

Roy L. Rich  
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### **Education**

Ph.D. (2005) Department of Forest Resources  
University of Minnesota, St. Paul, Minnesota  
Major in Forest Ecology

Thesis—*Large wind disturbance in the Boundary Waters Canoe Area Wilderness: forest dynamics and development changes associated with the July 4th 1999 blowdown.*

B.A. (1996) Department of Biology  
Grinnell College, Grinnell, Iowa  
Major in Biology—graduated with honors

### **Professional Experience**

Adjunct Professor, Trinity University, Washington DC (2015)  
Visiting Scientist—Smithsonian Environmental Research Center (2014–2015)  
Visiting Scholar—Zanne Lab, Department of Biology, George Washington University (2014–present)  
Research Associate, Forest Resources Department, University of Minnesota (2010–2015)  
Visiting Scholar—Biology Department, Wesleyan College (2013)  
Research Fellow and Visiting Scholar, Center for International Energy and Environmental Policy and Jackson School of Geosciences, The University of Texas at Austin (2010–2012)  
Research Program Coordinator, Environmental Science Institute, The University of Texas at Austin (2009–2010)  
Post-Doctoral Research Associate, Forest Resources Department, University of Minnesota (2005–2009)  
Adjunct Assistant Professor of Landscape Architecture, College of Design at University of Minnesota (2004–2007)  
Teaching Specialist, Forest Resources Department, University of Minnesota (2004–2007)  
Research Specialist, Forest Resources Department, University of Minnesota (1999–2005)

### **Publications**

**Rich, R.L.**; Stefanski, A; Montgomery, R.A; Hobbie, S.E; Reich, P.B. (2015) Design and performance of B4WarmED, an aboveground and belowground free-air warming experiment at the temperate-boreal forest ecotone. *Global Change Biology* 21(6):2224-2348.

Sendall, K.M., P.B. Reich, C. Zhao, H. Jihua, X. Wei, A. Stefanski, K. Rice, **R.L. Rich** and R.A. Montgomery. (2014) Acclimation of photosynthetic temperature optima of temperate and boreal tree species in response to experimental forest warming. *Global Change Biology* 21(3):1342-1357

Reich, P.B., K.M. Sendall, K. Rice, **R.L. Rich**, A. Stefanski, S.E. Hobbie, R.A. Montgomery (2015) Geographic range predicts photosynthetic and growth response to warming in co-occurring tree species. *Nature Climate Change* 5(2):148-152.

Eisenhauer, N; Stefanski, A; Rice, K; **Rich, RL**; Reich, PB. Warming shifts 'worming': effects of experimental warming on invasive earthworms in northern North America" (*Accepted at Scientific Reports*)

Reich P.; **Rich R.L.**; Lu, Xingjie; Wang Yingping; Oleksyn J. (2014) Biogeographic variation in evergreen conifer needle longevity and impacts on boreal forest carbon cycle projections. *Proc. Natl. Acad. Sci.* 111 (38) 13703-13708

Thakur, MP, PB Reich, N Fisichelli, A Stefanski, S Cesarz, T Dobies, **RL Rich**, S Hobbie & N Eisenhauer (2014) Nematode community shifts in response to experimental warming and canopy conditions are associated with plant community changes in the temperate-boreal forest ecotone. *Oecologia*, 1-11.

Thakur, MP, PB Reich, WC Eddy, A Stefanski, **R Rich** & SE Hobbie. (2013) Some plants like it warmer: Increased growth of three selected invasive plant species in soils with a history of experimental warming. *Pedobiologia* 57, 57-60.

**Rich, RL**; Frelich, L; Reich, P; Bauer, ME (2010) Coupling high-resolution satellite imagery and field data to predict forest blowdown across a gradient of disturbance severity. *Remote Sensing of Environment*. 114 (2), 299-308.

**Rich, RL**; Frelich, LE; Reich, PB. (2007) Wind-throw mortality in the southern boreal forest: effects of species diameter and stand age. *Journal of Ecology*. 95 (6) pp. 1261-1273.

Krueger, J; **Rich, RL**. (2001) Using PDAs for data collection. *Bulletin of the Ecological Society of America*. 82(2) 128-129.

### ***In preparation***

**Rich, R.L.**; Frelich, L.; Reich, P. Transitions in near-boreal forest composition following wind disturbance.

**Rich, R.L.**; Worm K.; Reich, P. Soil warming in established soil using minimally invasive soil warming pins.

Montgomery, RA, Reich, PB, Stefanski, A, Rice K, & **Rich RL**. B4WarmED forest warming experiment: Phenological responses of dominant tree species at the temperate-boreal ecotone.

### **Research Grants**

National Science Foundation, Collaborative Research: The Complexity of Global Change –Interactive Effects of Warming, Water Availability, CO<sub>2</sub> and N on Grassland Ecosystem Function. PI–Peter Reich, co-PIs–Sarah Hobbie, **Roy Rich**, Tali Lee. Award: \$950, 839 for University of Minnesota (2011-2015)

U.S. Department of Energy Program on Ecological Research. Renewal: Warming-induced biome change at the temperate-boreal ecotone: An experimental test of key regeneration processes. With P Reich (PI), S Hobbie, R Montgomery, **R Rich**. \$2,528,252 Location: University of Minnesota (2011-2015).

U.S. Department of Energy Program on Ecological Research, Warming-induced biome change at the temperate-boreal ecotone: An experimental test of key regeneration processes (B4WarmED) PI–Peter Reich, co-PIs– Sarah Hobbie, **R Rich**, Rebecca Montgomery, Nico Eisenhauer. Award amounts: \$1,806,655; supplement in 2009: \$286,000.

The University of Texas at Austin, Longhorn Innovation Fund for Technology: Data Flow Infrastructure Initiative (DFII) Coupling inventory practices and data-collection technology to enhance research productivity and information access. PI- Suzanne Pierce, co-PI– **Roy Rich**. Award: \$119,700 (2010-2011)

University of Minnesota, College of Food, Agricultural, and Natural Resources Sciences, An integrated initiative on climate change in northern forests. PI–Peter Reich, co-PIs Sarah Hobbie, **Roy Rich**, Rebecca Montgomery, Award amount: \$200,000 (2007-2009)

Wilderness Research Foundation, Dissertation work and research assistantships provided through P. Reich (1999-2005)

USDA-Forest Service, Superior National Forest, Participating Agreement No. 0x-PA-1109090x-0xx, Prescribed fire experiment. Award amount: \$20,000. PI– Peter Reich, co-PI–**Roy Rich** (2001)

#### **Pending Grants:**

Submitted, 8/4/14, U.S. Department of Energy Program on Ecological Research. Coastal Wetland Carbon Sequestration in a Warmer Climate. With Pat Megonigal (PI) and M Kirzwan, R Rich, P. Dijkstra, and P Thornton. \$1,501,441. Location: Smithsonian Environmental Research Center

#### **University Teaching Experience**

Instructor of Environmental Science, Trinity University, Washington, DC (*Spring 2015*)

Instructor of Landscape Ecology and Management, Forest Resources 3204/5204 (*2005–2007*)

15-week course for 25-40 undergraduate and 5-10 graduate students in natural resources management, ecology, and conservation biology. The major objective of this course was to teach landscape ecology and its application to natural resources management, specifically forestry. Topics covered included landscape quantification and modeling, patch dynamics, and ecosystem management.

Instructor of Landscape Ecology, Landscape Architecture 3204 (*2005–2007*)

Lecturer in Disturbance Ecology, Forest Resources 3203/5203 (*2004–2008*)

Taught sections on wind disturbance.

Instructor of Landscape Ecology, Landscape Architecture 5204 (*2003-2004*)

15-week course for 25 graduate students in landscape and applied ecology. The major objective of this course was the introduction of landscape ecology concepts and the application of those concepts through field projects and a concurrent studio class. Topics covered included landscape quantification and modeling, patch dynamics, nutrient pollution and cultural eutrophication, reserve design, and sustainability in landscapes.

Guest Lecturer in Restoration Ecology and Management, Horticulture 5071 (*2003*)

Covered topics such as forest stand dynamics and restoration. Lectures were designed for students to apply principles of forest development to restoration practices.

Guest Lecturer in Landscape Ecology, Landscape Architecture 3204 (*2002*)

Lectured on landscape interactions with disturbance, specifically how landforms influence disturbance frequency and type.

Curriculum Committee, Department of Forest Resources (*2001–2004*)

### **Additional Teaching Experience**

Lego Climate Connections: Special Program Instructor, University of Minnesota (2008)

Assisted 4th-8th graders in simulating effects of climate change on Minnesota forests.

Undergraduate Research Opportunities Program, University of Minnesota (2007)

Advised two students' research on seedbank germination variation following wildfire and seed viability of Balsam Fir.

Guest Field Instructor, Michigan State University, Forestry Department under the direction of Dr. Michael Walters (May 2002)

Led forestry students on field study of boreal forest communities.

Scientist In-Residence Program, University of Minnesota (February 2002)

Taught 6th graders about how humans change landscape patterns.

Wilderness Staff Trainer, Wilderness Program Leader and Nature Programs Director, Olin Sang Ruby Union Institute, Oconomowoc, WI (Summers of 1996, 1998, 1999, and 2001)

Created a new nature program at this summer camp. The program, serving 4th-11th grades, is an integration of outdoor environmental education and Judaism.

Supervised and led trip-leadership program for college students.

Provided staff training and logistical support for wilderness education program.

Plant Biology Teacher, Kickapoo River Institute, Gays Mills, WI (April 1998)

Taught plant biology and an accompanying field study to high school juniors and seniors.

Job Training Partnership Act (JTPA) Instructor, Weston High School, Cazenovia, WI (September 1997-May 1998)

JTPA was a program for at-risk students that emphasized pre-employment skills, basic skills, and work experience. I worked with 10 students for 10-14 hours a week, tutoring them, setting up internships, and developing career opportunities.

Substitute Teacher, Weston High School, Cazenovia, WI (1997-1999)

Taught approximately 120 days in a variety of 2nd-12th grade classes.

### **Selected Research Presentations**

Montgomery, RA, **Rich, RL**, Stefanski, A, Rice, KE, Hobbie, SE & PB Reich. B4WarmED forest warming experiment: Effects of warming on seedling growth of co-occurring temperate and boreal species. August 2013. Ecological Society of America Meeting, Mpls, MN.

Montgomery, RA, Reich, PB, Stefanski, A & **RL Rich**. B4WarmED forest warming experiment: Phenological responses of dominant tree species at the temperate-boreal ecotone. August 2013. Ecological Society of America Meeting, Mpls, MN.

Reich, PB, **Rich, RL**, Stefanski, A, Sendall, KM, Montgomery, RA, Hobbie, SE, Zhao, CM & KE Rice. B4WarmED forest warming experiment: Species geographic distributions predict photosynthetic responses of local ecotypes to climate warming. August 2013. Ecological Society of America Meeting, Mpls, MN.

**Rich, RL**, Stefanski, A, Montgomery, R, Hobbie, SE & PB Reich. B4WarmED forest warming experiment: Design and implementation of four years of concurrent above- and below-ground warming at the temperate-boreal ecotone. August 2013. Ecological Society of America Meeting, Mpls, MN.

**Rich, RL**; Frelich L; Reich P "Forest blowdowns: severity, relative susceptibility of tree species and successional patterns in Minnesota's Boundary Waters Wilderness" (*Forest Ungulates*)

*Research Network and the SNS/EFINORD Networks Natural Disturbance and PRIFOR, in Järvelja Forest Station, Estonian University of Life Sciences, October 8-12, 2012)*

Meyer, K; Malin, R; **Rich, RL**; Pierce, S.A. “Data Flow Infrastructure Initiative (DFII): Coupling Inventory Practices and Data Collection Technology to Enhance Research Productivity and Information Access” (*American Geophysical Union, Fall Meeting 2011*)

Malin, R; Pierce, SA; **Rich, RL** “Data Flow Infrastructure Initiative (DFII): Coupling Inventory Practices and Data Collection Technology to Enhance Research Productivity and Information Access” (*Ecology Society of America Annual Meeting Summer 2011, Austin, TX*)

**Rich RL**; Montgomery RA; Hobbie S; Reich P “Boreal forest warming at an ecotone in danger (B4WarmED): Climate change impacts at the temperate-boreal ecotone—An overview of initial results from a concurrent above and belowground warming experiment” (*Ecology Society of America Annual Meeting Summer 2011, Austin, TX*)

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**Rich, RL** “B4WarmED: Boreal Forest Warming at an Ecotone in Danger” (*Integrated Biology Department, The University of Texas at Austin, January, 2010*)

**Rich, RL** “Evaluating fire effects of prescribed burning on blowdown fuels and forest regeneration following the 2006 Cavity Lake Fire” (*The Future of Fire and Wind in Northern Minnesota Forests Symposium, Cloquet Forestry Center, Cloquet, MN, February 2009*)

**Rich, RL**; Reich, P “B4WarmED: Boreal Forest Warming at an Ecotone in Danger” (*Cloquet Forestry Center, Cloquet, MN, September 2008*)

**Rich, RL** “Disturbance and climate change in the near-boreal forest” (*Coe College Field Station, Ely, MN, July 2008*)

**Rich, RL**; Reich, P “Geographic variation in leaf traits among six boreal tree species” (*Northern Forest Research Station, Grand Rapids, MN, February 2008*)

**Rich, RL** “Assessing impacts to rotation period from biomass harvesting of brushlands and forest residues” (*Cloquet Forestry Center, Cloquet, MN, September 2006*)

## **Professional and Research Training**

### ***At University of Minnesota***

#### ***BIOCON (2011–present)***

The BIOCON experiment (Biodiversity, CO<sub>2</sub>, and Nitrogen) is an ecological experiment started in 1997 at the University of Minnesota’s [Cedar Creek Ecosystem Science Reserve](#). The goal of this experiment is to explore the ways in which grassland ecosystems will respond to three environmental changes that are known to be occurring on a global scale: increasing nitrogen deposition, increasing atmospheric CO<sub>2</sub>, and decreasing biodiversity. In 2011, a new grant added soil and above-ground warming along with precipitation manipulation to examine two- and three-way impacts of warming, moisture, and elevated CO<sub>2</sub> on perennial grassland ecosystems. Co-PI responsibilities include: 1) grant writing, budgeting, and faculty collaboration, 2) experimental design, fabrication, and implementation of above- and below-ground feedback control heating in established ecosystem, and 3) data management, statistical programming, data analysis and paper writing.

#### B4WarmED (2007–present)

The B4WarmED Experiment (Boreal Forest Warming at an Ecotone in Danger) examines the uncertainty surrounding the mechanisms of climate warming effects on vegetation compositional change in forests. This experiment aims to understand community and ecosystem responses of southern boreal forests to elevated temperature (and reduced precipitation as of June 2012) to assess the potential of projected climate warming to alter tree species composition at the southern boreal-temperate forest ecotone. Co-PI Responsibilities include: 1) experimental design, fabrication, and implementation of two identical sites in Cloquet, MN, and Ely, MN; 2) project administration, hiring, and supervision of multiyear, \$4 million budget; 3) protocol design and measurements of growth, survivorship, physiology, and phenology for 12,000+ seedlings and in situ vegetation under paperless data-collection system; and 4) data management, statistical programming, data analysis, and paper writing.

#### Geographic Variation in Leaf Traits (2005–2007)

This work examined the distribution and tradeoffs of canopy leaf traits in six boreal tree species across their geographic ranges (43°–63°N). Specifically, this study asks how leaf traits on an individual and community scale change with temperature via the sampling of leaves along a 2,000-mile latitudinal gradient from southern Wisconsin to Canada's Northwest Territories. The project is in collaboration with other regional efforts to examine global and regional trends in leaf traits across known resource or climate gradients. Responsibilities included: overseeing and coordinating field and lab work, managing data sources (including GIS components), analyzing data, and coordinating biogeochemistry and paper writing.

#### Compounded Disturbance Impacts on Near-Boreal Forest (2006–2007)

This study examined the influence of windstorm severity on wildfire severity. In 2006 and 2007, 30,000-acre and 80,000-acre wildfires burned over areas previously sampled in 2001–2002. This project included coordinating the resampling of 780 remote sites within these areas to examine the influence of wind followed by fire on forest successional dynamics. This was a long-term project with data recollection in 2011 and 2012.

#### Biomass Harvesting on Soil Productivity in Northern Minnesota (2006)

This study examined the potential impacts of biomass harvesting of shrubs and forest residues on soil productivity in Northern Minnesota using literature and agency data.

#### ***At The University of Texas***

**Research Fellow and Visiting Scholar:** Center for International Energy and Environmental Policy and The Jackson School of Geosciences, The University of Texas at Austin

#### Data Flow Infrastructure Initiative (DFII) (2010–2011)

DFII efforts concentrated on shortening the cycle from data collection to research publication. DFII introduced the use of handheld devices with integrated barcode scanners to enhance both research productivity and information access among four pilot research groups at The University of Texas. Research Fellow responsibilities included: 1) administration of funding and personnel, purchasing and programming of equipment, and collaborating and coordinating with research groups to effectively apply new technology across the university, 2) writing of summary reports and protocols, and 3) grant writing and recruiting pilot study personnel.

#### Carbonate Formation in Modern Soils as Analog for Paleosols (2012)

This project sought to understand soil carbonate formation in modern soils in an effort to calibrate interactions between hydrology and soil carbon records. My work in this project was to design and program an automated monitoring system to identify seasonal and diurnal fluxes of CO<sub>2</sub> related to soil carbonate formation. Research Scientist responsibilities included: mentoring graduate students on equipment fabrication, datalogger systems, and programming, and field deployment of prototype systems

**Research Program Coordinator:** Environmental Science Institute (ESI), The University of Texas at Austin (2009–2010)

I promoted ESI's mission to develop and manage interdisciplinary research opportunities and programs. Responsibilities included: 1) writing and coordinating NSF grant proposals, 2) coordinating REU program on *Global Change and Its Impacts*, and 3) coordinating symposia for faculty and research.

### ***Graduate Experience at University of Minnesota***

**Research Assistant:** Department of Forest Resources at the University of Minnesota under the direction of Dr. Peter Reich and Dr. Lee Frelich (*September 1999–May 2005*)

- Primary research examined how large wind disturbance affects near-boreal forests, specifically, how differential susceptibility among tree species accelerates changes in composition and structure in forests at individual, community, and landscape scales.
- Three Mile Island Prescribed Fire Experiment, done in coordination with the US Forest Service, studied the use of prescribed fire on wind-damaged forests, examining questions of how fuel loadings affect fire severity, forest floor, and fuel consumption across different community types in the Boundary Waters Canoe Area Wilderness.
- Field experience included data collection in remote sites, standard measures of forest structure, composition, and site. Assisted in dendrochronology, earthworm sampling, and prescribed fire in grassland systems. Prescribed fire experiment modified line intercept sampling procedures for measuring fuel loading on a plot level.
- Experience with methods of multivariate data analysis, regression, categorical data analysis, model accuracy assessment, and ordination techniques, including the use of statistical software such as S-plus, R, PC-ord, JMP, and ARC. I also have experience with Arcview.
- Worked in collaboration with remote sensing researchers to analyze and build models that predict severity based on links between field-data and high-resolution IKONOS satellite imagery.

### **Interests**

Aside from my current academic studies and research, I am an avid woodworker. As such, I apprenticed in in Amana, IA, and Carbondale, CO, and had my own woodworking business from 1996-1999. My initial interest in forest ecology stems from experiences selecting, harvesting, and milling lumber. In graduate school, my woodworking and fabrication skills allowed me to work as an assistant at the University of Minnesota Physics Workshop to develop experimental equipment, and more recently helped me to design and build several experiments. My other interests include playing the banjo, gardening, and reading science fiction.