

**Christopher M. Gough**  
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Department of Biology  
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Richmond, VA 23284-2012

## **ACADEMIC AND PROFESSIONAL BACKGROUND**

**Academic Interests:** forest ecology – from tissues to landscape, global change biology, urban ecology, plant-soil interactions, carbon and nitrogen cycling, biogeochemistry

### **Education**

Ph.D. Forestry, Virginia Tech, 2003

Dissertation: *Physiology and quantification of carbon dynamics in intensively managed loblolly pine stands.*

M.S. Forestry, Virginia Tech, 2000

Thesis: *Environmental influences on gas exchange in fertilized and non-fertilized stands of loblolly pine.*

B.S. Biology major, Music minor, James Madison University, 1997

Honors Thesis: *The nucleotide sequence of an Arabidopsis alpha-glucosidase.*

### **Professional Experience**

Researcher and Instructor (Adjunct); Virginia Commonwealth University; Biology Department  
Research Faculty/REU advisor; University of Michigan Biological Station; Summers 2003-present (ongoing)

Visiting Scholar; Ohio State University; 2008-present (ongoing)

Lecturer; Ohio State University; Center for Life Sciences Education; Winter Quarter 2008

Post-doctoral Researcher; Ohio State University; Department of Evolution, Ecology, and Organismal Biology; 2003 – 2008

Graduate Research Assistant; Virginia Tech; Forestry Department; 1998 – 2003

Field assistant; USDA Forest Service Southeastern Tree Experimental Station; 1998, 1999

Laboratory Technician; James Madison University; Biology Department; 1997 – 1998

## **GRANTS (Total awarded w/partnering institutions: \$2,333,745; VCU total: \$237,194)**

### **Awarded Research Grants**

Approved for funding: Forecasting Carbon Storage as Eastern Forests Age: Joining Experimental And Modeling Approaches at the UMBS Ameriflux Site. 2011-2013. \$978,120 (VCU, \$177,557). Department of Energy, Terrestrial Carbon Cycle Research.

COLLABORATIVE RESEARCH: Disturbance, succession and forest carbon dynamics: an ecosystem-scale experiment at the University of Michigan Biological Station (renewal). \$424,899. Department of Energy, National Institute for Climate Change Research. 2009-2011. Co-PI with Curtis P.S., Vogel C.S., Bohrer G.

COLLABORATIVE RESEARCH: Disturbance, succession and forest carbon dynamics: an ecosystem-scale experiment at the University of Michigan Biological Station. \$649,729. Department of Energy, National Institute for Climate Change Research. 2006-2009. Co-PI with Curtis P.S., Schmid H.P., Vogel C.S.

Mass and energy exchange in a northern mixed hardwood ecosystem. \$280,997. 2005-2006. Department of Energy, National Institute for Global Environmental Change. Co-PI with Curtis P.S., Schmid H.P., Su H.B., and Vogel C.S.

### **Awarded Service Grants**

VCU Council for Community Engagement March 13, 2009: Our Park, Our Environment. Co-PI with Anne Wright, Joy Ware, Robert Reilly, James Vonesh, Edward Crawford, Holly Houltz, and Andrew Garey. \$19,000 awarded.

### **PUBLICATIONS (26 = 25 peer-reviewed *research* + 1 peer-reviewed *education*)**

#### **Peer-Reviewed *Research* Publications**

26. Nave L.E., **Gough C.M.**, Maurer K., Bohrer G., Le Moine J., Munoz A.B., Nadelhoffer K.J., Sparks J.P., Strahm B.D., Vogel C.S., Curtis P.S. 2011. Disturbance and the resilience of coupled carbon and nitrogen cycling in a north temperate forest. *Journal of Geophysical Research – Biogeosciences*, in press.
25. Hardiman B.S., Bohrer G., **Gough C.M.**, Vogel C.S., Curtis P.S. 2011. The role of canopy structural complexity in wood net primary production of a maturing northern deciduous forest, *Ecology*, 92, 1818–1827.
24. Richardson, Andrew; Anderson, Ryan; Arain, M Altaf; Barr, Alan; Bohrer, Gil; Chen, Guangsheng; Chen, Jing; Ciais, Philippe; Davis, Ken; Desai, Ankur; Dietze, Michael; Dragoni, Danilo; El Maayar, M; Garrity, Stephen; **Gough, Chris**; Grant, Robert; Hollinger, David; Margolis, Hank; McCaughey, Harry; Migliavacca, Mirco; Monson, Russell; Munger, J. William; Poulter, Ben; Raczka, Brett; Ricciuto, Daniel; Sahoo, Alok; Schaefer, Kevin; Tian, Hanqin; Vargas, Rodrigo; Verbeeck, Hans; Xiao, Jingfeng; Xue, Y. 2011. Land surface models need better representation of vegetation phenology: Results from the North American Carbon, *Global Change Biology*, in press.
23. Dietze M.C., Vargas R., Richardson A.D., Stoy P., Barr A.G., Anderson R.S., Arain M.A., Baker I.T., Black T.A., Chen J.M., Flanagan L.B., **Gough C.M.**, Grant R.F., Hollinger D., Izaurrealde C., Kucharik C.J., Lafleur P., Liu S., Lokupitiya E., Luo Y., Munger W. J., Peng C., Poulter B., Price D.T., Ricciuto D.M., Riley W.J., Sahoo A.K., Schaefer K., Tian H., Verbeeck H., Verma S.B.. 2011. Characterizing the performance of ecosystem models across time scales: A spectral analysis of the North American Carbon Program site-level synthesis, *Journal of Geophysical Research – Biogeosciences*, in press.
22. Wang, T., P. Ciais, S. L. Piao, C. Ottlé, P. Brender, F. Maignan, M. A. Arain, A. Cescatti, D. Gianelle, **C.M. Gough**, L. Gu, P. Lafleur, T. Laurila, B. Marcolla, H. Margolis, L.

- Montagnani, E. Moors, N. Saigusa, T. Vesala, G. Wohlfahrt, C. Koven, M. Reichstein, M. Migliavacca, C. Ammann, M. Aubinet, A. Barr, C. Bernacchi, C. Bernhofer, T. Black, K. Davis, E. Dellwik, D. Dragoni, A. Don, T. Foken, A. Granier, J. Hadley, R. Hirata, D. Hollinger, T. Kato, A. Knohl, W. Kutsch, M. Marek, R. Matamala, G. Matteucci, T. Meyers, R. Monson, J. Munger, W. Oechel, K.T. Paw U, A. Suyker, Z. Tuba, R. Valentini, A. Varlagin, and S. Verma. 2011. Controls on winter ecosystem respiration in temperate and boreal ecosystems, *Biogeosciences*, 8, 2009-2025.
21. Yuan, W., Luo, Y., Liang, S., Yu, G., Niu, S., Stoy, P., Chen, J., Desai, A. R., Lindroth, A., **Gough, C. M.**, Ceulemans, R., Arain, A., Bernhofer, C., Cook, B., Cook, D. R., Dragoni, D., Gielen, B., Janssens, I., Longdoz, B., Liu, H., Lund, M., Matteucci, G., Moors, E., Scott, R. L., Seufert, G., and Varner, R. 2011. Thermal adaptation of net ecosystem exchange, *Biogeosciences*, 8, 1109-1136.
20. **Gough C.M.**, Hardiman B.<sup>1</sup>, Vogel C.S., Nave L., Curtis P.S. 2010. Wood net primary production resilience in an unmanaged forest transitioning from early to middle succession, *Forest Ecology and Management*, 260: 36-41.  
<sup>1</sup>*Ph.D. candidate*
19. Gough C.M., Flower C.E.<sup>1</sup>, Vogel C.S., Curtis P.S. 2010. Phenological and climate controls on seasonal non-structural carbohydrate dynamics of *Populus grandidentata* and *Quercus rubra*, *Forests*, 1: 65-81.  
<sup>1</sup>*M.S. recipient and advisee*
18. **Gough C.M.**, Flower C.<sup>1</sup>, Vogel C.S., Dragoni, D., Curtis P.S. 2009. Whole-ecosystem labile carbon production in a north temperate deciduous forest, *Agricultural and Forest Meteorology*, 149: 1531-1540.  
<sup>1</sup>*M.S. recipient and advisee*
17. **Gough C.M.**, Fritz E.A.<sup>1</sup> 2009. Management and social indicators of soil carbon storage in a residential ecosystem, Midlothian, VA. *Virginia Journal of Science*, 4: 181-194.  
<sup>1</sup>*Clover Hill High School student*
16. Nave L., Vogel C.S., **Gough C.M.**, Curtis P.S. The nitrogen budget of a northern hardwood forest: Sources and net primary productivity requirements, *Canadian J. Forest Research*, in press.
15. **Gough C.M.**, Vogel C.S., Schmid H.P., and Curtis P.S. 2008. Controls on annual forest carbon storage: Lessons from the past and predictions for the future, *BioScience*, 58: 609-622.
14. **Gough C.M.**, Vogel C.S., Schmid H.P., Su H.-B., and Curtis P.S. 2008. Multi-year convergence of biometric and meteorological estimates of forest carbon storage. *Agricultural and Forest Meteorology*. 148: 158-170. (Publication "recommended" by *Faculty of 1000*: <http://www.f1000biology.com/article/id/1103603/evaluation/sections>)

13. Desai A.R., Normeets A., Bolstad P.V., Chen J., Cook B.D., Davis K.J., Euskirchen E., **Gough C.**, Martin J., Ricciuto D.M., Schmid H.P., Tang J., Su H., and Wang W. 2008. Influence of vegetation type, stand age and climate on carbon dioxide fluxes across the Upper Midwest, USA: Implications for regional scaling of carbon flux. *Agricultural and Forest Meteorology*. 148: 288-308.
12. **Gough C.M.**, Vogel C.S., Harrold K.<sup>1</sup>, George K.<sup>1</sup>, and Curtis P.S. 2007. The legacy of harvest and fire on ecosystem carbon storage in a north temperate forest, *Global Change Biology* 13: 1935-1949.  
<sup>1</sup>*undergraduate co-author, NSF Research Experience for Undergraduates advisee*
11. **Gough C.M.**, Vogel C.S., Kazanski C.<sup>1</sup>, Nagel L.<sup>1</sup>, Flower, C.E., and Curtis P.S. 2007. Coarse woody debris and the carbon balance of a north temperate forest. *Forest Ecology and Management* 244: 60-67.  
<sup>1</sup>*undergraduate co-author, NSF Research Experience for Undergraduates advisee*
10. Nave LE, and **Gough CM.** 2006. Quantifying ecological change using stable isotopes: digging deep into the past to predict the future. *New Phytologist* 171: 3-6.
9. Sampson D.A., Waring R.H., Maier C.A., **Gough C.M.**, Lacey M.J., and Johnson K.H. 2006. Fertilization effects on forest carbon storage, exchange, and net primary production: a new hybrid process model for stand management. *Forest Ecology and Management* 221: 91-109.
8. Curtis P.S., Vogel C.S, **Gough C.M.**, Schmid H.P., Su H.B., and Bovard B.D. 2005. Respiratory Carbon Losses and the Carbon-Use Efficiency of a Northern Hardwood Forest, 1999 – 2003. *New Phytologist* 167: 437-456.
7. **Gough C.M.**, Seiler J.R., Wiseman P.E, and Maier C.M. 2005. Soil CO<sub>2</sub> efflux in loblolly pine (*Pinus taeda* L.) plantations on the Virginia Piedmont and South Carolina Coastal Plain over a rotation-length chronosequence. *Biogeochemistry* 73:127-147.
6. **Gough C.M.**, Seiler J.R., and Maier, C.A. 2004. Short-term effects of fertilization on loblolly pine (*Pinus taeda* L.) physiology. *Plant, Cell and Environment* 27: 876-886.
5. **Gough C.M.**, and Seiler J.R. 2004. An intensive examination of belowground carbon dynamics in loblolly pine (*Pinus taeda* L.) immediately following diammonium phosphate fertilization. *Tree Physiology* 24: 845-851.
4. **Gough C.M.**, and Seiler J.R. 2004. The influence of environmental, soil carbon, root, and stand characteristics on soil CO<sub>2</sub> efflux in loblolly pine (*Pinus taeda* L.) plantations located on the South Carolina coastal plain. *Forest Ecology and Management* 191: 353-363.
3. **Gough C.M.**, Seiler J.R., Johnsen K.H., and Sampson D.A. 2004. Seasonal photosynthesis in fertilized and non-fertilized loblolly pine. *Forest Science* 50: 1-9.

2. Monroe J.D., **Gough C.M.**, Chandler L.E., Loch, J.E. Ferrante J.E., and Wright P.W. 1999. Structure, properties and tissue localization of apoplastic alpha-glucosidase in crucifers. *Plant Physiology* 119: 385-397.

### **Peer-Reviewed Education Publications**

1. **Gough C.M.** 2010. Terrestrial primary production: Fuel for life. *Nature Education Knowledge* (by invitation from *Nature Publishing*) (see: <http://www.nature.com/scitable/knowledge/library/terrestrial-primary-production-fuel-for-life-17567411>)

### **Conference Proceedings and Other Publications**

**Gough C.**, Seiler J., and Wiseman E. 2004. Predicting soil CO<sub>2</sub> efflux in the loblolly pine ecosystem across the region. Proceedings of the 12<sup>th</sup> Biennial Southern Silviculture Conference.

Maier C.A., Johnsen K., Seiler J., **Gough C.**, and Selig M. 2004. Carbon Budgets of Managed Loblolly Pine Forests: Case Study for Greenhouse Gas Accounting Rules and Guidelines for Forestry. Section 1605(b) of the Energy Policy Act of 1992 (EPACT), 42 U.S.C. 13385(b).

Maier C.A., **Gough, C.**, Seiler, J., Sampson D.A., Johnsen, K., and Dougherty, P. 2003. Effects of forest management on soil CO<sub>2</sub> evolution in loblolly pine plantations. Project report meeting book of the NCASI Southern Regional Meeting. Asheville, NC.

**Gough C.**, Seiler J., Johnsen K. and Sampson D.A. 2002. GPP in loblolly pine: a monthly comparison of empirical and process models. Proceedings of the 11<sup>th</sup> Biennial Southern Silviculture Conference.

Monroe J.D., **Gough. C.**, Ferrante J, Chandler L., Loch C., and Stephen A. 1997. Characterization of the alpha-glucosidase gene family from *Arabidopsis thaliana*: gene structure and properties of enzymes. *Plant Physiology* 114(s):884. ASPP National Meeting, Vancouver BC.

Monroe J.D., Hall B.D., **Gough C.M.**, and Stephen A.L. 1997. Nucleotide sequence of an alpha-glucosidase gene (Accession No AFO14806) from *Arabidopsis thaliana*. *Plant Physiology* 115: 863.

### **Submitted or Nearly Accepted Peer-Reviewed Publications**

**Gough C.M.**, Elliott H.L.<sup>1</sup> Lawn soil carbon storage in abandoned residential properties: An examination of ecosystem structure and function following partial human-natural decoupling, in revision.

<sup>1</sup>*undergraduate co-author, VCU Undergraduate Research Colloquium Presenter*

Sprintsin M., Chen J.M., Desai A, **Gough C.M.**, and other PIs of fluxnet sites. Evaluation of leaf-to-canopy upscaling methodologies against carbon flux data in North America, in revision.

Wu Chaoyang; Jing Chen; Ankur R. Desai; David Y. Hollinger; M. Altaf Arain; Hank A. Margolis; **Christopher M. Gough**; Ralf Staebler. Towards remote sensing of canopy light use efficiency in temperate and boreal forests of North America. Submitted to Remote Sensing of Environment.

Eli K. Melaas, Andrew D. Richardson, Danilo Dragoni, **Christopher M. Gough**, Mathias Herbs, Leonardo Montagnani, Eddy Moors, and Mark A. Friedl. Using FLUXNET Data to Improve Models of Springtime Vegetation Activity Onset in Forest Ecosystems, Geophysical Research Letters, submitted.

## PRESENTATIONS

### Invited Oral Presentations

- Gough C.M.** Sustained carbon storage in old forests: Emerging mechanisms from the Forest Accelerated Succession Experiment (FASET), Virginia Department of Forest Resources and Environmental Conservation, Blacksburg, VA, March, 25, 2011.
- Gough C.M.** Forest carbon sequestration: Challenges and emerging opportunities. Society of American Foresters Rappahannock Chapter Meeting, Mechanicsville, VA, Nov. 17, 2010.
- Gough C.M.** Forest carbon cycling during a century of change: Lessons from the north woods. Joint Global Change Research Institute, Univ. of Maryland, College Park, MD, May 4, 2009.
- Gough C.M.** Controls on annual forest carbon storage: lessons from the past and predictions for the future. Department of Natural Resources, North Carolina State University, Raleigh, NC, November 24, 2008.
- Gough C.M.** The human footprint in a forested ecosystem: Carbon cycling during a century of change. Department of Biology, Homecoming Seminar, James Madison University, Harrisonburg, VA, October 31, 2008.
- Gough C.** Carbon Storage in the North Woods of the Midwest: A Century of Change. Department of Biology, Virginia Commonwealth University, Richmond, VA, January 28, 2008.
- Gough C.** Carbon Storage in the North Woods of the Midwest: A Century of Change. Department of Biological Sciences, University of Wisconsin-Parkside, Kenosha, WI, December 10, 2007.
- Gough C.** Forest carbon storage and prospects for mitigating climate change. Department of Environmental Sciences Spring 2007 Seminar Series, The University of Toledo, Toledo, OH, April 13, 2007.
- Gough C.** Carbon cycling in the north woods of Michigan: A century of change. Department of Biology. Central Michigan University, Mt. Pleasant, MI, January 11, 2007.
- Gough C.** Forest carbon storage and prospects for mitigating climate change. Department of Evolution, Ecology, and Organismal Biology Winter Seminar Series, The Ohio State University, Columbus, OH, February 23, 2006.
- Gough C.,** Seiler J., Wiseman E., and Selig M. 2003. Soil CO<sub>2</sub> efflux over a pine chronosequence. MeadWestvaco Pine Additivity Meeting. Summerville, SC.
- Gough C.,** Seiler J., Johnsen K, Maier C, Sampson D.A., and Butnor J. 2001. Modeling soil CO<sub>2</sub> efflux in managed loblolly pine ecosystems. James Madison University Biology Department Seminar. Harrisonburg, VA.

**Gough C.**, Seiler J., Johnsen K., and Sampson D.A. 2001. GPP in loblolly pine: a monthly comparison of empirical and process models. N.C. State Forest Nutrition Cooperative Annual Meeting. Raleigh, NC.

### **Oral Presentations**

Peter S. Curtis, **Christopher M. Gough**, Lucas E. Nave, Brady Hardiman, Gil Bohrer, Abby Halperin, Christoph S. Vogel, Kyle Maurer, Knute Nadelhoffer, and James Le Moine. Disturbance dynamics and the maintenance of sustained carbon storage in aging forests of the upper Great Lakes region.

Lucas E Nave, Knute J Nadelhoffer, James M Le Moine, Brady S Hardiman, Jed P Sparks, Brian D Strahm, Alexandra B Munoz, **Christopher M Gough**, Christoph S Vogel, Peter S Curtis. Disturbance and decoupling of belowground carbon and nitrogen cycles in a northern temperate forest. Ecological Society of America, Austin, TX, August 10, 2011.

Seiler, J.R., J.P. Stovall, T.R. Fox, M.C. Tyree, N.A. King and **C.M. Gough**. 2009.

Physiological understanding of loblolly pine growth: fertilization, clonal and interactive responses. 7th North American Forest Ecology Workshop, Logan Utah, June 22-26.

Curtis P.S., **Gough C.M.**, Vogel C.S., Schmid H.P., Dragoni D. 2007. Ecosystem Processes and Interannual Variability in Fluxes At the University of Michigan Biological Station. Annual Ameriflux Meeting. Boulder, CO, October 17, 2007.

Curtis P.S., **Gough C.M.**, Vogel C.S., Schmid H.P., Dragoni D. 2007. Ecosystem Processes and Interannual Variability in Fluxes At the University of Michigan Biological Station. Annual Ameriflux Meeting. Boulder, CO, October 17, 2007.

**Gough, C.M.**, Vogel C.S., Schmid, H.P., Curtis, P.S. 2007. Forest Carbon Storage in the Upper Midwest: Connecting the Past with the Future. 19<sup>th</sup> Biennial North American Forest Biology Workshop, Bloomington, IN, May 23, 2007.

Maier, C., Sampson, D.A., Teskey, R., Johnsen, K., **Gough, C.** 2006. Ecosystem Respiration: Components and Processes. Critical Processes and Properties Regulating Carbon Cycling in Southern Forests, Crowne Plaza Hotel, Asheville, NC May 31 - June 2, 2006.

**Gough, C.M.**, Seiler, J.R., and Selig, M.F. 2004. Soil CO<sub>2</sub> efflux in loblolly pine plantations: impacts of forest management, stand age, climate and productivity. 18<sup>th</sup> Biennial North American Forest Biology Workshop. Houghton, MI.

Sampson, D.A., and **Gough, C.M.** 2004. Carbon exchange and sequestration of pine ecosystems: simulations from the process model SECRET\_3PG. 2004. 18<sup>th</sup> Biennial North American Forest Biology Workshop. Houghton, MI.

**Gough C.**, Seiler J., and Wiseman E. 2003. Predicting soil CO<sub>2</sub> efflux in the loblolly pine ecosystem across the region. The 12<sup>th</sup> Biennial Southern Silviculture Conference. Biloxi, MS.

**Gough C.**, Seiler J, Johnsen K, and Maier C. 2002. Influences on soil CO<sub>2</sub> efflux in intensively managed loblolly pine stands. 17<sup>th</sup> Biennial North American Forest Biology Workshop. Pullman, WA.

**Gough C.**, Seiler J., Johnsen K, Maier C, Sampson D.A., and Butnor J. 2001. A model for soil carbon efflux in managed loblolly pine ecosystems. Southern Forest Science Conference. Atlanta, GA.

**Gough C.**, Seiler J., Johnsen K., and Sampson D.A. 2001. GPP in loblolly pine: a monthly comparison of empirical and process models. The 11<sup>th</sup> Biennial Southern Silviculture Conference. Knoxville, TN.

- Gough C.**, Seiler J. and Johnsen K. 2000. Environmental influences on gas exchange in fertilized and non-fertilized loblolly pine. 16<sup>th</sup> Biennial North American Forest Biology Workshop. Merida, Yucatan, Mexico.
- Gough C.**, and Monroe J. 1998. Purification and properties of acidic alpha-glucosidase from crucifers. Washington Area Section of American Society of Plant Physiologists. Baltimore, MD.
- Monroe J.D., **Gough C.M.**, Chandler L.E., and Loch C.M. 1998. Localization and properties of an acidic alpha-glucosidase in vegetative tissue of broccoli and arabidopsis. ASPP National Meeting, Madison, WI.
- Gough C.**, Hall B., Stephen A. and Monroe J. 1997. Cloning and sequencing of two divergent alpha-glucosidase genes from *Arabidopsis*. Washington Area Section of American Society of Plant Physiologists. Washington, DC.

### **Poster Presentations**

- Gough C.M.**, Nave L.E., Hardiman B., Bohrer G., Halperin A.<sup>1</sup>, Vogel C.S., Maurer K., Nadelhoffer K, Le Moine J., and Curtis P.S. 2010. High rates of carbon storage in old deciduous forests: Emerging mechanisms from the Forest Accelerated Succession Experiment (FASET). American Geophysical Union Fall Meeting, San Francisco, CA, December 16, 2010.
- <sup>1</sup>**NSF Research Experience for Undergraduates advisee**
- Goedhart Nietz J., Bohrer G., Detto M., Maurer K., **Gough C.M.**, Vogel C., Curtis P.S. Linking GPP and soil respiration during partial forest canopy senescence. Ecological Society of America Annual Meeting, Pittsburgh, PA, August 4, 2010.
- Hardiman B.S., **Gough C.M.**, Bohrer G., Vogel C.S., and Curtis P.S. Biological and structural diversity increase NPP resilience during forest succession. Ecological Society of America Annual Meeting, Pittsburgh, PA, August 4, 2010.
- Hardiman, B.S., G. Bohrer, **C.M. Gough**, C.S. Vogel, and P.S. Curtis. 2009. Net primary productivity is positively correlated with canopy structural complexity in a northern hardwood forest. in Ecological Society of America, 94th Annual Meeting, Albuquerque, NM, August 9, 2009.
- Curtis P.S., **Gough C.M.**, Hardiman B., Vogel C.S., Bohrer G., Nave L.E. Mechanisms for sustained carbon storage in old forests: Early results from the Forest Accelerated Succession Experiment (FASET). American Geophysical Union Fall Meeting, San Francisco, CA, December 18, 2009.
- Gough C.M.**, Flower C.E.<sup>1</sup>, Vogel C.S., Dragoni D., Curtis P.S. Whole-Ecosystem Labile Carbon Production in a North Temperate Deciduous Forest. American Geophysical Union Fall Meeting, San Francisco, CA, December 17, 2008.
- <sup>1</sup>**M.S. student and advisee**
- Curtis P.S., **Gough C.M.**, Vogel C.S., Hardiman B., Bohrer G., Nave L.E. Projecting carbon cycling trajectories in forests of the upper Midwest, USA: Has carbon storage peaked? American Geophysical Union Fall Meeting, San Francisco, CA, December 17, 2008.
- Vogel, C.S., **Gough C.M.**, Curtis P.S. Do continuous data improve estimates of annual soil respiration?: The importance of measurements during rapid weather changes. Automated Soil Respiration Workshop, Durham, NH, September 11, 2007.
- Flower, C.E.<sup>1</sup>, **Gough, C.M.**, Vogel, C.S., Curtis, P.S. Seasonal Patterns of Carbohydrate Allocation in Mature Aspen and Oak: Reconciling Above-canopy Measurements of CO<sub>2</sub>

Exchange and Allometric Measurements of Tree Growth. 19<sup>th</sup> Biennial North American Forest Biology Workshop, Bloomington, IN, May 23, 2007.

<sup>1</sup>*M.S. student and advisee*

Wood C.<sup>1</sup>, Hardimann B., **Gough C.**, Curtis P. Factors influencing soil carbon dynamics in Ohio prairies. OSU College of Biological Sciences Undergraduate Research Colloquium, Columbus, OH, April 27, 2007.

<sup>1</sup>*Outstanding Poster Award, OSU Undergraduate Research Colloquium; undergraduate lead author and advisee*

Curtis P.S., **Gough C.**, Vogel C., Schmid H.P. Disturbance, succession and forest carbon dynamics: Re-examining Odum's theory of ecosystem development with the tools of Fluxnet. North American Carbon Program Investigators Meeting. Colorado Springs, CO, January 22, 2007.

**Gough C.M.**, Vogel C.S., Kazanski C.<sup>1</sup>, Nagel L.<sup>1</sup>, Flower, C.E., and Curtis P.S. Coarse Woody Debris and Ecosystem Carbon Dynamics in a North Temperate Forest. The American Geophysical Union, Fall Meeting 2006. San Francisco, CA, December 15, 2006.

<sup>1</sup>*undergraduate co-author, NSF Research Experience for Undergraduates advisee*

Curtis P.S., Vogel C.S., Schmid H.P., and **Gough C.M.** Disturbance, succession and forest carbon dynamics: an ecosystem-scale experiment at the University of Michigan Biological Station. The American Geophysical Union, Fall Meeting 2006. San Francisco, CA, December 15, 2006.

Nave, L.E. Vogel C.S., **Gough C.M.**, Curtis P.S. The Nitrogen Budget of a Northern Hardwood Forest: Sources and net Primary Productivity Requirements The American Geophysical Union, Fall Meeting 2006. San Francisco, CA, December 12, 2006.

**Gough C.M.**, Vogel C.S., Schmid H.P., and Curtis P.S. Disturbance, succession and forest carbon dynamics: an ecosystem-scale experiment at the University of Michigan Biological Station. New Research at UMBS~Flux. Annual Ameriflux Meeting. Boulder, CO, October 16, 2006.

Herman J.<sup>1</sup>, **Gough C.**, Curtis P. Roots in the Prairie: Unraveling the belowground performance of non-native plant species in an experimental prairie restoration. OSU College of Biological Sciences Undergraduate Research Colloquium, Columbus, OH, May 1, 2006.

<sup>1</sup>*Outstanding Poster Award, OSU Undergraduate Research Colloquium; undergraduate lead author and advisee*

**Gough C.M.**, Vogel C.S., Harrold K.<sup>1</sup>, George K.<sup>1</sup>, and Curtis P.S. The legacy of forest harvest and burning on ecosystem carbon storage in the northern Midwest, USA. American Geophysical Union, Fall Meeting 2005. San Francisco, CA.

<sup>1</sup>*undergraduate co-author, NSF Research Experience for Undergraduates advisee*

Curtis P.S., **Gough C.M.**, and Vogel C.S. Forest carbon storage in the northern midwest, USA: a bottom-up scaling approach combining local meteorological and biometric data with regional forest inventories. American Geophysical Union, Fall Meeting 2005. San Francisco, CA.

**Gough C.M.**, Vogel C.S., Curtis P.S., Schmid H.P. and Su H.-B. 2005. Carbon storage in the upper Midwest, USA. Seventh International Carbon Dioxide Conference. Boulder, CO.

Sampson D.A., **Gough C.M.**, Seiler J.R. 2005. Rotation-length carbon storage in managed loblolly pine (*Pinus taeda* L.) forests of the southeastern United States. Seventh International Carbon Dioxide Conference. Boulder, CO.

**Gough C.M.**, Vogel C.S., Curtis P.S., Schmid H.P. and Su H.-B. 2005. Carbon sequestration in northern Great Lakes forests. Fourth Annual Conference On Carbon Capture &

Sequestration: Developing Potential Paths Forward Based on the Knowledge, Science and Experience to Date. Alexandria, VA.

**Gough C.M.**, Vogel C.S., Curtis P.S., Schmid H.P. and Su H.-B. 2004. Reconciling differences between eddy-covariance and biometric based estimates of annual C storage. American Geophysical Union Fall Meeting. San Francisco, CA.

Desai A.R., Normeets A., Bolstad P.V., Chen J., Cook B.D., Curtis P.S., Davis K.J., Euskirchen E., **Gough C.**, Martin J., Ricciuto D.M., Schmid H.P., Tang J., Su H., Vogel C. 2004. Impact of vegetation cover and stand age on scaling carbon fluxes in the upper Midwest: a multiple eddy flux site study. American Geophysical Union Fall Meeting. San Francisco, CA.

**Gough C.M.**, Curtis P.S., Vogel C.S., Schmid H.P. and Su H.-B. 2004. Annual carbon storage from 1999 through 2002 in a northern hardwood forest assessed using eddy-covariance and biometric methods. Annual Ameriflux Meeting. Boulder, CO.

**Gough C.M.**, Curtis P.S., Vogel C.S., Schmid H.P. and Su H.-B. 2004. Annual carbon storage over 4 years in a northern hardwood forest assessed using eddy-covariance and biometric methods. 18<sup>th</sup> Biennial North American Forest Biology Workshop. Houghton, MI.

**Gough C. M.**, Seiler J. R., Wiseman P.E. and Maier C.A. 2003. Impacts of Forest Management, Climate, and Productivity on Soil CO<sub>2</sub> Efflux from Loblolly Pine (*Pinus taeda* L.) stands located on the Virginia Piedmont and the South Carolina coastal plain. American Geophysical Union Fall Meeting. San Francisco, CA.

Seiler J., **Gough C.**, Selig M., and Maier C. 2003. Estimating soil CO<sub>2</sub> efflux in managed loblolly pine ecosystems: what we know and how we can apply it to carbon sequestration. Second Annual Conference on Carbon Sequestration: Developing and Validating the Technology Base to Reduce Carbon Intensity. Alexandria, VA.

**Gough C.**, Selig M., and Seiler J. 2002. Opportunities for reducing carbon turnover in managed loblolly pine stands: effects of fertilization and thinning. USDA Symposium on Natural Resource Management to Offset Greenhouse Gas Emissions. Raleigh, NC.

## TEACHING AND MENTORING

**Instructor of Record (course ratings: 4.50-4.89/5.00; instructor ratings: 4.75-5.00/5.00 )**

Name	Inst.	Cr.	Term	Enrolled	Course Rating (5 = high)	Instructor Rating (5 = high)	Comments
Forest Ecology, BIOL 491	V	4	Summer 2011	16	5.00	4.87	Developed & instructed
Global Change Biology, BIOL 491	V	3	Fall 2010, 2011	58, 31	4.81, 4.59	4.82	Developed & instructed
Biology Capstone: Science and Society, BIOL 475	V	1	Spring 2010, 2011	16, 16	4.50, 4.83	5.00, 5.00	Developed & instructed
Biology Capstone: Urban Ecology, BIOL 475	V	1	Spring 2011	17	4.75	4.75	Developed & instructed
Mid-Atlantic Glob.	V	1	Spring	14	4.89	5.00	Developed

Change Biology, ENVS 591			2010				& instructed
Human biology: A Case Study Approach, BIO 102	O	3	Winter 2008	400	4.6 (4.2 = university mean)		Instructed

V – Virginia Commonwealth University; O – Ohio State University

### **Guest Lectures/Teaching Assistant**

Guest Lecturer; Environmental Microbiology; Virginia Commonwealth University; Fall 2008, 2009, 2010; Title: Plant-microbial interactions in biogeochemical cycling.

Guest Lecture: Dr. Bud Watson's Forest Policy course; Fall 2009

Guest Lecture: Dr. McCallister's Biogeochemistry course; Fall 2009

Plant Physiological Ecology lecture series; University of Michigan Biological Station IGERT program; June 2009.

Honors College Berglund Seminar Series; April 17, 2009; Confronting climate change: Can forests offset our carbon dioxide emissions?

Guest Lecturer (2 lectures); LFSC 101; Virginia Commonwealth University; March 16, 18, 2009; Topic: The physical basis for climate change

Guest Lecturer; Ecosystem Ecology; Virginia Commonwealth University; November 19, 2008; Title: Controls on annual forest carbon storage: Lessons from the past and predictions for the future.

Co-developer and instructor of short course titled "Ecophysiological methods for global change research"; University of Michigan Biological Station; 2007.

Guest Lecturer; General Biology for Non-majors; Ohio State University; 2007, 2008; Topic: "The scientific basis for global climate change"

Guest Lecturer; General Biology; Ohio State University; 2006;

Topic: "Rising atmosphere carbon dioxide and global climate change: Are they related?"

Guest Lecturer; Plant Physiological Ecology; Ohio State University; 2003, 2005, 2008; Topic: Plant water relations.

Teaching Assistant; General Biology Laboratory; Virginia Tech; 2002; overall rating 3.9/4.0; Responsibilities: Teach laboratory, write and administer exams and quizzes, develop student projects, facilitate learning through multi-media presentations on the course website and in the classroom.

Teaching Assistant; Dendrology; Virginia Tech; 1998, 2001, 2003; overall rating 3.6/4.0 Responsibilities: Facilitate learning of >100 plant species through field education.

Teaching Assistant; Silviculture; Virginia Tech; 2002

Responsibilities: Teach field and laboratory component of course.

Guest Lecturer; Forest Ecology; Virginia Tech; 2002

Topic: "Carbon accounting 101: the balance between ecosystem photosynthesis and respiration".

Guest Lecturer; Forest Biology; Virginia Tech; 2002

Topic: Photosynthesis and respiration

Teaching Assistant; Forest Ecology; Virginia Tech; 1999, 2000

Responsibilities: Cultivate student-writing skills, teach field and laboratory component of course.

**Mentoring Experience (Note superscript student achievements)**

Katy Hofmeister, Hampshire College, undergraduate;

David Meehan, Virginia Commonwealth University; Graduate committee chair; 2009-present

Thesis title: Forecasting carbon storage in future forests: belowground carbon dynamics during a successional transition

Abby Halperin, Oberlin University, undergraduate, University of Michigan Biological Station REU advisee<sup>6</sup>

Paper title: Forest canopy heterogeneity and nitrogen availability maintain uptake of atmospheric carbon in a mature forest of the northern Great Lakes

Lisa Collins, Virginia Commonwealth University (CES); Graduate research advisee; 2009-2010<sup>1</sup>

Research topic: Forest carbon sequestration and nitrogen retention in response to chronic nutrient amendments: A new Rice Center experiment

Joseph Wood; Virginia Commonwealth University; Graduate committee member; 2009-2010

Hunter Elliot; Virginia Commonwealth University; Undergraduate research mentor; 2009-2010<sup>2,3</sup>

Research topic: Reclaiming ecosystem services following human abandonment: Soil carbon recovery following urban ecosystem reversion

Eliza Fritz; High school student science research mentor; school year 2008-2009<sup>3,7</sup>

Research topic: Suburban lawn management and soil carbon storage

Chris Wood; Ohio State University; undergraduate student; 2006-2007<sup>4,5</sup>

Research topic: Prairie species and soil fertility effects on soil carbon and nitrogen cycling.

Charles Flower; Ohio State University; M.S. recipient; 2005-2007

Thesis title: Seasonal carbohydrate allocation in big tooth aspen (*Populus grandidentata* Michx.) and northern red oak (*Quercus rubra* L.) from northern lower michigan.

Suparna Biswas; Ohio State University; M.S. recipient; 2003-2005

Thesis title: "Coarse woody debris pools and fluxes in a northern deciduous forest, Michigan, USA".

Brad Ewing; Ohio State University; undergraduate student; 2003-2006

Research topic: Fine root dynamics in a northern hardwood forest.

Jennifer Herman; Ohio State University; undergraduate student; 2005-2006<sup>4,5</sup>

Poster title: "Roots in the Prairie: Unraveling the belowground performance of native and non-native plant species in an experimental prairie restoration".

Sarah Yeskel; Univ. of Michigan Biological Station research associate; 2005

Research topic: Fine root dynamics over successional time in a northern hardwood forest.

Claire Baldeck; Ohio State University; Research Experience for Undergraduates; 2005

REU project: "Effects of temperature and moisture on the efflux of CO<sub>2</sub> from litter".

Katie Harrold; Middlebury College; Research Experience for Undergraduates; 2005<sup>3,6</sup>

REU project: "Soil carbon and coarse woody debris pools across a burned and clearcut forest chronosequence".

Kristen George; St. Cloud State University; Research Experience for Undergraduate; 2004<sup>3,6</sup>

REU project: "Microbial CO<sub>2</sub> Flux from Organic and Mineral Soil: Impacts of Tree Species Composition and Stand Age".

Clare Kazanski; Carleton College; Research Experience for Undergraduates; 2006<sup>3</sup>

REU project: "The contribution of coarse woody debris to ecosystem respiration: laboratory measurements".

Laura Nagel; Allegheny College; Research Experience for Undergraduates; 2006<sup>3</sup>

REU project: “The contribution of coarse woody debris to ecosystem respiration: field measurements”.

<sup>1</sup>Rice Center research award recipient; <sup>2</sup>VCU undergraduate colloquium presenter <sup>3</sup>co-author of peer-reviewed manuscript; <sup>4</sup>Outstanding Poster Award, OSU Undergraduate Research Colloquium; <sup>5</sup>lead author of presentation; <sup>6</sup>co-author of presentation; <sup>7</sup>First place in Environmental Sciences and Outstanding Research Award at Virginia Junior Science and Humanities Symposium (2009), Best in show in Chesterfield Co. Science Fair

## HONORS AND AWARDS

Gamma Sigma Delta Graduate Dissertation Award of Merit for 2004, awarded to one Virginia Tech Ph.D. graduate annually

Outstanding Graduate Student Award 2002-2003, awarded to one graduate student annually from each college by the Virginia Tech Graduate School

A.B. Massey Award 2002-2003, awarded to one graduate student annually from the Forestry Department

William J. Dann Graduate Fellowship, 2000-2003, awarded to an outstanding graduate student from the Forestry Department

Virginia Tech Graduate Student Association travel grant, 2000

Outstanding Undergraduate Presentation Award, American Society of Plant Physiologists Washington D.C. Section Meeting, 1998

Magna Cum Laude, James Madison University, 1997

Distinction in Biology, James Madison University, 1997

## ELECTED POSTS AND SERVICE

Host of PBS’s (WOSU) Bio Bits video for high school science education

Reviewer for: “Forest Carbon Working Group Accounting for Forest Carbon in Life Cycle Analysis” for the Environmental Paper Network (<http://www.environmentalpaper.org/>).

Quoted by and provided consultation to the Richmond Times Dispatch for story titled “Area Pounded by Pollen” by Chris L. Young, April 8, 2010. VCU Biology Department cited in story.

Spearheaded Biology’s contribution to the VCU Year of the Environment: “Invasive Species Day”

DOE National Institute for Climate Change Research pre-proposal reviewer, 2009

Virginia Commonwealth University Faculty learning community for Bio 101 reorganization; 2008-2009

Professional consulting on forest carbon crediting provided to Baker Botts Law Firm L.L.P.

Proposal reviewer, USDA Graduate Women in Science Fellowships, 2008-2009

Developer of VCU Biology Research Capstone Course, in University review, 2008

Proposal reviewer, National Science Foundation, Ecosystem Studies Program, 2005, 2006 (2), 2007 (2), 2010

*Tree Physiology* Editorial Review Board, 2005

Referee for: *Global Change Biology* (6), *New Phytologist* (3), *Tree Physiology* (6), *Journal of Geophysical Research – Atmospheres*, *Journal of Tropical Forest Science*, *Applied Soil Ecology* (2), *Annals of Forest Science*, *Ecosystems* (2), *Forest Ecology and Management* (11), *Annals of Botany*, *Pedosphere*, *Environmental Management*, *Boreal Environment*

*Research, Agricultural and Forest Meteorology (2), Plant Ecology, Canadian Journal of Forest Research, Ecological Applications (2), Sustainability, Trees - Structure and Function, Ecosphere, Global Ecology and Biogeography, Nature Education, Journal of Geophysical Research—Biogeosciences; Urban Ecosystems*

Proposal reviewer for U.S. Civilian Research & Development Foundation, 2005  
Ohio State College of Biological Sciences Undergraduate Student Research Fair Judge, 2004, 2005, 2006, 2007  
Forestry Dept Budget and Planning Committee, Graduate Student Representative, 2001-2003  
Graduate Student Association, Forestry Department Representative, 2001-2002  
Forestry Dept Graduate Affairs Committee, Graduate Student Representative, 2001-2003  
University Graduate Honor Court Panelist, College of Natural Resources Rep., 2002-2003  
Graduate Student Orientation Committee, Forestry Department Representative, 2002  
Forestry Department Graduate Student Mentoring Program Chair, 2002  
University Board of Visitors Graduate Student Representative Selection Committee, 2002  
4-H Natural Resources Student Presentations – Judge, 1999  
Virginia High School Science Fair – Judge, 1998

## PROFESSIONAL MEMBERSHIPS

American Geophysical Union  
Society of American Foresters  
Golden Key Club National Honor Society  
Phi Sigma, Biological Research Honor Society  
Phi Kappa Phi National Honor Society

## RESEARCH OUTREACH AND APPLICATION

### **Research in the popular press**

*VCU Receives Grant to Further Examine the Role of Forests in Regulating Greenhouse Gases.*  
August 15, 2011. VCU's press release on collaborative work with Ohio State and U. of Michigan.

[http://www.news.vcu.edu/news/VCU\\_Receives\\_Grant\\_to\\_Further\\_Examine\\_the\\_Role\\_of\\_Forests\\_in](http://www.news.vcu.edu/news/VCU_Receives_Grant_to_Further_Examine_the_Role_of_Forests_in)

*Natural defense: Research shows just how important and fragile forests are in global warming;*  
Sept 30, 2008. Kevin Mayhood. Columbus Dispatch.

*Scientists point to forests for carbon cycling solutions* is the media's take on a synthesis presented in *BioScience* of our carbon cycling research conducted at the Univ. of Michigan Biol. Station, Sept 2008. <http://www.sciencedaily.com/releases/2008/09/080908185330.htm>

*Aspen trees starved in global warming experiment.* AP release published by *NY Times*, *Chicago Tribune*, *USA Today*, *CBS*, *NBC*, *ABC* and several thousand news outlets, May 2008.

Article here: [http://www.usatoday.com/weather/climate/2008-05-22-aspen\\_globalwarming\\_experiment\\_N.htm](http://www.usatoday.com/weather/climate/2008-05-22-aspen_globalwarming_experiment_N.htm)

*U-M scientists remove thousands of aspens to glimpse forest's future* released by the University of Michigan Media Department, May 2008.

Article with multimedia: <http://www.ns.umich.edu/htdocs/releases/story.php?id=6562>

*Modern forests suffer from century old logging legacy* featured in OSU research news and several popular news outlets, December 2005:

<http://researchnews.osu.edu/archive/carbstor.htm>

*Global change and forest carbon cycling: Lessons from the great north woods* was featured in the James Madison University's "Living Connection" Biology Department Newsletter, 2007:

<http://www.jmu.edu/biology/2007newsletter.pdf>

### **Research in policy publications**

Research publication cited In: *The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research

<http://www.climatescience.gov/Library/sap/sap2-2/final-report/default.htm>

Wisconsin's Forestland Woody Biomass Harvesting Guidelines: Rationale for the Guidelines; Department of Natural Resources.

<http://council.wisconsinforestry.org/biomass/pdf/Rationale061608.pdf>

Research publication cited In: *Carbon Storage in British Columbia's Forests and Management Options*. Pacific Institute for Climate Solutions, November 2008. Eds: Black, Jassal, Fredeen.

<http://www.pics.uvic.ca/assets/pdf/Forestry.pdf>

Gerardo Mery, Pia Katila, Glenn Galloway, René I. Alfaro, Markku Kanninen, Max Lobovikov and Jari Varjo. (eds.). 2010. *Forests and Society – Responding to Global Drivers of Change*. International Union of Forest Research Organization IUFRO World Series Volume 25. Vienna. 509 p.

[http://agents.cirad.fr/pjjimg/bruno.locatelli@cirad.fr/Locatelli\\_atal\\_2010\\_Forests\\_and\\_Adaptation\\_CC\\_IUFRO.pdf](http://agents.cirad.fr/pjjimg/bruno.locatelli@cirad.fr/Locatelli_atal_2010_Forests_and_Adaptation_CC_IUFRO.pdf)

A New Climate for Conservation: Nature, Carbon and Climate Change in British Columbia. Commissioned by the Working Group on Biodiversity, Forests and Climate, an alliance of ENGOs ([http://www.y2y.net/data/1/rec\\_docs/726\\_NewClimate\\_Report\\_reduced.pdf](http://www.y2y.net/data/1/rec_docs/726_NewClimate_Report_reduced.pdf)).