2015) Global Patterns and controls of soil organic carbon dynamics as simulated by multiple terrestrial biosphere models: current status and future directions. *Global Biogeochem. Cycles*, 29, doi:10.1002/2014GB005021.
21. **Schwalm CR**, Huntzinger DN, Cook RB et al. (2014) A model–data intercomparison of simulated runoff in the contiguous United States: results from the North America Carbon Regional and Continental Interim-Synthesis. *Biogeosciences Discuss.*, 11(1), 1801-1826.
22. Fisher JB, Huntzinger DN, **Schwalm CR**, Sitch S (2014) Modeling the Terrestrial Biosphere. *Annual Review of Environment and Resources*, 39:91-123, doi:10.1146/annurev-environ-012913-093456.
23. Lei H, Huang M, Leung LR, ... , **Schwalm CR** et al. (2014) Sensitivity of global terrestrial gross primary production to hydrologic states simulated by the Community Land Model using two runoff parameterizations. *Journal of Advances in Modeling Earth Systems*, doi:10.1002/2013MS000252.
24. Poco J, Dasgupta A, Wei Y, Hargrove W, **Schwalm CR** et al. (2014) SimilarityExplorer: A Visual Inter-Comparison Tool for Multifaceted Climate Data. *Computer Graphics Forum*, 33(3), 341-350.
25. Poco J, Dasgupta A, Wei Y, Hargrove W, **Schwalm CR** et al. (2014) Visual Reconciliation of Alternative Similarity Spaces in Climate Modeling. *IEEE Transactions on Visualization and Computer Graphics*, 20(12), 1923-1932, doi:10.1109/TVCG.2014.2346755.
26. Wei Y, Liu S, Huntzinger, DN, ... , **Schwalm CR** et al. (2014) The North American Carbon Program Multi-scale Synthesis and Terrestrial Model Intercomparison Project – Part 2: Environmental driver data. *Geosci. Model Dev.*, 7, 2875-2893, doi:10.5194/gmd-7-2875-2014.
27. Zscheischler J, Michalak AM, **Schwalm CR** et al. (2014) Impact of Large-Scale Climate Extremes on Biospheric Carbon Fluxes: An Intercomparison Based on MsTMIP Data. *Global Biogeochem. Cycles*, 28, doi:10.1002/2014GB004826.
28. **Schwalm CR**, Huntzinger DN, Michalak AM et al. (2013) Sensitivity of inferred climate model skill to evaluation decisions: A case study using CMIP5 evapotranspiration. *Environ. Res. Lett.*, 8 024028, doi:10.1088/1748-9326/8/2/024028.
29. Huntzinger DN, **Schwalm CR**, Michalak AM et al. (2013) The North American Carbon Program Multi-scale synthesis and Terrestrial Model Intercomparison Project – Part 1: Overview and experimental design. *Geosci. Model Dev.*, 6, 2121-2133, doi:10.5194/gmd-6-2121-2013.
30. Liu Z, Bambha RP, Pinto J, ... , **Schwalm CR** et al. (2013) Toward verifying fossil fuel CO₂ emissions with the Community Multi-scale Air Quality (CMAQ) model: motivation, model description and initial simulation, *J. Air Waste Manag. Assoc.*, 64 (4), 419-435, doi:10.1080/10962247.2013.816642.
31. Stoy PC, Dietze M, Richardson AD, ... , **Schwalm CR** et al (2013) Evaluating the agreement between measurements and models of net ecosystem exchange at different times and time scales using wavelet

- coherence: an example using data from the North American Carbon Program Site-Level Interim Synthesis. *Biogeosciences*, 10, 6893-6909, doi:10.5194/bg-10-6893-2013.
32. **Schwalm CR**, Williams CA, Schaefer K, Baldocchi D, Black TA, Goldstein AH, Law BE, Oechel WC, Paw U KT, Scott RL (2012) Reduction in carbon uptake during turn of the century drought in western North America. *Nature Geosci.*, 5, 551-556, doi:10.1038/ngeo1529.
 33. Luo YQ, Randerson J, Abramowitz G, ... , **Schwalm CR** et al. (2012) A framework of benchmarking land models. *Biogeosciences*, 9, 3857-3874, doi:10.5194/bg-9-3857-2012.
 34. Schaefer KM, **Schwalm CR**, Williams CA. et al. (2012) A model-data comparison of gross primary productivity: Results from the North American Carbon Program site synthesis. *J. Geophys. Res.*, 117, G03010, doi:10.1029/2012JG001960.
 35. Williams CA, Reichstein M, Buchmann N, ... , **Schwalm CR** et al. (2012) Climate and vegetation controls on the surface water balance: Synthesis of evapotranspiration measured across a global network of flux towers. *Water Resour. Res.*, 48, W06523, doi:10.1029/2011WR011586.
 36. **Schwalm CR**, Williams CA, Schaefer KM (2011) Carbon consequences of global hydrologic change, 1948–2009. *J. Geophys. Res.*, 116, G03042, doi:10.1029/2011JG001674.
 37. **Schwalm CR**, Williams CA, Schaefer K et al. (2011) Does terrestrial drought explain global CO₂ flux anomalies induced by El Niño? *Biogeosciences.*, 8, 1-14, doi:10.5194/bg-8-1-2011.
 38. **Schwalm CR**, Williams CA, Schaefer K et al. (2010) A model-data intercomparison of CO₂ exchange across North America: Results from the North American Carbon Program site synthesis. *J. Geophys. Res.*, 115, G00H05, doi:10.1029/2009JG001229.
 39. **Schwalm CR**, Williams CA, Schaefer K et al. (2009) Assimilation exceeds respiration sensitivity to drought: A FLUXNET synthesis. *Global Change Biology*, 16, 657-670.
 40. **Schwalm CR** (2009) Forest harvest levels in Minnesota - Effects of selected forest management practices on sustained timber yields. Staff Paper Series No. 204, Department of Forest Resources, College of Food, Agricultural, and Natural Resource Sciences, University of Minnesota, 49pp.
 41. Hilker T, Coops NC, **Schwalm CR** et al. (2008) Effects of mutual shading of tree crowns on prediction of photosynthetic light use efficiency in a Coastal Douglas Fir Forest. *Tree Physiology*, 28, 825-834.
 42. **Schwalm CR**, Black TA, Morgenstern K, Humphreys ER (2007) A method for deriving net primary productivity and component respiratory fluxes from tower-based EC data: a case study using a 17-year data record from a Douglas-fir chronosequence. *Global Change Biology*, 13, 370-385.
 43. **Schwalm CR**, Black TA, Amiro BD et al. (2006) Photosynthetic light use efficiency of three biomes across an east-west continental-scale transect in Canada. *Agricultural and Forest Meteorology*, 140, 269-286.
 44. **Schwalm CR**, Ek AR (2004) A process-based model of forest ecosystems driven by meteorology. *Ecological Modelling*, 179, 317-348.
 45. **Schwalm CR**, Ek AR (2003) Developing the next generation of forest ecosystem models In: McRoberts RE, Reams GA, Van Deusen PC, Moser JW (eds), Proceedings of the Third Annual Forest Inventory and Analysis Symposium; Gen. Tech. Rep. NC-230. St. Paul, MN: USDA, Forest Service, North Central Research Station: 130-136.
 46. **Schwalm CR**, Milner KS (2002) Stand responses following partial cutting. *Western Journal of Applied Forestry*, 17, 31-36.
 47. **Schwalm CR**, Ek AR (2001) Climate change and site: relevant mechanisms and modeling techniques. *Forest Ecology and Management*, 150, 241-258.

DATA PRODUCTS

1. Fisher JB, Sikka M, Huntzinger DN, **Schwalm CR** et al. (2016) Modeled Net Ecosystem Exchange at 3-hourly Time Steps, 2004-2010. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1315>.
2. Huntzinger DN, **Schwalm CR**, Wei Y et al. (2016) NACP MsTMIP: Global 0.5-deg Terrestrial Biosphere Model Outputs (Version 1) in Standard Format. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. doi: 10.3334/ORNLDAAC/1225.

3. Huntzinger DN, **Schwalm CR**, Michalak AM et al. (2014) NACP MsTMIP Summary of Model Structure and Characteristics. Available on-line (<http://daac.ornl.gov>) from ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1228>.
4. Wei Y, Liu S, Huntzinger D, ... , **Schwalm CR** et al. (2014) NACP MsTMIP: Global and North American Driver Data for Multi-Model Intercomparison. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1220>.
5. Cook RB, Post WM, Thornton PE, ... , **Schwalm CR** et al. (2013) NACP Regional: Original Observation Data and Biosphere and Inverse Model Outputs. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1193>.

RECENT ABSTRACTS

1. **Schwalm CR**, Giffen A, Duffy P et al. (2016) Seeing the forest beyond the carbon. AGU Fall Meeting, San Francisco, CA, December 2016.
2. Stofferahn EJ, Fisher JB, Hayes DJ, Huntzinger DH, **Schwalm CR** (2016) How well does your model capture the terrestrial ecosystem dynamics of the Arctic-Boreal Region?. AGU Fall Meeting, San Francisco, CA, December 2016.
3. Duffy KW, Arcus VL, Schipper LA, **Schwalm CR** (2016) The Intrinsic Temperature Sensitivity of Ecosystem Respiration as Explained by Thermodynamics. AGU Fall Meeting, San Francisco, CA, December 2016.
4. Hayes DJ, Fisher JB, Stofferahn EJ, **Schwalm CR** et al. (2016) A model-data integration framework for NASA-ABOVE: the role of remote sensing in process-based model representation of Arctic ecosystem dynamics. 14th International Circumpolar Remote Sensing Symposium, Homer, Alaska, September 2016.
5. Schaefer K, Jafarov E., Piper M, **Schwalm CR**, Yarmey L (2016) A Permafrost Benchmark System to evaluate permafrost models. 11th International Conference on Permafrost, Potsdam, Germany, June 2016.
6. Thomas R, Prentice IC, Graven H, ... , **Schwalm CR** et al. (2016) CO₂ and greening observations indicate increasing light use efficiency in northern terrestrial ecosystems. EGU General Assembly, Vienna, Austria, April 2016.
7. Truettner C, Anderegg WRL, Biondi F... , **Schwalm CR** et al. (2016) Drought legacies over the past 60 years in tree-ring records from the Four Corners region, USA. AAG Annual Meeting, San Francisco, CA, December 2016.
8. **Schwalm CR**, Huntzinger DN, Michalak A et al. (2016) Multi-scale Synthesis & Terrestrial Model Intercomparison Project: From cohort to insight. 2016 International Land Model Benchmarking (ILAMB) Workshop, Washington D.C., May 2016.
9. Jung MJ, Ichii K, Tramontana G, Camps-Valls G, **Schwalm CR** et al. (2015) FLUXCOM - Overview and First Synthesis. AGU Fall Meeting, San Francisco, CA, December 2015.
10. **Schwalm CR**, Anderegg WRL, Biondi F et al. (2015) Global Patterns of Drought Recovery. AGU Fall Meeting, San Francisco, CA, December 2015.