

**GAIUS R. SHAVER**

The Ecosystems Center  
Marine Biological Laboratory  
Woods Hole, Massachusetts 02543  
(508) 289-7492  
Email: [gshaver@mbi.edu](mailto:gshaver@mbi.edu)

Birthdate: 19 August 1949  
Birthplace: Pasadena, Calif.  
Citizenship: U.S.A.

Education

B.S. with departmental honors, Biological Sciences, Stanford University, 1972  
M.A., Biological Sciences, Stanford University, 1972 (B.S. and M.A. awarded coterminally)  
Ph.D., Botany, Duke University, 1976

Appointments

The Ecosystems Center, Marine Biological Laboratory, Woods Hole, Massachusetts  
Assistant Scientist, 1979 - 1984  
Associate Scientist, 1984 - 1990  
Senior Scientist, 1990 - present  
Brown University, Providence, Rhode Island  
Professor (MBL), Department of Ecology and Evolutionary Biology, 2004-present  
National Science Foundation, Washington, DC (on leave from The Ecosystems Center)  
Program Director, Division of Environmental Biology, 1996-1998  
University of Alaska, Fairbanks  
Research Associate, 1976 - 1984  
Senior Research Associate, 1984 - 1986  
Principal Research Associate, 1986 - present  
San Diego State University, San Diego, California  
Research Associate, June 1976 - January 1979  
Instructor in Ecology, Spring 1977 - Fall 1978

Teaching Experience

Duke University: Teaching Assistant (Ecology and General Biology)  
San Diego State University: Ecology, Physiological Ecology  
Marine Biological Laboratory: Ecology, Ecology and Management of Resources, Interns in Science, Semester in Environmental Sciences  
Brown University: Ecosystem Ecology  
Advisory Committee/External Examiner for graduate students at Boston University, Duke University, University of Toronto, University of Göteborg, Australian National University, Umeå University, Uppsala University, Lund University, University of Durham, University of British Columbia, and Brown University.  
Research Experiences for Undergraduates: Summer research mentor for 1-4 students per year since 1993.

Research Grants and Contracts

ERDA-DOE #EE-77-03-1525. Research on dynamics of tundra ecosystems and their potential response to energy resource development. June 1976 - May 1979. (Co-principal investigator and subcontractor.)  
NSF-DEB-77-13944. Community organization and resource utilization by vegetation in convergent ecosystems. October 1977 - May 1979. (Co-principal investigator and subcontractor.)  
NSF-DEB-79-05842. Effects of mineral nutrition and temperature on mobile carbon pools in arctic tundra plants. June 1979 - May 1982. (Subcontractor and principal investigator.)  
NSF-DEB-79-23329. The world carbon budget: An analysis through modelling. March 1980 - February 1982. (Co-principal investigator.)  
DOE-P800014. The effect of changes in terrestrial carbon pools on the CO<sub>2</sub> content of the atmosphere: A pilot study using satellite imagery. October 1980 - September 1982. (Co-principal investigator.)  
NSF-DEB-80-04174. Recovery of nutrients from senescing plant tissues: Its controls and its role in nutrient cycling. July 1980 - June 1982. (Principal investigator.)

- U.S. Army CRREL DACA89-80-M-1453. Baseline studies in arctic plant growth: Effects of latitude and annual climatic variation. June - November 1980; renewed June 1981 - June 1982; renewed June 1982 - June 1983; renewed June 1983 - 1984. (Principal investigator.)
- NSF-DEB-81-10477. The biota and the global carbon cycle. November 1981 - October 1984. (Co-principal investigator.)
- U.S. Army Research Office DAA629-76-6-0296. Revegetation of Alaskan disturbed sites by native tundra species. May 1979 - April 1982; renewed May 1982 - April 1985. (Subcontractor and co-principal investigator.)
- NSF-DEB-82-05344. The relationship of relative growth rate of plants to ecosystem processes in Alaskan tundra. July 1982 - June 1985. (Subcontractor and co-principal investigator.)
- DOE-U8406034. Nutrient cycling on river floodplains in Arctic Alaska: Variation in biogeochemistry and response to disturbance. July 1984 - December 1986. (Principal investigator.)
- NSF-BSR-8509732. Nutrient cycling in an arctic landscape: Interactions between ecosystems along a riverside toposequence. September 1985 - September 1988. (Principal investigator.)
- NSF-BSR-8509732. The biota and the global carbon cycle: Effects of changes in climate and in global element cycles. October 1985 - October 1987. (Co-principal investigator.)
- NSF BSR-8702328. An LTER Program for the Alaskan Arctic. September 1987 - August 1992. (Principal investigator and co-principal investigator.)
- NSF-BSR-8718426. A comparative study of the response of terrestrial ecosystems to changes in the global environment. March 1988 - February 1991. (Co-principal investigator.)
- NSF-BSR-8806635. Biogeochemical diversity in the Arctic landscape: Element transport and the spread of disturbance effects. 15 September 1988 - September 1991. (Principal investigator.)
- NSF-BBS-8714281. A biological facility center for application of stable isotope technology in environmental science. September 1987 - August 1989. (Co-principal investigator.)
- DOE-19X-SC968V. Response of northern ecosystems to global climate change. October 1988 - September 1989. (Subcontractor.)
- NSF-BSR-9019055. Global Change and the Carbon Balance of Arctic Ecosystems: The Importance of Carbon/nutrient Interactions. November 1991-October 1994. (Principal Investigator.)
- NSF-BSR-9024188. The Arctic LTER Project: Terrestrial and Freshwater Research on Ecological Controls. September 1992-August 1998. (Co-Principal Investigator.)
- US EPA. Current and Future Global Terrestrial Carbon Pool Distribution. May 1992-May 1994. (Co-Principal Investigator.)
- NSF-DEB-9307888: "Recovery of terrestrial ecosystems from major disturbance: Constraints due to carbon/nutrient interactions" August 1993-July 1996; 2 months/yr; \$850,000 (Co-principal Investigator)
- NSF-OPP-9415411: "Primary production in arctic ecosystems: Interacting mechanisms of adjustment to climate change" April 1995-March 2001; 3 months/yr; \$1,080,000 (Principal Investigator)
- American Geophysical Union: Travel grant to attend NATO workshop on Disturbance and Recovery of Arctic Terrestrial Ecosystems, Rovaniemi, Finland, September 1995; \$2200.
- NSF-DEB-9509613. "Multiple Resource Interactions and Ecosystem Functions" April 1996-March 1999; 1 month/yr; \$400,000 (Co-principal Investigator)
- NSF-OPP-9614308: "Modeling Canopy and Energy Balances in the Pan-Arctic: Scaling from Leaf to Region" March 1997-February 2000; 0, 1, 2 months/yr; \$292,000 (Co-principal Investigator)
- NSF-DEB-9615563. Global Change and the Carbon Balance of Arctic Ecosystems: The Importance of Carbon/nutrient Interactions in Soils. April 1997-March 2000; 0,1,2 months/yr; \$743,000 (Principal Investigator and Co-principal Investigator)
- NSF-DEB-9810222: "The Arctic LTER Project: The Future Characteristics of Arctic Communities, Ecosystems, and Landscapes" October 1998-September 2004; 1 month/year; \$4,199,882 (Co-principal Investigator)
- NSF-DEB-0087046: "LTER Cross Site 2000: Interactions between climate and nutrient cycling in arctic and subarctic tundras" January 2001-June 2003; 1,1, 0 Month/yr; \$300,000 (Principal Investigator)
- NSF-OPP-0096523: "Primary production in arctic ecosystems: Interacting mechanisms of adjustment to climate change" April 2001-March 2004; 3 months/yr; \$520,000 (Principal Investigator)
- NSF-DEB-0089585: Turnover and Retention of Nitrogen in an Arctic Watershed: Links to Organic Matter Accumulation and Response to Climate"; September 2001-August 2004; 2 months/yr; \$1,088,000 (Principal Investigator)
- NSF-DEB-0108960: "Species-, Community-, and Ecosystem-Level Consequences of the Interactions Among Multiple Resources" July 2001-June 2004; 1 month/yr; \$418,000 (Co-principal Investigator)

- NSF-OPP-0352897: "Resource Allocation and Allometry of Plant Growth in the Arctic: Key Constraints on Change and Predictability of the Arctic System"; 2/15/04-2/14/07; 3 months/year; \$870,809 (Principal Investigator)
- NSB-DBI-0301231 "Controlled Environment Facilities for Examination of the Effects of Climate Change and Human Land Use on Terrestrial and Aquatic Ecosystems"; 9/4/2003-10/4/2006; 0 months per year; \$271,230 (Principal Investigator)
- NSF-DEB 0444592; "Loss And Retention Of Nitrogen In An Arctic Landscape: Key Pathways And Process Regulation"; 12/1/2004-11/30/2007; 2 months/year; \$900,000 (Principal Investigator)
- NSF-DEB-0423385; "The Arctic LTER Project: Regional Variation in Ecosystem Processes and Landscape Linkages"; 1/15/2005-1/14/2011; 1 month/year; \$4,920,000 (Co-Principal Investigator)
- NSF-DEB-0620020, "Ecological Foundations of a Sustainable Biosphere"; \$3600 (Principal Investigator)
- NSF-OPP-0632139, "IPY: Collaborative Research on Carbon, Water, and Energy Balance of the Arctic Landscape at Flagship Observatories and in a PanArctic Network"; 3/15/2007-2/28/2011; 2 months/year; \$1,398,346 (Principal Investigator)
- NSF-OPP-0732955, "IPY: Improving the Public's Understanding of Polar Research Through Hands-On Fellowships for Science Journalists in the Arctic and Antarctic"; 3 weeks/year; \$365,289 (Co-Principal Investigator)
- NSF-OPP-0808789, "Effects of and Recovery from a Major Regional Disturbance in an Arctic Landscape, the Anaktuvuk River Fire of 2007" ; 12/31/2008-12/31/2009; 1 month; \$80,000 (Principal Investigator)
- NSF-NEON-0829285, "SGER: The Anaktuvuk River Fire of 2007: A Test Bed for NEON Technology and Protocols in Northern Alaska"; 2/28/2009-2/28/2010; 1 month; \$200,000 (Principal Investigator)
- NSF-OPP-0807639, "Canopy Structure and CO2 Exchange of Arctic Vegetation: Key Constraints on Change and Predictability of the Arctic System" ; 8/1/2008-7/31/2011; 3 months/year; \$997,782 (Principal Investigator)
- NSF-OPP-0856853, "Fire In the Arctic Landscape: Impacts, Interactions And Links To Global and Regional Environmental Change"; 6/15/2009-5/31/12; 1 month/year; \$872,715 (Principal Investigator)
- NSF-DEB-1026843, "Arctic LTER: Climate Change and Changing Disturbance Regimes in Arctic Landscapes"; 12/1/2010-11/30/2016; 2 months/year; \$5,640,000 (Principal Investigator)

#### Theses

- Shaver, G. R. 1972. The significance of leaf angle and absorptance in the distribution of selected species of *Arctostaphylos* (Ericaceae). Undergraduate honors thesis, Stanford University.
- Shaver, G. R. 1976. Ecology of roots and rhizomes in graminoid plants of the Alaskan coastal tundra. Ph.D. thesis, Duke University.

#### Papers Published

- Billings, W. D., G. R. Shaver and A. W. Trent. 1973. Temperature effects on growth and respiration of roots and rhizomes in tundra graminoids, pp. 57-63. In: L. C. Bliss and F. E. Wielgolaski (eds.), Primary Production and Production Processes, Tundra Biome. Proceedings of the Conference, Dublin, Ireland, April 1973. University of Alberta Press, Edmonton.
- Shaver, G. R. and W. D. Billings. 1975. Root production and root turnover in a wet tundra ecosystem, Barrow, Alaska. *Ecology* 56(2):401-410.
- Shaver, G. R. and W. D. Billings. 1976. Carbohydrate accumulation in tundra graminoid plants as a function of season and tissue age. *Flora* 165:247-267.
- Billings, W. D., G. R. Shaver and A. W. Trent. 1976. Measurements of root growth in simulated and natural temperature gradients over permafrost. *Arctic and Alpine Research* 8:247-250.
- Billings, W. D., K. M. Peterson, G. R. Shaver and A. W. Trent. 1977. Effect of temperature on root growth and respiration in a tundra ecosystem, Barrow, Alaska, pp. 111-116. In: J. K. Marshall (ed.), The Belowground Ecosystem: A Synthesis of Plant-Associated Processes. Range Science Dept. Science Series #26, Colorado State University, Fort Collins, Colorado. 351 pp.
- Shaver, G. R., and W. D. Billings. 1977. Effects of daylength and temperature on root elongation in tundra graminoids. *Oecologia* 28:57-65.
- Billings, W. D., K. M. Peterson, G. R. Shaver and A. W. Trent. 1977. Root growth, respiration, and carbon dioxide evolution in an arctic tundra soil. *Arctic and Alpine Research* 9:129-137.
- Billings, W. D., K. M. Peterson and G. R. Shaver. 1978. Growth, turnover, and respiration rates of roots and tillers in tundra graminoids. Chapter 18. In: L. L. Tieszen (ed.), Vegetation and Production Ecology of an Alaskan Arctic Tundra. Ecological Studies Series, Vol. 29. Springer-Verlag, New York. 686 pp.

- Miller, P. C., W. A. Stoner, L. L. Tieszen, M. L. Allesio, B. H. McCown, F. S. Chapin, III and G. R. Shaver. 1978. A model of carbohydrate, nitrogen, and phosphorus allocation and growth in tundra production. Chapter 25. In: L. L. Tieszen (ed.), *Vegetation and Production Ecology of an Alaskan Arctic Tundra*. Ecological Studies Series, Vol. 29. Springer-Verlag, New York. 686 pp.
- Shaver, G. R. 1978. Leaf angle and light absorptance of *Arctostaphylos* species along environmental gradients. *Madroño* 25:133-138.
- Shaver, G. R. and J. C. Cutler. 1979. The vertical distribution of phytomass in cottongrass tussock tundra. *Arctic and Alpine Research* 11(3):335-342.
- Shaver, G. R., F. S. Chapin, III and W. D. Billings. 1979. Ecotypic differentiation in *Carex aquatilis* as related to icewedge polygonization in the Alaskan coastal tundra. *Journal of Ecology* 67:1025-1046.
- Shaver, G. R. and F. S. Chapin, III. 1980. Response to fertilization by various plant growth forms in an Alaskan tundra: nutrient accumulation and growth. *Ecology* 61(3):662-675.
- Shaver, G. R. 1981. Mineral nutrition and leaf longevity in an evergreen shrub, *Ledum palustre* ssp. *decumbens*. *Oecologia* 49:362-365.
- Shaver, G. R. 1981. Nutrient and nonstructural carbon utilization. Chapter 9. In: P. C. Miller (ed.), *Resource Utilization in Two Mediterranean-type Ecosystems*. Springer-Verlag Ecological Studies Series, Volume 39. Springer-Verlag, New York.
- Chapin, F. S., III and G. R. Shaver. 1981. Changes in soil properties and vegetation following disturbance of Alaskan arctic tundra. *Journal of Applied Ecology* 18:605-617.
- Moore, B., R. D. Boone, J. E. Hobbie, R. A. Houghton, J. M. Melillo, B. J. Peterson, G. R. Shaver, C. J. Vorosmarty and G. M. Woodwell. 1981. A simple model for analysis of the role of terrestrial ecosystems in the global carbon budget, pp. 365-385. In: B. Bolin (ed.), *Modelling the Global Carbon Cycle*, SCOPE 16. John Wiley and Sons, New York.
- Chester, A. L. and G. R. Shaver. 1982. Reproductive effort in cottongrass- tussock tundra. *Holarctic Ecology* 5:200-206.
- Chester, A. L. and G. R. Shaver. 1982. Seedling dynamics of some cottongrass tussock tundra species during the natural revegetation of small disturbed areas. *Holarctic Ecology* 5:207-211.
- Fetcher, N. and G. R. Shaver. 1982. Growth and tillering patterns within tussocks of *Eriophorum vaginatum*. *Holarctic Ecology* 5:180-186.
- McGraw, J. B. and G. R. Shaver. 1982. Seedling density and seedling survival in Alaskan cottongrass-tussock tundra. *Holarctic Ecology* 5:212-217.
- Lechowicz, M. J. and G. R. Shaver. 1982. A multivariate approach to the analysis of factorial fertilization experiments in Alaskan Arctic tundra. *Ecology* 63:1029-1038.
- Shaver, G. R. 1982. Mineral nutrient and nonstructural carbon pools in shrubs from two Mediterranean-type ecosystems, pp. 286-299. Chapter 16. In: F. J. Kruger, D. T. Mitchell and J. U. M. Jarvis (eds.), *Mediterranean-Type Ecosystems: The Role of Nutrients*. Springer-Verlag Ecological Studies Series, Volume 43. Springer-Verlag, New York. 552 pp.
- Shaver, G. R. 1983. Mineral nutrition and leaf longevity in *Ledum palustre*: The role of individual nutrients and the timing of leaf mortality. *Oecologia* 56:160-165.
- Fetcher, N. and G. R. Shaver. 1983. Life histories of tillers of *Eriophorum vaginatum* in relation to tundra disturbance. *Journal of Ecology* 71:131-148.
- Houghton, R. A., J. E. Hobbie, J. M. Melillo, B. Moore, B. J. Peterson, G. R. Shaver and G. M. Woodwell. 1983. Changes in the carbon content of biota and soils between 1860 and 1980: Effects on atmospheric CO<sub>2</sub>. *Ecological Monographs* 53:235-262.
- Shaver, G. R., B. L. Gartner, F. S. Chapin, III and A. E. Linkins. 1983. Revegetation of Arctic disturbed sites by native tundra plants, pp. 1133-1138. In: *Proceedings 4th International Conference on Permafrost*. National Academy Press, Washington, D.C. 1524 pp.
- Woodwell, G. M., J. E. Hobbie, R. A. Houghton, J. M. Melillo, B. Moore, B. J. Peterson and G. R. Shaver. 1983. The contribution of global deforestation to atmospheric carbon dioxide. *Science* 222:1081-1086.
- Gartner, B. L., F. S. Chapin, III and G. R. Shaver. 1983. Demographic patterns of seedling establishment and growth of native graminoids in an Alaskan tundra disturbance. *Journal of Applied Ecology* 20:965-980.
- Woodwell, G. M., J. E. Hobbie, R. A. Houghton, J. M. Melillo, B. Moore, A. Park, B. J. Peterson and G. R. Shaver. 1984. Measurement of changes in vegetation of the earth by satellite imagery, pp. 221-240. In: G. M. Woodwell (ed.), *The Role of Terrestrial Vegetation in the Global Carbon Cycle: Measurement by Remote Sensing*. SCOPE 23. John Wiley and Sons, New York. 247 pp.

- Shaver, G. R. and J. M. Melillo. 1984. Nutrient budgets of marsh plants: Efficiency concepts and relation to availability. *Ecology* 65:1491-1510.
- Shaver, G. R. and F. S. Chapin, III. 1984. Limiting factors for plant growth in northern ecosystems, pp. 49-60. In: T. R. Moore (ed.), *Future Directions for Research in Nouveau-Quebec*. McGill Subarctic Research Paper No. 39, McGill University, Montreal.
- Chapin, F. S. III and G. R. Shaver. 1985. Arctic. pp. 16-40. In: B. Chabot and H. A. Mooney (eds.), *Physiological Ecology of North American Plant Communities*. Chapman and Hall, London. 351 pp.
- Chapin, F. S., III and G. R. Shaver. 1985. Individualistic growth response of tundra plant species to manipulation of light, temperature, and nutrients in a field experiment. *Ecology* 66:564-576.
- Mark, A. F., N. Fetcher, G. R. Shaver and F. S. Chapin, III. 1985. Estimated ages of mature tussocks of cotton sedge, *Eriophorum vaginatum*, along a latitudinal gradient in central Alaska. *Arctic and Alpine Research* 17:1-5.
- Shaver, G. R. and M. J. Lechowicz. 1985. A multivariate approach to plant mineral nutrition: Dose-response relationships and nutrient dominance in factorial experiments. *Canadian Journal of Botany* 63:2138-2143.
- Gartner, B. L., F. S. Chapin, III and G. R. Shaver. 1986. Reproduction by seed in *Eriophorum vaginatum* in Alaskan tussock tundra. *Journal of Ecology* 74:1-19.
- Chapin, F. S. III, G. R. Shaver and R. A. Kedrowski. 1986. Environmental controls over carbon, nitrogen, and phosphorus chemical fractions in *Eriophorum vaginatum* L. in Alaskan tussock tundra. *Journal of Ecology* 74:167-196.
- Shaver, G. R., F. S. Chapin III and B. L. Gartner. 1986. Factors limiting growth and biomass accumulation in *Eriophorum vaginatum* L. in Alaskan tussock tundra. *Journal of Ecology* 74:257-278.
- Shaver, G. R. 1986. Woody stem production in Alaskan tundra shrubs. *Ecology* 67:660-669.
- Shaver, G. R., and F. S. Chapin, III. 1986. Effect of fertilizer on production and biomass of tussock tundra, Alaska, U.S.A. *Arctic and Alpine Research* 18:261-268.
- Shaver, G. R., N. Fetcher and F. S. Chapin, III. 1986. Growth and flowering in *Eriophorum vaginatum*: Annual and latitudinal variation. *Ecology* 67:1524-1525.
- Houghton, R. A., R. D. Boone, J. R. Fruci, J. E. Hobbie, J. M. Melillo, C. A. Palm, B. J. Peterson, G. R. Shaver, G. M. Woodwell, B. Moore, D. L. Skole and N. Myers. 1987. The flux of carbon from terrestrial ecosystems to the atmosphere in 1980 due to changes in land use: geographic distribution of the global flux. *Tellus* 39B:122-139.
- Chapin, F. S., III and G. R. Shaver. 1988. Differences in carbon and nutrient fractions among arctic growth forms. *Oecologia* 77:506-514.
- Chapin, F. S., III and G. R. Shaver. 1989. Differences in growth and nutrient use among arctic plant growth forms. *Functional Ecology* 3:73-80.
- Chapin, F. S., III and G. R. Shaver. 1989. Lack of latitudinal variations in graminoid storage reserves. *Ecology* 70:269-272.
- Chapin, F. S., III, J. B. McGraw and G. R. Shaver. 1989. Competition causes regular spacing of alder in Alaskan shrub tundra. *Oecologia* 79:412-416.
- Shaver, G. R., K. J. Nadelhoffer and A. E. Giblin. 1990. Climatic change, nutrient cycling, and primary production in the Arctic landscape. pp. 134-135 In: *Arctic Research: Advances and Prospects (Part 2)*. Proceedings of the Conference of Arctic and Nordic Countries on Coordination of Research in the Arctic, Leningrad, USSR. Nauka, Moscow. 446 pages.
- Fetcher, N. and G. R. Shaver. 1990. Environmental sensitivity of ecotypes as a potential influence on primary productivity. *American Naturalist* 136:126-131.
- Shaver, G. R., K. J. Nadelhoffer and A. E. Giblin. 1991. Biogeochemical diversity and element transport in a heterogeneous landscape, the North Slope of Alaska. pp. 105-126 In: M. G. Turner and R. H. Gardner (eds.), *Quantitative Methods in Landscape Ecology*. Springer-Verlag, New York.
- Nadelhoffer, K. J., A. E. Giblin, G. R. Shaver and J. A. Laundre. 1991. Effects of temperature and organic matter quality on C, N, and P mineralization in soils from six arctic ecosystems. *Ecology* 72:242-253
- Shaver, G. R. and F. S. Chapin, III. 1991. Production/biomass relationships and element cycling in contrasting arctic vegetation types. *Ecological Monographs* 61:1-31.
- Rastetter, E. B., M. G. Ryan, G. R. Shaver, J. M. Melillo, K. J. Nadelhoffer, J. E. Hobbie and J. D. Aber. 1991. A general biogeochemical model describing the responses of the C and N cycles in terrestrial ecosystems to changes in CO<sub>2</sub>, climate, and N deposition. *Tree Physiology* 9:101-126.

- Giblin, A. E., K. J. Nadelhoffer, G. R. Shaver, J. A. Laundre and A. J. McKerrow. 1991. Biogeochemical diversity along a riverside toposequence in arctic Alaska. *Ecological Monographs* 61:415-436.
- Chapin, F.S., III, R. Jefferies, J. Reynolds, G. Shaver and J. Svoboda (eds.). 1992. Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective. 469 pp. Academic Press, New York.
- Nadelhoffer, K. J., A. E. Linkins, A. E. Giblin and G. R. Shaver. 1992. Microbial processes and plant nutrient availability in arctic soils. pp. 281-300 In: F. S. Chapin, III, R. Jefferies, J. Reynolds, G. Shaver, and J. Svoboda (eds.), Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective. Academic Press, New York.
- Shaver, G. R. and J. Kummerow. 1992. Phenology, resource allocation, and growth of arctic vascular plants. pp. 193-212 In: F. S. Chapin, III, R. Jefferies, J. Reynolds, G. Shaver, and J. Svoboda (eds.), Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective. Academic Press, New York.
- Chapin, F. S., III, R. Jefferies, J. Reynolds, G. Shaver and J. Svoboda. 1992. Arctic plant physiological Ecology: A challenge for the future. pp. 441-452 In: F. S. Chapin, III, R. Jefferies, J. Reynolds, G. Shaver, and J. Svoboda (eds.), Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective. Academic Press, New York.
- Chapin, F.S., III, R. Jefferies, J. Reynolds, G. Shaver and J. Svoboda. 1992. Arctic physiological ecology in an ecosystem context. pp. 3-10 In: F. S. Chapin, III, R. Jefferies, J. Reynolds, G. Shaver, and J. Svoboda (eds.), Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective. Academic Press, New York.
- Shaver, G. R., W. D. Billings, F. S. Chapin, III, A. E. Giblin, K. J. Nadelhoffer, W. C. Oechel and E. B. Rastetter. 1992. Global change and the carbon balance of arctic ecosystems. *BioScience* 42:433-441.
- Rastetter, E. B., R. B. McKane, G. R. Shaver and J. M. Melillo. 1992. Changes in C storage by terrestrial ecosystems: How C-N interactions restrict responses to CO<sub>2</sub> and temperature. *Water, Air, and Soil Pollution* 64:327-344.
- Rastetter, E. B. and G. R. Shaver. 1992. A model of multiple element limitation for acclimating vegetation. *Ecology* 73:1157-1174.
- Giblin, A. E., J. A. Laundre, K. J. Nadelhoffer and G. R. Shaver. 1994. Measuring nutrient availability in arctic soils using ion exchange resins. *Soil Science Society of America Journal*. 58:1154-1162.
- Rastetter, E. B. and G. R. Shaver. 1994. Functional redundancy and process aggregation: Linking ecosystems to species. pp. 215-223 In: C.G. Jones and J.H. Lawton, eds. Linking Species and Ecosystems. Chapman and Hall, New York.
- Jefferies, R.L., D.R. Klein, and G.R. Shaver. 1994. Herbivores and northern plant communities: Reciprocal influences and responses. *Oikos* 71:193-206.
- Hobbie, J. E., L. A. Deegan, B. J. Peterson, E. B. Rastetter, G. R. Shaver, G. W. Kling, W. J. O'Brien, F. S. Chapin, M. C. Miller, G. W. Kipphut, W. B. Bowden, A. E. Hershey and M. E. McDonald. 1994. Long-term measurements at the arctic LTER site. pp. 391-409 In: T. M. Powell and J. H. Steele, eds. Ecological Time Series. Chapman and Hall, New York. 491 pp.
- Shaver, G. R. 1995. Plant functional diversity and resource control of primary production in Alaskan arctic tundras. pp. 199-212 In: C. Körner and F.S. Chapin, III, eds. Arctic and Alpine Biodiversity: Patterns, Causes, and Ecosystem Consequences. Springer-Verlag Ecological Studies Series, vol. 113. Springer-Verlag, New York. 332 pp.
- Chapin, F. S., III, G. R. Shaver, A. E. Giblin, K. J. Nadelhoffer, and J. A. Laundre. 1995. Responses of arctic tundra to experimental and observed changes in climate. *Ecology* 76:694-711.
- McKane, R. B., E. B. Rastetter, J.M. Melillo, G. R. Shaver, C.S. Hopkinson, D.N. Fernandes, D.L. Skole, and W.H. Chomentowski. 1995. Effects of global change on carbon storage in tropical forests of South America. *Global Biogeochemical Cycles* 9:329-350.
- Shaver, G.R., and F.S. Chapin, III. 1995. Long-term responses to factorial NPK fertilizer treatment by Alaskan wet and moist tundra sedge species. *Ecography* 18: 259-275.
- Shaver, G. R. 1996. Integrated ecosystem research in northern Alaska, 1947-1994. In: J. Reynolds and J. Tenhunen, eds. Landscape Function and Disturbance in Arctic Tundra. Springer-Verlag Ecological Studies Series, Volume 120. Springer-Verlag, Heidelberg. pp.19-34.
- Shaver, G. R., A. E. Giblin, K. J. Nadelhoffer and E. B. Rastetter. 1996. Plant functional types and ecosystem change in arctic tundras. pp. 152-172 In: T. Smith, H. Shugart, and I. Woodward, eds. Plant Functional Types. Cambridge University Press, Cambridge.

- Chapin, F.S., III, and G.R. Shaver. 1996. Physiological and growth responses of arctic plants to a field experiment simulating climatic change. *Ecology* 77:822-840.
- Williams, M., E.B. Rastetter, D.N. Fernandez, M.L. Goulden, S.C. Wofsy, G.R. Shaver, J.M. Melillo, J.W. Munger, S.-M. Fan, and K.J. Nadelhoffer. 1996. Modelling the soil-plant-atmosphere continuum in a *Quercus-Acer* stand at Harvard Forest: The regulation of stomatal conductance by light, nitrogen, and soil/plant hydraulic properties. *Plant, Cell, and Environment* 19: 911-927.
- Nadelhoffer, K.J., G. Shaver, B. Fry, L. Johnson, and R. McKane. 1996. <sup>15</sup>N natural abundances and N use by tundra plants. *Oecologia* 107:386-394.
- Shaver, G.R., J.A. Laundre, A.E. Giblin, and K.J. Nadelhoffer. 1996. Changes in vegetation biomass, primary production, and species composition along a riverside toposequence in arctic Alaska. *Arctic and Alpine Research* 28:363-379.
- Chapin, F.S., III, S.A. Zimov, G.R. Shaver, and S.E. Hobbie. 1996. CO<sub>2</sub> fluctuation at high latitudes. *Nature* 383: 585-586.
- Shaver, G. R. and J. D. Aber. 1996. Carbon and nutrient allocation in terrestrial ecosystems. pp. 183-198 In: J. Melillo and A. Breymer, eds. Global Change: Effects on coniferous forests and grasslands. SCOPE synthesis series, John Wiley Publishers. 459 pp.
- Johnson, L.C., G.R. Shaver, A.E. Giblin, K.J. Nadelhoffer, E.R. Rastetter, J.A. Laundre, and G.L. Murray. 1996. Effects of drainage and temperature on carbon balance of tussock tundra microcosms. *Oecologia* 108:737-748.
- Rastetter, E.B., R.B. McKane, G.R. Shaver, and K.J. Nadelhoffer. 1997. Analysis of CO<sub>2</sub>, temperature, and moisture effects on carbon storage in Alaskan arctic tundra using a general ecosystem model. In: W.C. Oechel and J. Holten, eds. Global Change and Arctic Terrestrial Ecosystems. Springer-Verlag, New York. Pp. 437-451.
- Chapin, F.S. III, S.E. Hobbie, and G.R. Shaver. 1997. Impacts of global change on composition of arctic communities: Implications for ecosystem functioning. In: W.C. Oechel and J. Holten, eds. Global Change and Arctic Terrestrial Ecosystems. Springer-Verlag, New York. Pp. 221-229.
- Nadelhoffer, K.J., G.R. Shaver, A.E. Giblin, and E.B. Rastetter. 1997. Potential impacts of climate change on nutrient cycling, decomposition, and productivity in arctic ecosystems. In: W.C. Oechel and J. Holten, eds. Global Change and Arctic Terrestrial Ecosystems. Springer-Verlag, New York. Pp. 349-364.
- Shaver, G.R., Rastetter, E.B., Giblin, A.E., and Nadelhoffer, K.J. 1997. Carbon-nutrient interactions as constraints on recovery of arctic ecosystems from disturbance. In: "Disturbance and Recovery in Arctic Lands: An Ecological Perspective" (R.M.M. Crawford, Ed.), pp. 553-562. Kluwer Academic Publishers, Dordrecht.
- Rastetter, E.B., Göran I. Ågren, and G.R. Shaver. 1997. Responses of N-limited ecosystems to increased CO<sub>2</sub>: Application of a balanced-nutrition, coupled-element-cycles model. *Ecological Applications* 7: 444-460.
- McKane, R. B., E. B. Rastetter, G. R. Shaver, K. J. Nadelhoffer, A. E. Giblin, and J. A. Laundre. 1997. Climatic effects on tundra carbon storage inferred from experimental data and a model. *Ecology* 78: 1170-1187.
- McKane, R. B., E. B. Rastetter, G. R. Shaver, K. J. Nadelhoffer, A. E. Giblin, and J. A. Laundre. 1997. Reconstruction and analysis of historic changes in carbon storage in arctic tundra. *Ecology* 78: 1188-1198.
- Williams, M., E.B. Rastetter, D.N. Fernandez, M.L. Goulden, and G.R. Shaver. 1997. Predicting gross primary productivity in terrestrial ecosystems. *Ecological Applications* 7:882-894.
- Molau, U., and G.R. Shaver. 1997. Controls on seed production and seed germinability in *Eriophorum vaginatum*. *Global Change Biology*, special issue on ITEX research. 3, suppl. 1:80-89.
- Shaver, G.R., and J.A. Laundre. 1997. Leaf exsertion, leaf elongation, and leaf senescence in *Eriophorum vaginatum* and *Carex bigelowii* in northern Alaska. *Global Change Biology*, special issue on ITEX research. 3, suppl. 1:146-157.
- Shaver, G.R., L.C. Johnson, D.H. Cades, G. Murray, J.A. Laundre, E.B. Rastetter, K.J. Nadelhoffer, and A.E. Giblin. 1998. Biomass accumulation and CO<sub>2</sub> flux in three Alaskan wet sedge tundras: Responses to nutrients, temperature, and light. *Ecological Monographs* 68:75-99.
- Ågren, G., G.R. Shaver, and E.B. Rastetter. 1999. Nutrients: Dynamics and Limitations. pp. 333-345 In: Luo, Y., and H.A. Mooney, eds. *Carbon Dioxide and Environmental Stress*. Academic Press, New York. 415 pp.
- Herbert, D.A., E.B. Rastetter, G.R. Shaver, and G. Ågren. 1999. Effects of plant growth characteristics on biogeochemistry and community composition in a changing climate. *Ecosystems* 2:367-382.
- Vavrek, M.C., N. Fetcher, J.B. McGraw, G.R. Shaver, F.S. Chapin, III, B. Bovard, and A. Gatesman. 1999. Recovery of species diversity in tussock tundra following disturbance. *Arctic, Antarctic, and Alpine Research* 31: 254-258.

- Jonasson, S., and G.R. Shaver. 1999. Within-stand nutrient cycling in arctic and boreal herbaceous and forested wetlands. In: D. Whigham and I. Feller, eds. Special Features section on Wetland Ecosystems. *Ecology* 80: 2139-2150.
- Shaver, G.R., and S. Jonasson. 1999. Response of arctic ecosystems to climate change: Results of long-term field experiments in Sweden and Alaska. *Polar Biology* 18:245-252.
- Johnson, Loretta, G.R. Shaver, D. Cades, E. Rastetter, K.J. Nadelhoffer, A. Giblin, J. Laundre, and A. Stanley. 2000. Carbon-nutrient interactions control CO<sub>2</sub> exchange in Alaskan wet sedge ecosystems. *Ecology* 81: 453-469.
- Gough, Laura, G.R. Shaver, J. Carroll, D. Royer, and J.A. Laundre. 2000. Vascular plant species richness in Alaskan arctic tundra: The importance of soil pH. *Journal of Ecology* 88: 54-66.
- Canadell, J.G., H.A. Mooney, D.D. Baldocchi, J.A. Berry, J.R. Ehleringer, C.B. Field, S.T. Gower, D.Y. Hollinger, J.E. Hunt, R.B. Jackson, S.W. Running, G.R. Shaver, W. Steffen, S.E. Trumbore, R. Valentini, B.Y. Bond. 2000. Carbon Metabolism Of The Terrestrial Biosphere: A Multi-technique Approach for Improved Understanding. *Ecosystems* 3: 115-130.
- Shaver, G.R., J. Canadell, F.S. Chapin, III, J. Gurevitch, J. Harte, G. Henry, P. Ineson, S. Jonasson, J. Melillo, L. Pitelka, and L. Rustad. 2000. Global Warming and Terrestrial Ecosystems: A Conceptual Framework for Analysis. *BioScience* 50: 871-882.
- Jonasson, S., T.V. Callaghan, G.R. Shaver, and L. Nielsen. 2000. Arctic Terrestrial Ecosystems and Ecosystem Function. Pp. 275-314 In: M. Nuttall and T.V. Callaghan, eds. *The Arctic: Environment, People, Policy*. Harwood Academic Publishers, Amsterdam.
- Bret-Harte, M.S., G.R. Shaver, J.P. Zoerner, J.F. Johnstone, J.L. Wagner, A.S. Chavez, R.F. Gunkelman, S.C. Lippert, and J.A. Laundre. 2001. Developmental plasticity allows *Betula nana* to dominate tundra subjected to an altered environment. *Ecology* 82: 18-32.
- Shaver, G.R., and S. Jonasson. 2001. Productivity of Arctic Ecosystems. pp. 189-210. In: H. Mooney, J. Roy, and B. Saugier, eds. *Terrestrial Global Productivity*. Academic Press, New York.
- Rastetter, E.B., P.M. Vitousek, C. Field, G.R. Shaver, D. Herbert, and G.I. Ågren. 2001. Resource Optimization and Symbiotic N Fixation. *Ecosystems* 4: 369-388.
- Graglia E., Julkunen-Tiitto R., Shaver G., Schmidt I.K., Jonasson S., Michelsen A. 2001. Changes in birch phenolic compounds in long term manipulations of temperature, nutrients and light in Alaska and N. Sweden. *New Phytologist* 151:227-236.
- Jonasson, S, F.S. Chapin, III, and G.R. Shaver. 2001. Biogeochemistry in the Arctic: Patterns, Processes, and Controls. In: E.-D. Schulze, S. P. Harrison, M. Heimann, E. A. Holland, J. J. Lloyd, I. C. Prentice, D. Schimel (Eds.), *Global Biogeochemical Cycles in the Climate System*. Academic Press. Pp. 139-150.
- Shaver, G.R., M.S. Bret-Harte, M.H. Jones, J. Johnstone, L. Gough, J. Laundre, and F.S. Chapin, III. 2001. Species Composition Interacts With Fertilizer To Control Long Term Change In Tundra Productivity. *Ecology* 82: 3163-3181.
- Williams, M., Rastetter, E. B., Shaver, G. R., Hobbie, J. E., Carpino, E. and Kwiatkowski, B. L. 2001. Primary production in an arctic watershed; an uncertainty analysis. *Ecological Applications* 11:1800-1816
- Cornelissen, J.H.C., T.V. Callaghan, J.M. Alatalo, A. Michelsen, E. Graglia, A.E. Hartley, D.S. Hik, S.E. Hobbie, M.C. Press, C.H. Robinson, G.H.R. Henry, G.R. Shaver, G.K. Phoenix, D. Gwynn Jones, S. Jonasson, F.S. Chapin III, U. Molau, C. Neill, J.A. Lee, J.M. Melillo, B. Sveinbjörnsson and R. Aerts. 2001. Global change and arctic ecosystems: is lichen decline a function of increases in vascular plant biomass? *Journal of Ecology* 89: 984-994.
- McKane, R.B., L.C. Johnson, G.R. Shaver, K.J. Nadelhoffer, E.B. Rastetter, B. Fry, A. E. Giblin, K. Kielland, B.L. Kwiatkowski, J. A. Laundre, and G. Murray. 2002. Resource-based niches provide a basis for plant species diversity & dominance in arctic tundra. *Nature* 415:68-71
- Bret-Harte, M. S., G. R. Shaver, and F. S. Chapin, III. 2002. Primary and secondary stem growth in arctic shrubs: implications for community response to environmental change. *Journal of Ecology* 90: 251-267.
- Gough, L., P.A. Wookey, and G.R. Shaver. 2002. Dry heath arctic tundra responses to long-term nutrient and light manipulation. *Arctic, Antarctic, and Alpine Research* 34: 211-218.
- Schmidt, I.K., S. Jonasson, G. Shaver, A. Michelsen, and A. Nordin. 2002. Mineralization and allocation of nutrients by plants and microbes in four arctic ecosystems: responses to warming. *Plant and Soil* 242: 93-106.
- Nadelhoffer K. J., L. Johnson, J. Laundre, A. E. Giblin, and G.R. Shaver. 2002. Fine Root Production and Nutrient Use in Wet and Moist Arctic Tundras as Influenced by Chronic Fertilization. *Plant and Soil* 242: 107-113.

- Van Wijk, M.T., M. Williams, J.A. Laundre, and G.R. Shaver. 2003. Inter-annual variability of plant phenology in tussock tundra: modelling interactions of plant productivity, snowmelt, and soil thaw. *Global Change Biology* 9:743-758.
- Van Wijk, M.T., M. Williams, L. Gough, S.E. Hobbie, and G.R. Shaver. 2003. Luxury consumption: A possible competitive strategy in above-belowground carbon allocation for slow-growing vegetation? *Journal of Ecology* 91: 664-676.
- Boelman, N.T., M. Steiglitz, H. Rueth, M. Sommerkorn, K.L. Griffin, G.R. Shaver, and J. Gamon. 2003. Establishing Relationships between optical measurements and ecosystem level processes across long term warming and fertilization plots in wet sedge tundra. *Oecologia* 135: 414-421.
- Hobbie, J.E., G. Shaver, J. Laundre, K. Slavik, L. Deegan, J. O'Brien, S. Oberbauer and S. MacIntyre. 2003. Climate forcing at the Arctic LTER Site. In: D. Greenland, D. Goodin and R. Smith (eds.) *Climate Variability and Ecosystem Response at Long-Term Ecological Research (LTER) Sites*. Oxford University Press, New York. pp. 74-91.
- Van der Welle, M.E.W., P.J. Vermuelen, G.R. Shaver, and F. Berendse. 2003. Factors determining plant species richness in Alaskan arctic tundra. *Journal of Vegetation Science* 14: 711-720.
- van Wijk, M.T., K. Clemmensen, G.R. Shaver, M. Williams, T.V. Callaghan, F.S. Chapin III, J.H.C. Cornelissen, L. Gough, S.E. Hobbie, S. Jonasson, J.A. Lee, A. Michelsen, M.C. Press, S.J. Richardson, H. Rueth. 2003. Long-term ecosystem level experiments in Toolik Lake, Alaska, and Abisko, Northern Sweden: generalizations and differences in ecosystem and plant type responses to global change. *Global Change Biology* 10: 105-123.
- Nordin, A., I.K. Schmidt, and G.R. Shaver. 2004. Nitrogen uptake by arctic soil microbes and plants in relation to soil nitrogen supply. *Ecology* 85: 955-962
- Herbert, D.A., E.B. Rastetter, L. Gough, and G.R. Shaver. 2004. Species diversity along nutrient gradients: An analysis of resource competition in model ecosystems. *Ecosystems* 7: 296-310.
- Mack, M.C., E.A.G. Schuur, M.S. Bret-Harte, G.R. Shaver, and F.S. Chapin, III. 2004. Ecosystem carbon storage in arctic tundra reduced by long-term nutrient fertilization. *Nature* 431: 440-443
- Callaghan, Terry V., Lars Olof Björn, Yuri Chernov, Terry Chapin, Torben R. Christensen, Brian Huntley, Rolf A. Ims, Margareta Johansson, Dyanna Jolly, Sven Jonasson, Nadya Matveyeva, Nicolai Panikov, Walter Oechel, Gus Shaver, Sibyll Schaphoff, Stephen Sitch and Christoph Zöckler 2004. Key Findings and Extended Summaries *Ambio* 33: 386-392
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Johansson, M., Jolly, D., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C. and Shaver, G. R. 2004. Rationale, concepts and approach to the assessment. *Ambio* 33, 393-397.
- Callaghan, Terry V., Lars Olof Björn, Yuri Chernov, Terry Chapin, Torben R. Christensen, Brian Huntley, Rolf A. Ims, Margareta Johansson, Dyanna Jolly, Sven Jonasson, Nadya Matveyeva, Nicolai Panikov, Walter Oechel and Gus Shaver. 2004. Past Changes in Arctic Terrestrial Ecosystems, Climate and UV Radiation. *Ambio* 33: 398-403
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Jolly, D., Johansson, M., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C., Shaver, G. R., Elster, J., Henttonen, H., Laine, K., Taulavuori, K., Tau-lavuori, E. and Zöckler, C. 2004. Biodiversity, distributions and adaptations of Arctic species in the context of environmental change. *Ambio* 33, 404-417.
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Jolly, D., Johansson, M., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C., Shaver, G. R., Elster, J., Jonsdottir, I. S., Laine, K., Taulavuori, K., Taulavuori, E. and Zöckler, C. 2004. Responses to projected changes in climate and UV-B at the species level. *Ambio* 33, 418-435.
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Johansson, M., Jolly, D., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C., Shaver, G. R. and Henttonen, H. 2004. Effects on the structure of Arctic ecosystems in the short- and long-term. *Ambio* 33, 436-447.
- Callaghan, Terry V., Lars Olof Björn, Yuri Chernov, Terry Chapin, Torben R. Christensen, Brian Huntley, Rolf A. Ims, Margareta Johansson, Dyanna Jolly, Sven Jonasson, Nadya Matveyeva, Nicolai Panikov, Walter Oechel and Gus Shaver. 2004. Effects on the Function of Arctic Ecosystems in the Short- and Long-term Perspectives. *Ambio* 33: 448-458.
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Jolly, D., Johansson, M., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C., Shaver, G. R., Schaphoff, S. and

- Sitch, S. 2004. Effects on landscape and regional processes and feedbacks to the climate system. *Ambio* 33, 459-468.
- Callaghan, T. V., Björn, L. O., Chernov, Y, Chapin, III. F. S., Christensen, T. R., Hunt-ley, B., Ims, R. A., Johansson, M., Jolly, D., Jonasson, S., Matveyeva, N., Panikov, N., Oechel, W. C., Shaver, G. R., Schaphoff, S., Sitch, S., and Zöckler, C. 2004 . Synthesis of effects in four Arctic subregions. *Ambio* 33, 469-473.
- Callaghan, Terry V., Lars Olof Björn, Yuri Chernov, Terry Chapin, Torben R. Christensen, Brian Huntley, Rolf A. Ims, Margareta Johansson, Dyanna Jolly, Sven Jonasson, Nadya Matveyeva, Nicolai Panikov, Walter Oechel and Gus Shaver. 2004. Uncertainties and Recommendations. *Ambio* 33: 474-479.
- Van Wijk, M., M. Williams, and G.R. Shaver. 2005. Tight coupling between leaf area index and foliage N content in arctic plant communities. *Oecologia* 142:421-427.
- Rastetter, E.B., S.S. Perakis, G.R. Shaver, and G. Ågren. 2005. Terrestrial C sequestration at elevated CO<sub>2</sub> and temperature: The role of dissolved organic N loss. *Ecological Applications* 15: 71-86.
- Boelman N.T., M. Stieglitz, K.L. Griffin and G.R. Shaver. 2005. Inter-annual variability of NDVI in response to long-term warming and fertilization in wet sedge and tussock tundra. *Oecologia*, 143: 588-597.
- Hobbie, S. E., L. Gough, and G. R. Shaver. 2005. Species compositional differences on different-aged glacial landscapes drive contrasting responses of tundra to nutrient addition. *Journal of Ecology* 93: 770-782
- Callaghan, T.V., L.O. Björn, F. S. Chapin III, Y. Chernov, T.R. Christensen, B. Huntley, R. Ims, M. Johansson, D.J. Riedlinger, S. Jonasson, N. Matveyeva, W.C. Oechel, N. Panikov, G. Shaver. 2005. Chapter 7: Arctic Tundra and Polar Desert Ecosystems In: ACIA, 2005. Arctic Climate Impact Assessment. Cambridge University Press. pp. 243-352.
- Shaver, G.R. 2005. Spatial Heterogeneity Past, Present, and Future. In: G.M. Lovett, C.G. Jones, M.G. Turner, and K.C. Weathers, eds. *Ecosystem Function in Heterogeneous Landscapes*. Springer-Verlag, New York. Pp. 443-449
- Williams, M., L.E. Street, M. van Wijk, and G.R. Shaver. 2006. Identifying differences in rates of carbon exchange among vegetation types along an arctic toposequence. *Ecosystems* 9: 288-304
- Shaver, G.R., A.E. Giblin, K.J. Nadelhoffer, K.K. Thielert, M.R. Downs, J.A. Laundre, and E.B. Rastetter. 2006. Carbon Turnover in Alaskan Tundra Soils: Effects of Organic Matter Quality, Temperature, Moisture, and Fertilizer. *Journal of Ecology* 94: 740-753
- Clemmensen, K, A. Michelsen, S. Jonasson, and G.R. Shaver. 2006. Increased ectomycorrhizal fungal abundance after long-term fertilization and warming of two arctic tundra ecosystems. *New Phytologist* 171: 391-404
- Walker, Marilyn D., C. Henrik Wahren, Robert D. Hollister, Greg H. R. Henry, Lorraine E. Ahlquist, Juha M. Alatalo, M. Syndonia Bret-Harte, Monika P. Calef, Terry V. Callaghan, Amy B. Carroll, Howard E. Epstein, Ingibjorg S. Jonsdottir, Julia A. Klein, Borgpor Magnusson, Ulf Molau, Steven F. Oberbauer, Steven P. Rewa, Clare H. Robinson, Gaius R. Shaver, Katharine N. Suding, Catharine C. Thompson, Anne Tolvanen, Ørjan Totland, P. Lee Turner, Craig E. Tweedie, Patrick J. Webber, and Philip A. Wookey. 2006. Plant community responses to experimental warming across the tundra biome. *Proceedings National Academy of Sciences* 103: 1342-1346.
- Hobara, S., C. McCalley, K. Koba, A.E. Giblin, M.S. Weiss, G.M. Gettel, and G.R. Shaver. 2006. Nitrogen fixation in an arctic tundra watershed: a key atmospheric N source. *Arctic, Antarctic, and Alpine Research* 38:363-372.
- Street LE, Shaver GR, Williams M, van Wijk MT. 2007. What is the relationship between changes in leaf area and changes in photosynthetic CO<sub>2</sub> flux in arctic ecosystems? *Journal of Ecology* 95: 139-150.
- Cornelissen JHC, PM van Bodegom, R Aerts, TV Callaghan, RSP van Logtestijn, J Alatalo, F S Chapin, R Gerdol, J Gudmundsson, D Gwynn-Jones, AE Hartley, DS Hik, A Hofgaard, IS Jónsdóttir, S Karlsson, JA Klein, J Laundre, B Magnusson, A Michelsen, U Molau, VG Onipchenko, HM Queded, SM Sandvik, IK Schmidt, GR Shaver, B Solheim, NA Soudzilovskaia, A Stenström, A Tolvanen, Ø Totland, N Wada, JM Welker, X Zhao, and MOL Team. 2007. Global negative vegetation feedback to climate warming responses of leaf litter decomposition rates in cold biomes. *Ecology Letters* 10: 619-627.
- Sullivan, P.F., M. Sommerkorn, H.M. Rueth, K. J. Nadelhoffer, G. R. Shaver, J. M. Welker. 2007. Climate and species affect fine root production with long-term fertilization in acidic tussock tundra near Toolik Lake, Alaska. *Oecologia* 153: 643-652.
- Shaver, G.R., L.E. Street, E.B. Rastetter, M. T. van Wijk, M. Williams. 2007. Functional Convergence In Regulation Of Net CO<sub>2</sub> Flux In Heterogeneous Tundra Landscapes In Alaska And Sweden *Journal of Ecology* 95: 802-817.

- Douma, J.C., M.T. van Wijk, and G.R. Shaver. 2007. The contribution of mosses to the carbon and water exchange of arctic ecosystems: quantification and relationships with system properties. *Plant, Cell, and Environment* 30: 1205-1215.
- Knapp, A.K., J. M. Briggs, S.L. Collins, S.R. Archer, M.S. Bret-Harte, B.E. Ewers, D.P. Peters, D.R. Young, G.R. Shaver, E. Pendall, and M. B. Cleary. 2008. Shrub encroachment in North American grasslands: shift in growth form dominance rapidly alters control of ecosystem C inputs. *Global Change Biology* 14: 615-623.
- Lambers, H., J. A. Raven, G. Shaver and S. E. Smith. 2008. Specialised nutrient-acquisition strategies reflect plant adaptations to changing N and P status as soils change over geological time scales. *Trends in Ecology and Evolution* 23: 95-103.
- Nowinski, N., S. Trumbore, E. Schuur, M. Mack, and G. Shaver 2008. Nutrient Addition Prompts Rapid Destabilization Of Organic Matter In An Arctic Tundra Ecosystem. *Ecosystems* 11:16-25
- Bret-Harte, M.S., M.C. Mack, G.R. Goldsmith, D.B. Sloan, J. DeMarco, G.R. Shaver, P. M. Ray, Z. Biesinger, and F. S. Chapin, III. 2008. Plant functional types do not predict biomass responses to removal and fertilization in Alaskan tussock tundra. *Journal of Ecology* 96:713-726. DOI: 10.1111/j.1365-2745.2008.01378
- Wookey, P.A., R. Aerts, R.D. Bardgett, F. Baptist, K.A. Bråthen, J.H.C. Cornelissen, L. Gough, I.P. Hartley, D.W. Hopkins, S. Lavorel, and G.R. Shaver. 2009. Ecosystem Feedbacks and cascade processes: understanding their role in the responses of arctic and alpine ecosystems to environmental change. *Global Change Biology* 15:1153-1172.
- Yano, Y., G.R. Shaver, A.E. Giblin, and E.B. Rastetter. 2009. Depleted  $^{15}\text{N}$  in hydrolysable-N of arctic soils and its implication for mycorrhizal fungi-plant interaction. *Biogeochemistry*, DOI 10.1007/s10533-009-9365-1
- Campioli, M., Street, Lorna E., Michelsen, Anders, Shaver, Gaius R., Maere, Thomas, Samson, Roeland, Lemeur, Raoul. 2009. Determination of leaf area index, foliar N, and normalized difference vegetation index for arctic ecosystems dominated by *Cassiope tetragona*. *Arctic, Antarctic, and Alpine Research* 41:426-433
- Rocha, A.V., and G.R. Shaver. 2009. Advantages of a two band EVI calculated from solar and photosynthetically active radiation fluxes. *Agricultural and Forest Meteorology* 149: 1560-1563.
- Rastetter, E.B., Williams, M, Griffin, K.L., Kwiatkowski, B.L., Tomasky, G., Potosnak, M.J., Stoy, P.C., Shaver, G.R., Stieglitz M., Kling G.W., Hobbie, J.E. 2010. Application of the Ensemble Kalman Filter to Assimilate Eddy Covariance Flux data into a Model of Arctic Carbon Exchange. *Ecological Applications*, doi: 10.1890/09-0876
- Yano, Y., G.R. Shaver, A.E. Giblin, E.B. Rastetter, and K.J. Nadelhoffer. 2010. Nitrogen dynamics in a small arctic watershed: Retention and downhill movement of  $^{15}\text{N}$ . *Ecological Monographs* 80: 331-351.

#### Papers submitted, accepted, or in press

- Rocha, A., and G.R. Shaver. 2010. Burn severity influences post-fire CO<sub>2</sub> exchange in arctic tundra. *Ecological Applications*, in press
- Loranty, M.M., S. J. Goetz, E.B. Rastetter, A.V. Rocha, G. R. Shaver, E.R. Humphreys, P.M. Lafleur. 2010. Scaling an instantaneous model of tundra NEE to the Arctic landscape. *Ecosystems*, in review.
- Hobara, S., K. Koba, AE Noriharu, AE Giblin, K. Kushida, and G.R. Shaver. 2010. Geochemical Retention of Dissolved Organic Matter and Its Replacement by Phosphorus in Organic Layer of Arctic Tundra Ecosystems. *Biogeochemistry*, in review.

#### Manuscripts

- Boelman, N.T., G.R. Shaver, and A.V. Rocha. 2010. Limitations to burn severity mapping in Arctic tundra: Vegetation indices and spatial heterogeneity. *Remote Sensing and Environment*, in revision.
- Street, L. E., G. R. Shaver, E.B. Rastetter, M. T. van Wijk, Kaye B. A., M. Williams. 2009. Photosynthetic CO<sub>2</sub> Flux And The Relationship Between Leaf Area Index And Total Foliar Nitrogen - Do High And Low Arctic Ecosystems Differ? *Oecologia*, in revision.
- Raven, J., Lambers, H., Smith, S.E., Shaver, G., Westoby, M. 2010. Predicting the costs of acquiring nitrogen and phosphorus by vascular land plants: progress and problems. *New Phytologist*, in revision.
- G Shaver, J Laundre, MS Bret-Harte, FS Chapin, III, A Giblin, L Gough, S Hobbie, G Kling, MC Mack, J Moore, K Nadelhoffer, E Rastetter, J Schimel. Chapter 5: Terrestrial Ecosystems. IN:

Walker et al. BAMS

Shaver et al. Fire and Ice

Shaver et al. Denitrification

Electronic publication:

Shaver, G.R. 1996. History of Research. In: D.A. Walker, ed. The Geobotanical Atlas of the Toolik Lake and Kuparuk River Region, Alaska. Tundra Ecosystem Analysis and Mapping Laboratory, Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO.  
(<http://www.colorado.edu/INSTAAR/TEAML/atlas/>)

Reports

- Miller, P. C., et al. (24 authors). 1981. Carbon balance in northern ecosystems and the potential effect of carbon dioxide induced climatic change. US DOE CONF-8003118. 109 p.
- Shaver, G. R., et al. (7 authors). 1982. The role of terrestrial biota and soils in the global carbon budget, pp. 160-165. In: S. Brown (ed.), Global Dynamics of Biospheric Carbon. US DOE CONF-8108131. 194 pp.
- Woodwell, G. M., et al. (9 authors). 1983. Deforestation measured by LANDSAT: Steps toward a method. US DOE/EV/10468-1. 62 pp.
- Shaver, G.R., Callaghan, T.V., Tweedie, C.E., and Webber, P.J. 2005. Flagship Observatories for Arctic Environmental Research and Monitoring. Report of a Workshop held November 18-20, 2004 at The Ecosystems Center, Marine Biological Laboratory, Woods Hole, Massachusetts, USA. 21 pp.

Abstracts

- Shaver, G. R. and W. D. Billings. 1976. Carbohydrate and inorganic nutrient accumulation in tundra graminoid plants as functions of season and tissue age. *Bulletin of the Ecological Society of America* 57:5.
- Shaver, G. R. and F. S. Chapin. 1978. Nutrient limitations to plant growth in Alaskan tussock tundra vegetation. *Bulletin of the Ecological Society of America* 59:55.
- Shaver, G. R. 1980. Community structure, plant nutrition, and turnover in microhabitats of polygonal wet tundra. *Bulletin of the Ecological Society of America* 61:132-133.
- Woodwell, G. M., J. E. Hobbie, R. A. Houghton, J. M. Melillo, B. Moore, B. J. Peterson and G. R. Shaver. 1981. The role of terrestrial biota and soils in the global carbon budget. *Bulletin of the Ecological Society of America* 62:63.
- Lachenbruch, B. E., F. S. Chapin, III and G. R. Shaver. 1981. The role of natural disturbance in seedling establishment of *Eriophorum vaginatum* in arctic tussock tundra. *Bulletin of the Ecological Society of America* 62:79.
- Chapin, F. S., III and G. R. Shaver. 1981. Changes in soil properties and vegetation following disturbance of an Alaskan arctic tundra. Proc. 1981 Alaska Science Conference, pp. 56-57.
- Melillo, J. M., J. D. Aber, J. R. Gosz, G. R. Shaver, K. Van Cleve and P. M. Vitousek. 1982. Decomposition of red pine needle litter at six sites in North America. *Bulletin of the Ecological Society of America* 63:95.
- Shaver, G. R. 1982. Mineral nutrition in relation to carbon and biomass turnover processes in plants. *Bulletin of the Ecological Society of America* 63:183.
- Chapin, F. S. and G. R. Shaver. 1983. Experimental test of factors limiting plant growth in Alaskan tussock and wet meadow tundras. *Bulletin of the Ecological Society of America* 64:177.
- Shaver, G. R., B. L. Gartner, F. S. Chapin and A. E. Linkins. 1983. Revegetation of arctic disturbed sites by native tundra plants. Permafrost: Fourth International Conference, Fairbanks, Alaska. 219 p.
- Chapin, F. S., III and G. R. Shaver. 1984. Controls over growth rate by carbon, nitrogen, and phosphorus chemical fractions in Alaskan tundra plants. *Bulletin of the Ecological Society of America* 65:142.
- Shaver, G. R., E. M. Sechoka and F. S. Chapin, III. 1984. A demographic approach to woody stem production in four Alaska tundra ecosystems. *Bulletin of the Ecological Society of America* 65:257.
- Nadelhoffer, K., G. Shaver, A. Giblin and J. Laundre. 1986. Ecosystem functions along a tundra toposequence. *Bulletin of the Ecological Society of America* 67:249-250.
- Shaver, G. R. and F. S. Chapin, III. 1986. Production/biomass relationships and element cycling on four contrasting Alaskan vegetation types. *Bulletin of the Ecological Society of America* 67:308.

- Nadelhoffer, K. J., G. R. Shaver, A. E. Giblin and J. E. Laundre. 1987. Effects of temperature on C, N, and P mineralization in soils from a tundra toposequence. *Agronomy Abstracts*, American Society of Agronomy. Page 189.
- Chapin, F. S., III and G. R. Shaver. 1988. Ecosystem consequences of multiple limiting factors in natural ecosystems. *Bull. Ecol. Soc. Amer.* 69:96.
- Laundre, J. A., K. J. Nadelhoffer, A. E. Giblin and G. R. Shaver. 1988. Controls on soil respiration and nutrient mineralization in tundra ecosystems along a toposequence. *Bulletin of the Ecological Society of America* 69(2):203.
- Nadelhoffer, K. J., A. E. Giblin and G. R. Shaver. 1988. Biogeochemical diversity in an arctic landscape. In: *Observations Across Scales: Function and Management of Landscapes*. Proceedings of the 3rd Annual Landscape Ecology Symposium, US-IALE, Albuquerque, New Mexico.
- Nadelhoffer, K. J., A. E. Giblin and G. R. Shaver. 1988. Soil element interactions on a tundra toposequence. Paper presented at S.S.S.A. invited symposium "The Interface Between Microbiology and Ecosystems Science", November 29, 1988, Anaheim, CA. *Agronomy Abstracts*, American Society of Agronomy. Page 222.
- Rastetter, E. B. and G. R. Shaver. 1988. A model of multiple resource limitation for an acclimating plant. *Bull. Ecol. Soc. Amer.* 69:270-271.
- Shaver, G. R., A. E. Giblin and K. J. Nadelhoffer. 1988. Biogeochemical diversity in the arctic landscape. *Bull. Ecol. Soc. Amer.* 69:294.
- Davis, S. J., J. S. Pallant, M. G. Ryan, E. B. Rastetter, J. D. Aber, J. M. Melillo, K. J. Nadelhoffer, G. R. Shaver and J. E. Hobbie. 1989. A general model for predicting the effects of environmental change on terrestrial ecosystems: production and allocation of C and N in biomass. *Bulletin of the Ecological Society of America* 70(2):221.
- Nadelhoffer, K. J., A. E. Linkins, A. E. Giblin and G. R. Shaver. 1989. *Bulletin of the Ecological Society of America* 70(2):241.
- Pallant, J. S., S. J. Davis, M. G. Ryan, E. B. Rastetter, K. J. Nadelhoffer, G. R. Shaver, J. D. Aber, J. M. Melillo and J. E. Hobbie. 1989. A general model for predicting the effects of environmental change on terrestrial ecosystems: decomposition and C and N cycling in litter and soil. *Bulletin of the Ecological Society of America* 70(2):93.

ESA 1990 (2)

INTECOL 1990 (2)

ESA 1991 (2)

ESA 1993 (2)

GCTE Woods Hole 1994 (4)

ESA 1994 (3)

ESA 1995 (3)

ESA 1996 (2)

ESA 1997 (2)

ESA 1999 (3)

ESA 2000 (2)

ESA 2005 (2)

ESA 2006 (2)

AGU 2007 (2)  
ESA 2007

AGU 2008

ESA 2008

ESA 2009 (4)

AGU 2009 (2)

ESA 2010 (2)

Book Reviews

- 1980 High Altitude Geocology, ed. by P. J. Webber. *BioScience* 30: 191.  
 1980 Comparative Mechanisms of Cold Adaptation, ed. by L. S. Underwood, L. L. Tieszen, A. B. Callahan and G. E. Folk. *Science* 209:395.  
 1982 Stress Effects on Natural Ecosystems, ed. by G. W. Barrett and R. Rosenburg. *Ecology* 63:1613.  
 1986 The Living Tundra, by Yu. I. Chernov. *Ecology* 67:1107-1108.  
 2000 Global Environmental Change: Research Pathways for the Next Decade. NRC Committee on Global Change Research. *BioScience* 50:1124-1129

Seminars and Meetings

- March, 1979 MBL/Boston University Marine Program. Seminar on "Plant growth form and response to disturbance in Alaskan arctic tundra."  
 October 1979 Virginia Polytechnic Institute. Seminar on "Plant growth forms and response to disturbance in Alaskan arctic tundra."  
 December, 1979 University of Connecticut. Seminar on "Ecotypic variation in Carex aquatilis among microhabitats of wet tundra."  
 March, 1980 San Diego State University. DOE-sponsored workshop on "Carbon in boreal and tundra ecosystems." Brief presentation of the MBL/TCM model.  
 Washington, DC. Review of DOE-sponsored arctic research programs. Brief presentation on plant responses to disturbance in the Arctic.  
 April, 1980 MBL/Ecosystems Center. Seminar on "Carbon-nutrient interactions and primary production in tundras."  
 May, 1980 University of Alaska, Fairbanks. Workshop on "Environmental protection of permafrost terrain." Brief presentation of the MBL/TCM model.  
 August, 1980 University of Arizona. Annual Meeting of the Ecological Society of America. Paper presented on "Community structure, plant nutrition, and turnover in microhabitats of polygonal wet tundra."  
 October, 1980 University of North Carolina. Seminar on "Plant nutrition and leaf turnover in Ledum palustre."  
 Duke University. Seminar on "The biota and the world carbon budget" (with J. M. Melillo).  
 December, 1980 The New England Center. NSF/MBL/UNH Workshop on "The role of tropical forests in the world carbon budget."  
 January, 1981 National Research Institute of the Amazon, Manaus, Brazil. Discussions on the role of tropical forests in the world carbon budget.

|                 |   |
|-----------------|---|
| February, 1981  | Johnson State College, Vermont. Seminar on "The biosphere, the atmosphere, and the world carbon budget."  |
| March, 1981     | MBL/Ecosystems Center. Seminar on "Mineral nutrition and leaf turnover in Alaskan moist tundra."  |
| August, 1981    | Indiana University. Annual Meeting of the Ecological Society of America. Joint author of three papers presented.<br>MBL Botany Seminar Series. "Limiting factors for plant growth in Alaskan tundra."   |
| October, 1981   | University of Alaska. Seminar on "The biosphere, the atmosphere, and the global CO <sub>2</sub> problem."   |
| November, 1981  | MBL/Boston University Marine Program. Seminar on "The regulation of plant biomass, litter mass, and litter nutrient content in Alaskan cottongrass."  |
| April, 1982     | MBL/Ecosystems Center. Seminar on "Disturbance and recovery in Alaskan tundra vegetation."  |
| June, 1982      | University of California, Santa Barbara. Seminar on "Disturbance and recovery in Alaskan tundra vegetation."  |
| August, 1982    | Pennsylvania State University. Annual Meeting of the Ecological Society of America. Organized symposium on "Carbon-nutrient interactions in plants and ecosystems" and author of 2 papers presented.  |
| November, 1982  | Duke University. Seminar on "Carbon-nutrient interactions in phytotron-grown marsh plants."<br>U.S. Army CRREL, Hanover, New Hampshire. Workshop on "Tundra impact and recovery."<br>Boulder, Colorado. NAS-DOE Workshop on "Arctic terrestrial environmental research."  |
| December, 1982  | San Diego State University. Seminar and discussions on arctic plant growth.   |
| March, 1983     | MBL/Ecosystems Center. Seminar on "Nitrogen uptake, nitrogen recovery, and nitrogen use in marsh plants."   |
| May, 1983       | Washington, D.C. DOE Workshop on "Plant uptake and soil-plant processes."   |
| July 1983       | Fourth International Conference on Permafrost, Fairbanks, Alaska. Paper titled - "Revegetation of arctic disturbed sites by native tundra plants."  |
| September, 1983 | University of Massachusetts, Amherst. Seminar on "Nutrient use by marsh plants: Efficiency concepts and relation to nutrient cycling."  |
| October, 1983   | U.S. Army CRREL, Hanover, New Hampshire. Workshop on tundra impact and recovery.  |
| February, 1984  | McGill University, Montreal. Two talks on "Limiting factors for plant growth in arctic ecosystems" and "Demographic approaches to production/biomass relationships in arctic tundra."<br>Johnson State College, Vermont. Seminar/lecture on "Environmental regulation on plant growth form abundance in tundra ecosystems." |
| March, 1984     | Cornell University. Seminar on "Nutrient budgets of marsh plants: Efficiency concepts and relation to availability."  |
| April, 1984     | University of Washington, Seattle. Seminar on "Limitation of primary production in Alaskan tundra ecosystems."<br>U.S. DOE Arctic Research Program Planning Meeting, Seattle, Washington.   |
| May, 1984       | Cornell University. Seminar on "Limiting factors for plant growth in Alaskan tundra ecosystems."  |

August, 1984 Colorado State University. Annual Meeting of Ecological Society of America and co-author of 2 papers presented.

November 1984 Laval University, Quebec. Seminar on "The regulation of primary production and plant biomass in Alaskan tundra."  
San Diego State University. Seminar on "The regulation of primary production and plant biomass in Alaskan tundra."

February, 1985 University of Rhode Island. Seminar on "The regulation of primary production and plant biomass in Alaskan tundra."

April, 1985 U.S. DOE Arctic Research Program Planning Meeting, San Diego.

November, 1985 U.S. DOE Arctic Research Program Planning Meeting, Easton, Maryland.

January, 1986 University of Georgia. Symposium on "The role of landscape heterogeneity in the spread of disturbance."

February, 1986 Marine Biological Laboratory. Seminar on "Comparative element cycles of contrasting Alaskan vegetation types."

April, 1986 U.S. DOE Arctic Research Program Planning Meeting, San Diego.  
NASA-Ames Research Center. Seminar on "Production/biomass relationships and element cycling in contrasting Alaskan ecosystems."

August, 1986 Syracuse University. Annual meeting of the Ecological Society of America and co-author of 2 papers presented.

September, 1986 Colorado State University. Workshop on "The use of supercomputers in landscape ecology."

October, 1986 Syracuse University. Two seminars.

December, 1986 Institute of Ecosystem Studies. Seminar on "Production/biomass relationships and element cycling in contrasting Alaskan ecosystems."

December, 1986 Ecosystems Center, MBL. Seminar.

May, 1987 Ecosystems Center, MBL. Seminar.

July, 1987 International Symposium on Vegetation Structure, Utrecht, The Netherlands. Paper presented.

October, 1987 University of Colorado. Seminar.  
Colorado State University. Seminar.  
Woods Hole, Massachusetts. DOE CO<sub>2</sub> Workshop.

November, 1987 Washington, DC. NSF Committee on Long term technological needs of the LTER program.

January, 1988 Washington, DC. 2 NSF LTER committee meetings.

February, 1988 Woods Hole, Massachusetts. Arctic LTER workshop.

March, 1988 San Diego State University. Consulting on research planning for DOE Arctic research.

April, 1988 SUNY, Binghamton. 2 seminars.  
University of Virginia. Workshop on global modeling.

May, 1988 Oak Ridge National Laboratory. Workshop on the role of northern peatlands in response to global climate change; seminar.

June, 1988 University of Washington, Seattle. Seminar.

August, 1988 University of California, Davis. Presented 1 paper and co-author of 3 others at annual meeting of ESA.

November, 1988 Kellogg Biological Station, Michigan. LTER CC Meetings.

December, 1988 Leningrad, USSR. Conference of Arctic and Nordic Countries on coordination of research in the Arctic.

February, 1989. San Diego State University. Consulting on research planning for DOE Arctic Research.

March, 1989 Woods Hole, Massachusetts. Arctic LTER Workshop. Co-organizer.  
Colorado State University. Landscape Ecology Symposium. Presented paper.  
University of Minnesota, Duluth. Meeting on effects of global climate change on northern ecosystems.

April, 1989 Woods Hole, Massachusetts. SCOPE workshop on effects of climate change on production and decomposition in coniferous forests and grasslands.  
Woods Hole, Massachusetts. IGBP CP4 workshop on modeling.

May, 1989 Woods Hole, Massachusetts. LTER workshop on decomposition.  
San Diego State University. Consulting on research planning for DOE Arctic research.

August, 1989 University of Toronto. Annual meeting of ESA.  
Toronto, Canada. Workshop on Arctic physiological processes in a changing climate.

September, 1989 Woods Hole, Massachusetts. LTER Stable Isotopes workshop.

October, 1989 University of New Mexico, Albuquerque. International workshop on long-term ecological research.  
Harvard Forest, Massachusetts. LTER coordinating committee meeting.  
Woods Hole, Massachusetts. Intergovernmental Panel on Climate Change.

January 1990 Woods Hole, Massachusetts. SCOPE modeling workshop.

February 1990 University of Colorado, Boulder. ARCUS workshop on planning of terrestrial research for Arctic Systems Science (ARCSS).  
Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.

April 1990 San Diego State University, San Diego. DOE-R4D arctic research planning meeting.

June 1990 University of Alaska, Fairbanks. Meeting of the steering committee for Land/Atmosphere/Ice Interactions, Arctic System Science Program.

July 1990 Snowbird, Utah. Annual meeting of the Ecological Society of America (presented paper).

September 1990 King's College, London, England. SCOPE modeling workshop (presented paper).  
Estes Park, Colorado. LTER All-Scientists' Meeting.

December 1990 Kellogg Biological Station, Michigan State University. Workshop on an International Tundra Experiment (ITEX).  
Duke University. Review of EPRI-funded research on CO<sub>2</sub> effects on ecosystems.

February 1991 Pacific Northwest Laboratories, Richland, Washington. Planning workshop for development of a US consortium for wetlands and climate change research.

March 1991 Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.  
University of Massachusetts, Amherst. Annual meeting of the Arctic Research Consortium of the United States, and meeting of steering committee for Arctic Systems Science Program.

April 1991 University of Colorado, Boulder. Seminar on "Alaskan moist tundra: A model ecosystem."

July 1991 Prudhoe Bay, Alaska. EPA, Consultant on development of an Arctic North Slope Ecorestoration Research Strategy (ANSWERS).

|                 |   |
|-----------------|---|
| August 1991     | San Antonio, Texas. Annual meeting of the Ecological Society of America (presented paper).  |
| September 1991  | Woods Hole, Massachusetts. Workshop on design of soil warming experiments.  |
| November 1991   | Desert Research Institute, Reno, Nevada. Review of EPRI-funded research on CO <sub>2</sub> effects on ecosystems.   |
| January 1992    | INSTAAR, University of Colorado. Planning meeting for proposals to NSF-ARCSS program.   |
| March 1992      | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.<br>Washington, DC. Annual meeting of the Arctic Research Consortium of the United States.   |
| May 1992        | Washington, DC. NSF-DPP planning workshop on development of a field laboratory for ARCSS research.<br>Washington, DC. DOE planning workshop on development of a new "Program for Ecosystem Research."   |
| July 1992       | Cedar Creek, Minnesota. Site review of NSF Cedar Creek LTER program.  |
| October 1992    | Washington, DC. NSF-Ecosystem Studies Panel meeting.  |
| January 1993    | Duke University. Review of EPRI-funded research on CO <sub>2</sub> effects on ecosystems.<br>Duke University. Seminar on "Multiple Resource Limitation in a Changing World."<br>University of Virginia. IGBP-GCTE workshop on plant Functional Types and Global Change. |
| February 1993   | Kellogg Biological Station, Michigan State University. Seminar on "Ecosystem Stoichiometry in a Changing World."<br>San Diego State University. Seminar on "Ecosystem Stiochiometry in a Changing World."   |
| March 1993      | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.   |
| April 1993      | Washington, DC. NSF-Ecosystem Studies Panel meeting.  |
| May 1993        | Washington, DC. Scope workshop on CO <sub>2</sub> effects on terrestrial ecosystems.  |
| August 1993     | Madison, Wisconsin. Annual meeting of the ESA.<br>Kongsvold, Norway. Workshop on functional significance of biodiversity in arctic ecosystems.  |
| September, 1993 | Fort Collins, Colorado. Site review of Central Plains LTER program.   |
| October 1993    | Washington, DC. NSF-Ecosystem Studies Panel meeting.  |
| January 1994    | Lake Tahoe, Nevada. Review of EPRI-funded research on CO <sub>2</sub> effects on ecosystems.<br>Woods Hole, Massachusetts. Seminar on "Plant diversity and the regulation of primary production in Alaskan arctic tundras."   |
| March 1994      | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.<br>St. Petersburg, Russia. Annual workshop of the ITEX program. Talk on "Short-term versus long-term controls of primary production in arctic ecosystems."                                |
| May 1994        | Washington, DC. NSF-LTER Panel Meeting.<br>Woods Hole, Massachusetts. GCTE Science Conference. Presented paper and coauthor of three others.  |
| October 1994    | Washington, DC. Annual Meeting of the Arctic Research Consortium (ARCUS).<br>Washington, DC. Planning meeting of Committee for Future Needs of Toolik Field Station.<br>Dillard, Georgia. LTER Coordinating Committee.  |

|                  |  |
|------------------|--|
| February 1995    | Bodega Bay, California. Toolik Field Station Planning Workshop (Organizing Committee)<br>Woods Hole. IPCC Working Group meeting on CO <sub>2</sub> -water tradeoffs  |
| March 1995       | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.<br>University of Toronto. Seminar on “The carbon balance of arctic ecosystems: Do species matter?”   |
| April 1995       | Washington, DC. NSF-Ecosystem Studies Panel meeting.<br>University of Ottawa. 6th Annual ITEX Workshop. Presented paper on “Leaf elongation, leaf exsertion, and leaf senescence in Alaskan tundra graminoids.”  |
| May 1995         | Lake Tahoe, California IGBP-GCTE Workshop on “Stress effects on future carbon fluxes”  |
| July/August 1995 | Snowbird, Utah. Annual meeting of the Ecological Society of America (presented paper, coauthor of 2 others).   |
| September 1995   | Rovaniemi, Finland. NATO workshop on Disturbance and Recovery of Arctic Terrestrial Ecosystems (presented paper)   |
| October 1995     | Washington, D.C. NSF-Ecosystem Studies Panel meeting<br>Duke University. Review of EPRI-funded research on CO <sub>2</sub> effects on ecosystems.<br>Gothenburg, Sweden. “Opponent” at Ph.D. defense of Mats Havstrom, Univ. Gothenburg                |
| November 1995    | Washington, D.C. NSF Division of Environmental Biology -seminar on “A Model Landscape: The Arctic Tundra at Toolik Lake, Alaska”   |
| December 1995    | Dartmouth College, N.H. International Conference on Arctic Research Planning   |
| February 1996    | Seattle, WA. Arctic Systems Science/Land-Atmosphere-Ice Interactions Workshop (presented paper)  |
| March 1996       | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.<br>Washington, D.C. Annual meeting of Arctic Research Consortium of the United States.<br>Presented a paper on “Terrestrial and aquatic research at Toolik Lake, Alaska” |
| April 1996       | Washington, D.C. NSF-Ecosystem Studies Panel meeting<br>Copenhagen, Denmark. 7th Annual ITEX workshop (presented paper, chaired session)   |
| May 1996         | Snowbird, Utah. NSF-ARCSS “All-Hands” Workshop   |
| June 1996        | Abisko, Sweden. Workshop on Long-Term Experiments in Arctic Tundra (presented paper)   |
| August 1996      | Providence, RI. Annual meeting of the Ecological Society of America (coauthor of 2 papers presented).  |
| November 1996    | Santa Barbara, CA; National Center for Ecological Analysis and Synthesis. Workshop on “Synthesis in Ecology—Applications, Opportunities, and Challenges.”  |
| December 1996    | Fairbanks, Alaska, Institute of Arctic Biology. Meeting of Toolik Field Station Steering Committee and invited seminar on “Production and biomass regulation in tundra vegetation: Does species composition make any difference?”                      |

January 1997            Smithsonian Environmental Research Laboratory, Edgewater, MD. Invited seminar.

March 1997            Salt Lake City, Utah. Steering committee meeting, GCTE Focus 1: Ecosystem Physiology and Global Change

                             Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.

                             Montpellier, France. IGBP-GCTE Workshop on Terrestrial Primary Productivity. Presented a paper on Arctic Productivity

April 1997            London, England. 8<sup>th</sup> Annual ITEX meeting (presented paper)

                             Andrews Experimental Forest, Oregon. Spring meeting of the LTER Coordinating Committee

June 1997            Puerto Rico. Site review of Luquillo LTER program

July 1997            Cedar Creek, Minnesota. Site review of Cedar Creek LTER program

                             Palo Alto, CA. GCTE NETFLUX workshop.

September 1997      Sevilleta NWR, New Mexico. Site review of Sevilleta LTER Program

October 1997        Jasper National Park, Canada. Workshop on Ecosystem Experiments; presented paper

                             Santa Barbara, CA. LTER Coordinating Committee, fall meeting

November 1997      Taipei, Taiwan. International LTER Program, annual meeting and workshop

February 1998      Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.

March 1998           Stony Brook, NY. Invited seminar at SUNY-Stony Brook

                             Fairfax, Virginia. Invited seminar at George Mason University

April 1998            Kansas State University, Manhattan, KS Invited Seminar

                             Colorado State Univ., Ft. Collins, CO. LTER Coordinating Committee, Spring meeting

May 1998            Las Vegas and Reno, Nevada. NSF-EPSCOR site visits and talks with faculty, University of Nevada campuses

                             Desert Research Institute, Reno, NV. Fritz Went Laboratory advisory committee

June 1998            Portland, Maine. Organizing meeting for Workshop on Ecosystem Warming

August 1998        Baltimore, Maryland. Annual meeting of the Ecological Society of America

                             Tromsø, Norway. IASC workshop on Role of the Polar Regions in Global Change (presented paper)

September 1998    Abisko, Sweden. Workshop on Plant Ecology at High Altitudes and Latitudes (presented paper)

October 1998 Estes Park, Colorado. Workshop on “The contribution of long-term ecological research and monitoring to broad-scale management needs: Integrating up from research intensive sites to develop regional perspectives”  
Madison, Wisconsin. LTER Coordinating Committee, Fall meeting

November 1998 Woods Hole, MA. Ecosystems Center Seminar.

December 1998 Fairbanks, Alaska, Institute of Arctic Biology. Meeting of Toolik Field Station Steering Committee

January 1999 East Lansing, Michigan. 9<sup>th</sup> ITEX workshop. Presented 2 talks

February 1999 Santa Barbara, California. Workshop on “A Cross-Biome Synthesis of Ecosystem Response to Global Warming” (Organizing Committee)

March 1999 Ottawa, Canada. Canadian National Science and Engineering Research Council (NSERC) Major Facilities Access Panel meeting  
Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.

April 1999 Luquillo, Puerto Rico. LTER Coordinating Committee, Spring meeting

June 1999 Abisko, Sweden. Workshop on “How nutrient cycles constrain carbon balances in boreal forests and arctic tundra” (Invited speaker)

August 1999 Spokane, Washington. Annual meeting of the Ecological Society of America. Talk presented and coauthor of 2 others

October 1999 Hubbard Brook, NH. LTER Coordinating Committee, Fall meeting. Speaker in Symposium on Primary Production at LTER sites

November 1999 University of Rhode Island. Invited seminar, Department of Biological Sciences

January 2000 St. John's, Newfoundland. Canadian National Science and Engineering Research Council (NSERC) Major Facilities Access Panel Site Review

February 2000 Washington, DC. LTER Executive Committee Meeting  
Seattle, Washington. Annual ARCSS-LAII Workshop. Presented paper, attended Steering Committee (member)

March 2000 Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.

August 2000 Snowbird, Utah. LTER All-Scientists meeting. Workshop participant and speaker  
Snowbird, Utah. Annual meeting of the Ecological Society of America. Coauthor of 2 talks.

September 2000 Abisko, Sweden. 10<sup>th</sup> ITEX workshop. Presented 1 talk and coauthored 1 poster

November 2000 Pomona College, California. Seminar on "Global Warming and Arctic Tundra Ecosystems: the Carbon-Nutrient Connection"  
Fort Collins, CO. LTER Network Executive Committee

December 2000 Fairbanks, AK. Annual meeting of Toolik Field Station Steering Committee

|                |  |
|----------------|--|
| January 2001   | Sevilleta NWR, NM. LTER Executive Committee/Principal Investigators  |
| February 2001  | Seattle, WA . ARCSS-LAII Steering Committee<br>Washington, DC. LTER EXEC/National Advisory Board<br>Boulder, CO. ITEX Community Change Synthesis workshop                  |
| March 2001     | Copenhagen, Denmark. Visiting Fellow at University of Copenhagen Global Change Program. Three seminars presented.  |
| April 2001     | Tempe, AZ. LTER EXEC/Coordinating Committee  |
| October 2001   | Ithaca, NY. Seminar on "Species composition interacts with N supply to control long-term change in an Alaskan tundra ecosystem". Biogeochemistry group, Cornell University |
| October 2001   | LTER 20 Year Review, University of New Mexico, Albuquerque   |
| November 2001  | ARCSS-LAII All-Scientists' Meeting, Salt Lake City   |
| January 2002   | Umea, Sweden. Opponent for thesis defense of Joachim Strengbom   |
| January 2002   | ITE Banchory, Scotland. Invited seminar on "Species composition interacts with N supply to control long-term change in Alaska tundra"                                      |
| February 2002  | Seattle, WA. ARCSS All-Hands meeting (LAII Steering Committee member)  |
| February 2002  | Arlington, VA. LTER minisymposium at NSF; talk on "LTER in the next Decade"  |
| March 2002     | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.  |
| April 2002     | Sevilleta NWR, New Mexico. LTER Exec/Coordinating Committee  |
| May 2002       | Durham, NH. GCTE-Terrestrial Ecosystem Responses to Atmospheric and Climate Change (TERACC). Organizing committee, session chair.  |
| May 2002       | Woods Hole,, MA. Invited talk on "The LTER Network" to Watson Scholars of the Environment, Brown University  |
| August 2002    | Tucson, AZ Annual meeting of the Ecological Society of America   |
| September 2002 | Niwot Ridge, CO LTER Exec/Coordinating Committee Presented paper on "Causes and Consequences of Species Change in Ecosystems: A Perspective from the Arctic LTER Site"     |
| October 2002   | Study of Environmental Arctic Change (SEARCH) planning meeting, University of Washington, Seattle  |
| November 2002  | Study of Environmental Arctic Change (SEARCH) Scientific Steering Committee/Interagency Working Group (SSC/IWG), Orlando, FL   |
| December 2002  | Fairbanks, AK. Annual meeting of Toolik Field Station Steering Committee   |
| March 2003     | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.  |

|                |  |
|----------------|--|
| March 2003     | Brown University. Seminar on “Biodiversity regulates biogeochemistry of arctic ecosystems”   |
| April 2003     | Lamont-Doherty Earth Observatory, Columbia University. Seminar on “Biodiversity regulates biogeochemistry of arctic ecosystems”    |
| April 2003     | Ecosystem Center, Woods Hole, MA Seminar on “Biodiversity regulates biogeochemistry of arctic ecosystems”                          |
| April 2003     | Uppsala University, Sweden. Opponent for Ph.D. thesis defense of Sofie Sjögersten  |
| April 2003     | Cary Conference, Millbrook, NY. Panelist and speaker.  |
| May 2003       | Kellogg Biological Station, Hickory Corners, MI. LTER Network Coordinating Committee   |
| August 2003    | Savannah, Georgia. Annual meeting of the Ecological Society of America   |
| September 2003 | Abisko, Sweden. Workshop on development of international collaboration in arctic research  |
| September 2003 | Seattle, WA. LTER network All-Scientists' meeting  |
| October 2003   | Seattle, WA. Study of Environmental Arctic Change (SEARCH) Open Science meeting. Steering Committee and panelist                   |
| February 2004  | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.  |
| March 2004     | Cumberland, Simons, and Cambridge, MD. University of Maryland Center for Environmental Science. Center Review team and site visits |
| April 2004     | Santa Barbara, CA. US LTER network Coordinating Committee meeting  |
| May 2004       | Uppsala University, Sweden. Organizing meeting of the Circum Arctic Terrestrial Biodiversity Project (European Union)              |
| May 2004       | University of Edinburgh, Scotland. Seminar on “C-N interactions in Arctic Tundra Ecosystems”                                       |
| May 2004       | Washington, DC. Ecological Society of America Governing Board  |
| August 2004    | Portland, Oregon. Annual meeting of Ecological Society of America (2 posters)  |
| September 2004 | Washington, DC Steering Committee, Study of Environmental Arctic Change (SEARCH)   |
| October 2004   | Lund University, Sweden. Seminar on “Long-Term Experiments in Arctic Tundra at Toolik Lake, Alaska”                                |
| October 2004   | Lund University, Sweden. Opponent at thesis defense of Maria Olsrud  |
| November 2004  | Washington, DC. Governing Board, Ecological Society of America   |
| November 2004  | Woods Hole, MA. Host, international workshop on “Flagship Observatories in Arctic Ecological Research”                             |

|                |  |
|----------------|--|
| December 2004  | San Francisco. Annual meeting of Toolik Field Station Steering Committee   |
| December 2004  | San Francisco. Annual meeting of the American Geophysical Union (poster presented)   |
| December 2004  | University of Massachusetts, Boston. Seminar on "Climate Change and Ecosystem Stoichiometry in an Arctic Landscape, Toolik Lake, Alaska"   |
| January 2005   | Fort Myers, FL GSCTE-TERRAC Workshop on "Model-Experiment Interactions in Global Change Research" Meeting organizer  |
| January 2005   | Seattle, WA. Research Planning Workshop of the ARCSS-LAII program  |
| February 2005  | Woods Hole, Massachusetts. Annual workshop of the Arctic LTER research group.  |
| February 2005  | Boulder Colorado. Seminar on "Climate Change and Ecosystem Stoichiometry in an Arctic Landscape, Toolik Lake, Alaska"  |
| February 2005  | Washington, DC ESA Governing Board planning meeting on new initiatives in Public Affairs   |
| March 2005     | Irvine, CA. Seminar on "Climate Change and Ecosystem Stoichiometry in an Arctic Landscape, Toolik Lake, Alaska"  |
| April 2005     | Vrije Universitet, Amsterdam. Seminar on "Climate Change and Ecosystem Stoichiometry in an Arctic Landscape, Toolik Lake, Alaska"  |
| May 2005       | Dourdan, France. International workshop on "Biodiversity and Global Climate Change"  |
| May 2005       | Washington, DC. ESA Governing Board  |
| May 2005       | Washington, DC. Study of Environmental Arctic Change: Steering Committee   |
| July 2005      | Longyearbyen, Svalbard, Norway. Field work and gave 2 lectures in an international summer field course in Arctic Plant Ecology, organized by UNIS, the University Center in Svalbard |
| August 2005    | Montreal, Quebec. Annual meeting of the ESA (2 talks presented, session organizer) and ESA Governing Board   |
| August 2005    | Sydney, Australia. Workshop on Plant N-P strategies (talk presented)   |
| September 2005 | Virginia Coast Reserve, Virginia. LTER Coordinating Committee and Symposium (talk presented)   |
| September 2005 | Amsterdam, Netherlands. Opponent at thesis defense of Ellen Dorrepaal, Vrije Universitet Amsterdam   |
| October 2005   | Washington DC. ESA Governing Board   |
| November 2005  | Copenhagen, Denmark. International Conference on Arctic Research Planning (ICARP II).  |
| December 2005  | Fairbanks, Alaska. SEARCH Steering Committee   |

January 2006 Merida, Yucatan, Mexico Joint meeting of Ecological Society of America and Mexican Ecological Society

January 2006 Miami, Florida. 13<sup>th</sup> ITEX meeting (talk presented)

February 2006 Durham, England. Seminar on "'Changing vegetation composition—does it make any difference to CO<sub>2</sub> flux, productivity, or biomass accumulation in arctic ecosystems?" Also, external examiner on Ph.D. defense of James Cook

March 2006 Sydney, Australia. 2<sup>nd</sup> Workshop on Plant N-P strategies (talk presented)

March 2006 Providence, RI. Workshop on "Impacts of Disaster: Comparing Ecological and Social Resilience. Talk presented on "Resilience and Sustainability in a World of Constant Change: What is the reference state?"

March 2006 Boston, MA. Boston University Center for Ecology and Conservation. Seminar on "Changing vegetation composition—does it make any difference to CO<sub>2</sub> flux, productivity, or biomass accumulation?"

May 2006 Cedar Creek National History Area, Minnesota. LTER Coordinating Committee

May 2006 Washington DC. ESA Governing Board and Science Committee

May 2006 Helsingor, Denmark. International Workshop on "Effects of Precipitation Change on Terrestrial Ecosystems"

May 2006 Abisko Natural Science Research Station, Sweden. Workshop on Arctic Carbon Cycling Research

August 2006 ESA Annual meeting and Governing Board, Memphis, TN

September 2006 Estes Park, CO US LTER All Scientists' meeting. Workshop organizer and speaker in two workshops

October 2006 Woods Hole Oceanographic Institute. US Arctic Research Commission, invited speaker on upscaling of plot-scale research results

November 2006 Washington DC. Search Steering Committee Meeting

November 2006 Washington DC. ESA Governing Board

December 2006 Hartford, CT NEON RFI organizational meeting

February 2007 Washington DC. Invited briefing to NSF-OPP on interactions of LTER, IPY, and NEON at Toolik Lake

March 2007 Brown University, Providence RI. Meeting on "Ecological Foundations of Sustainability in a Constantly Changing World" (Meeting host & organizer)

March 2007 Boulder, CO IPY-AON Principal Investigators meeting

April 2007 University of Georgia, Athens, GA. LTER planning meeting, Integrated Science for Society and the Environment

May 2007 Washington, DC ESA Governing Board

|                |   |
|----------------|---|
| May 2007       | Portland, OR LTER Science Council   |
| August 2007    | San Jose, CA. ESA Annual meeting and Governing Board  |
| August 2007    | Boulder, CO. NEON GCE (Global Change Experiment) planning meeting   |
| September 2007 | Abisko, Sweden. International Workshop on High Latitude Terrestrial and Freshwater Ecosystems (Organizing Committee, Plenary Speaker)   |
| October 2007   | Duke University. Invited seminar on “Changing views of a changing Arctic”   |
| October 2007   | Stirling University, Scotland. Workshop/ writing session on Circumpolar Arctic Biodiversity   |
| November 2007  | Washington, DC. Annual meeting of SEARCH Scientific Steering Committee  |
| December 2007  | Woods Hole, MA. Ecosystems Center seminar on “Changing Views of a Changing Arctic Tundra”   |
| February 2008  | Boston, MA Symposium organizer and speaker at AAAS meeting, “Ecology for Sustainability”  |
| February 2008  | NSF, Arlington, VA. Invited workshop attendee, “Cyberinfrastructure for Environmental Observing Networks”   |
| March 2008     | Palisades, NY. Arctic Observing Network PIs meeting   |
| April 2008     | Edmonton, Alberta, Canada. International Workshop on Sustaining Arctic Observing Networks (SAON). Organizer and presenter in a special side session on carbon, water, and energy flux monitoring. |
| May 2008       | Baltimore, MD LTER Science Council  |
| August 2008    | Milwaukee, Wisconsin. ESA Annual meeting  |
| September 2008 | Fairbanks and Toolik Lake, Alaska. National Science Board; presentation on LTER and NEON research at Toolik Lake  |
| December 2008  | Woods Hole, MA Workshop on C, water, and energy fluxes in arctic landscapes   |
| December 2008  | San Francisco, CA. Annual meeting of AGU. Invited paper on “Fire and Ice: Surprises in a Warming Arctic Land Surface”   |
| February 2009  | University of Alaska, Fairbanks. Seminar on “Heterogeneity and change in the arctic landscape”  |
| March 2009     | Fairbanks, AK. Annual meeting of Bonanza Creek LTER. Presented talk on Anaktuvuk River Fire   |
| May 2009       | State College, PA. Penn State University Plant Biology Symposium. Invited talk on “Changing Views of a Changing Arctic Tundra”  |
| July 2009      | University of Utah, Salt Lake City. DOE Next Generation Ecosystem Experiment Planning Meeting   |

|                |   |
|----------------|---|
| August 2009    | Albuquerque, NM. ESA Annual Meeting. Presented paper and coauthor of three others; presided over a session              |
| September 2009 | Estes Park, CO. LTER All Scientists Meeting. Co-chair of Program Committee  |
| September 2009 | Villefrance-sur-mer, France. Meeting of Scientific Steering Committee, International Study of Arctic Change             |
| November 2009  | Boulder, CO. AON PI meeting   |
| December 2009  | Boulder, CO. AON Design and Implementation planning meeting<br>San Francisco. AGU Annual Meeting. Coauthor of two talks |
| March 2010     | Miami, FL State of the Arctic Meeting. Presented paper, participated in ISAC SSC meeting                                |
| April 2010     | Vancouver, BC. ITEX community change workshop   |
| May 2010       | Toolik Lake, AK. Lecture in Field Ecology Course  |
| June 2010      | Toolik Lake, AK. Lecture, field trip in Science Journalism course   |

### Reviews

#### Proposals:

|        |  |
|--------|--|
| 1979 - | NSF Ecology Program (2 proposals)  |
| 1980 - | NSF Ecology Program<br>NSF Ecosystems Analysis<br>NSF Population Biology and Physiological Ecology                           |
| 1981 - | NSF Ecology Program (2 proposals)<br>NSF Ecosystems Analysis<br>NSF Population Biology and Physiological Ecology (2)         |
| 1982 - | NSF Ecosystems Analysis<br>NSF Ecology<br>NSF Population Biology and Physiological Ecology (2)                               |
| 1983 - | NSF Ecosystems Analysis (3)<br>NSF Population Biology and Physiological Ecology (3)<br>NSF Polar Programs (4)<br>NSF Ecology |
| 1984 - | NSF Ecosystems<br>NSF Ecology<br>NSF Population Biology and Physiological Ecology (5)<br>DOE CO <sub>2</sub> Program         |
| 1985 - | NSF Ecology<br>NSF Population Biology and Physiological Ecology (2)<br>NSF Polar Programs (2)                                |
| 1986 - | NSF Ecosystems (4)<br>NSF Polar Programs (3)   |
| 1987 - | NSF Population Biology and Physiological Ecology (2)<br>NSF Ecosystems (7)<br>NSF Polar Programs                             |
| 1988 - | NSF Ecology (2)<br>NSF Ecosystems (7)  |

- DOE CO<sub>2</sub> Program
- NSF Climate Dynamics
- NSF Polar Programs
- Earthwatch
- 1989 - NSF Ecosystems (2)
- DOE Theoretical Ecology
- NSF Ecology
- NSF Population Biology and Physiological Ecology (2)
- Electric Power Research Institute (9)
- 1990 - NSF Ecosystems (3)
- NSF Population Biology and Physiological Ecology (3)
- NSF Polar Programs (2)
- British Natural Environment Research Council (2)
- 1991 - USDA/NRICGP Forest/Rangeland/Crop Ecosystems Program
- NASA Earth Systems Science
- Earthwatch/Center for Field Research (2)
- NSF Ecosystems
- NSF Ecology
- NSF Division of Polar Programs (ARCSS-PALE)
- BION (Netherlands Organization for Scientific Research)
- British Natural Environment Research Council
- 1992 - USDA/NRICGP Forest/Rangeland/Crop Ecosystems Program
- USDA/NRICGP Plant Responses to Environment Program
- NASA-Global Change Fellowship Program (2)
- New York Sea Grant Institute
- NSF Ecosystems (Panel member)
- NSF DPP-ARCSS
- 1993 - NSF Ecosystems (Panel member 2x)
- NSF OPP
- 1994 - NSF Ecosystems (1)
- NSF Long-term Studies (1)
- NSF LTER Program (Panel member)
- NASA Global Change Research Graduate Fellowship Program (2)
- 1995 - NSF Ecosystems (Panel member 2x)
- Natural Environment Research Council, Great Britain (4)
- DOE Global Change Research Program
- 1996 - NSF Ecosystems (Panel member and Program Officer)
- National Geographic Society
- NSF-OPP, Arctic Systems Science
- 1997 - NSF Ecosystems (Program Officer)
- NSF Environmental Geochemistry and Biogeochemistry (Program Officer)
- Natural Environment Research Council, United Kingdom
- 1998 - NSF/BIO Doctoral Dissertation Improvement Awards (Program Officer)
- NSF/Interagency TECO Program (Program Officer)
- NSF Ecosystems (Program Officer)
- Nature Conservancy
- 1999- Canadian NSERC Major Facilities Access Program (Panel Member; 54 proposals)
- USDA Plant Responses to the Environment
- NSF Ecological and Evolutionary Physiology
- NSF Ecology
- NSF Ecosystem Studies (3)
- NSF Integrated Research Challenges in Environmental Biology
- NSF Office of Polar Programs—Arctic systems Science Program
- NSF Population Biology
- IGBP-GCTE Core Research Program (2)

Chilean National Fund for Science and Technology (FONDECYT)  
 Earthwatch  
 2000- Canadian NSERC Major Facilities Access Panel Site Review, St. Johns, Newfoundland  
 Nebraska EPSCOR  
 NSF Ecology (2)  
 NSF Biocomplexity  
 NSF Office of Polar Programs—Arctic Natural Sciences Program  
 NSF Ecological and Evolutionary Physiology  
 2001- USDA Plant Responses to the Environment  
 NASA Carbon Cycle Studies (2)  
 NSF Ecology  
 NSF LTREB  
 NSF Arctic Systems Science  
 2002- USDA Soils and Soil Biology  
 NSF Ecosystems (2)  
 NSF OPP Arctic Natural Sciences  
 NSF Integrated Research Challenges in Environmental Biology  
 NSF GEO Carbon Cycle Science  
 NSF OPP Antarctic Sciences  
 2003- Netherlands Organization for Scientific Research  
 NSF Ecosystems (2)  
 NSF FIBR  
 NSF Ecology  
 NSF OPP Arctic Natural Sciences  
 Ecological and Evolutionary Physiology  
 2004- NSF Ecosystem Studies  
 NSF OPP Arctic Systems Science  
 NSF LTREB  
 NSF FIBRE  
 Australian Research Council Discovery Projects  
 US National Academy of Sciences INTREU program  
 NSF OPP “SNACS” program  
 DOE Program for Ecosystem Research  
 2005- NSF-DEB Ecosystem Studies (2)  
 NSF-IOB Environmental and Structural Systems  
 NSF OPP Postdoctoral Program  
 NSF OPP ARCSS Synthesis competition  
 2006- NSF Integrative Organismal Biology  
 NSF OPP  
 NSF OPP Arctic Systems Science  
 NSERC Government of Canada Program for International Polar Year  
 NSF Long Term Research in Environmental Biology (LTREB)  
 NSF Ecosystem Studies (2)  
 NSERC (Canada) International Polar Year  
 2007- NSF Ecosystem Studies  
 NSF Long Term Research in Environmental Biology (LTREB)  
 NSF International Programs  
 NSERC (Canada) Discovery Grant program  
 2008- NSF Ecosystem Studies (3)  
 NSF OPP Postdoctoral Fellowships in Polar Regions Research  
 2009- NSF Arctic Research Support and Logistics  
 NSF OPP Arctic Systems Science  
 NSF DEB Long Term Research in Environmental Biology  
 2010- NSF-OPP Arctic Systems Science  
 NSF-DEB Ecosystem Studies

Publications:

- 1979 - Ecology  
Ecological Monographs
- 1980 - Ecology  
Canadian Journal of Botany
- 1982 - Ecology (2)  
Polar Biology  
Canadian Journal of Forest Research
- 1983 - Proceedings 4<sup>th</sup> International Conference on Permafrost  
Ecology (2)  
Arctic and Alpine Research (3)  
Oikos (2)  
Holarctic Ecology (2)
- 1984 - Ecology (3)  
American Midland Naturalist  
Arctic and Alpine Research (2)  
Canadian Journal of Botany  
Environmental and Experimental Botany
- 1985 - Ecology (4)  
Canadian Journal of Botany  
Arctic and Alpine Research  
American Journal of Botany  
American Naturalist
- 1986 - Ecology (2)  
Arctic and Alpine Research  
American Naturalist  
Biogeochemistry
- 1987 - Arctic and Alpine Research (2)  
Symposium on Chaparral Ecology  
American Journal of Botany  
Journal of Ecology  
American Midland Naturalist  
Science  
Biogeochemistry  
Ecology
- 1988 - Science  
Canadian Journal of Botany (2)  
Journal of Ecology  
Holarctic Ecology (2)  
BioScience  
Ecology
- 1989 - Arctic and Alpine Research  
American Journal of Botany  
Canadian Journal of Botany  
Ecology (3)  
Landscape Ecology (2)  
Oecologia Plantarum
- 1990 - Oecologia  
Holarctic Ecology  
Arctic and Alpine Research  
Biogeochemistry  
Landscape Ecology  
Ecology (3)  
Science

- Acta Oecologia  
 American Naturalist  
 1991 - Blackwell Scientific Publications, Inc.  
 Arctic and Alpine Research  
 Estuaries  
 Oecologia (2)  
 Ecology  
 Holarctic Ecology  
 Canadian Journal of Botany  
 Vegetation  
 Journal of Vegetation Science  
 1992 - Ecology and Ecological Monographs (Editorial Board)  
 Oecologia (2)  
 Journal of Ecology  
 American Journal of Botany  
 Nature  
 1993 - Ecology and Ecological Monographs (Editorial Board)  
 Trends in Ecology and Evolution  
 Oecologia  
 Encyclopedia of Environmental Biology  
 1994 - Ecology and Ecological Monographs (Editorial Board)  
 Global Change and Arctic Terrestrial Ecosystems (Proceedings)  
 Oecologia  
 Biogeochemistry  
 Canadian Journal of Forest Research  
 1995 - Ecology and Ecological Monographs (Editorial Board)  
 Arctic, Antarctic, and Alpine Research (Interdisciplinary Advisory Board)  
 Global Change and Arctic Terrestrial Ecosystems (Proceedings)  
 Biogeochemistry  
 Ecological Bulletins (Swedish NFR)  
 Journal of Ecology  
 1996 - Ecology (ad hoc editor)  
 Biogeochemistry  
 Journal of Ecology (2)  
 Canadian Journal of Botany  
 Nature  
 Vegetatio  
 1997 - Arctic, Antarctic, and Alpine Research (Interdisciplinary Advisory Board)  
 Ecology (2)  
 Academic Press (book)  
 Cary Conference  
 Oecologia  
 Biogeochemistry  
 1998 - Arctic, Antarctic, and Alpine Research (Interdisciplinary Advisory Board)  
 Tree Physiology  
 Oikos  
 Plant Ecology  
 Proceedings Workshop on Role of the Polar Regions in Global Change  
 1999 - Ecosystems (Editorial Board)  
 Arctic, Antarctic, and Alpine Research (Interdisciplinary Advisory Board)  
 Polar Biology (2)  
 Ecological Applications  
 Ecography (2)  
 Oikos  
 Oecologia

Journal of Climate (2)  
 Journal of Ecology (2)  
 Proceedings National Academy of Sciences (2)  
 Biogeochemistry  
 2000- Ecosystems (Editorial Board)  
 Plant and Soil (Editorial Board)  
 Arctic, Antarctic, and Alpine Research (Interdisciplinary Advisory Board & reviewer)  
 Nature  
 Ecography  
 Journal of Climate  
 Science  
 Oecologia (2)  
 Climate Change  
 Functional Ecology  
 Journal of Vegetation Science  
 Oikos  
 Ecology  
 Biogeochemistry  
 2001- Ecosystems (Editorial Board)  
 Plant and Soil (Editorial Board)  
 Oikos  
 Journal of Vegetation Science  
 Nature (3)  
 Natural History  
 Journal of Ecology (2)  
 Biogeochemistry  
 2002- Ecosystems (Editorial Board)  
 Plant and Soil (Editorial Board)  
 Functional Ecology  
 Nature (2)  
 Arctic, Antarctic, and Alpine Research (2)  
 Ecology (2)  
 JGR-Atmospheres  
 Plant and Soil  
 Advances in Ecological Research  
 American Naturalist  
 2003- Ecosystems (Editorial Board)  
 Island Press  
 Functional Ecology  
 Permafrost and Periglacial Processes  
 BioScience  
 Biogeochemistry (2)  
 Global Change Biology  
 Cary Conference (Proceedings)  
 Frontiers in Ecology and the Environment  
 2004- Global Change Biology  
 Nature  
 Ecology  
 Biogeochemistry  
 Millennium Ecosystem Assessment  
 Oikos  
 IGBP-GCTE Synthesis Volume  
 Journal of Ecology (2)  
 Arctic, Antarctic, and Alpine Research  
 2005- Nature

Soil Biology and Biochemistry  
 Ecology Letters  
 Frontiers in Ecology and Environment  
 Global Change Biology  
 Oecologia  
 Oikos  
 2006- Ecology  
 Journal of Ecology (2)  
 Ecological Applications  
 2007- Global Change Biology (2)  
 Nature (3)  
 JGR Biogeosciences (3)  
 PNAS  
 Journal of Ecology  
 2008- Journal of Ecology  
 Proceedings National Academy of Sciences  
 University of British Columbia (Ph.D. dissertation)  
 PNAS  
 Oecologia  
 2009- Functional Ecology  
 Ecology  
 PNAS  
 New Phytologist  
 Proceedings of the Royal Society B  
 2010- New Phytologist  
 Science  
 Journal of Geophysical Research  
 Global Change Biology

Reviews for Promotion, Tenure, and Faculty Honors

1987 Swedish Natural Sciences Research Council  
 1997 West Virginia University  
 1999 University of Michigan  
 University of Minnesota Twin Cities  
 Chilean National Fund for Science and Technology (FONDECYT)  
 2000 Kansas State University  
 Wallenberg Foundation (Sweden)  
 2001 Ohio State University  
 2002 Queens University (Canada)  
 2003 Mount Holyoke College  
 University of Minnesota Twin Cities  
 Carlsberg Foundation (Denmark)  
 2004 Boston University  
 2005 Binghamton University (SUNY)  
 Queens University (Canada)  
 Institute of Ecosystem Studies (New York)

|      |   |
|------|---|
| 2007 | University of Minnesota Duluth<br>University of Maryland<br>University of Florida<br>Stellenbosch University (South Africa) |
| 2008 | Stirling University (Scotland)  |
| 2009 | Purdue University   |
| 2010 | University of Minnesota Duluth  |

#### Educational Activities

|              |  |
|--------------|--|
| 1980         | Ecology (January Course)   |
| 1981         | Basic Ecology and the Management of Resources (January Course)                 |
| 1980-81      | Ecosystems Center Interns-in-Science Program (Preceptor)                       |
| 1982-83      | Graduate Student Advisory Committee (B. Howes - BUMP)                          |
| 1986-89      | Graduate Student Advisory Committee (D. Valentine - Duke Univ.)                |
| 1995         | External "Opponent" University of Göteborg, Sweden (Mats Havström)             |
| 1996         | External Examiner, Australian National University (Jason Lutze)                |
| 2002         | External "Opponent" Umeå University, Sweden (Joachim Strengbom)                |
| 2003         | External "Opponent" Uppsala University, Sweden (Sofie Sjögerstrom)             |
| 2004         | External "Opponent" Lund University, Sweden (Maria Olsrud)                     |
| 2005         | External "Opponent" Vrije Universitet Amsterdam, Netherlands (Ellen Dorrepaal) |
| 2006         | External Examiner, Durham University, UK (James Cook)                          |
| 2008         | External Examiner, University of British Columbia (Trevor Lantz)               |
| 1998-present | MBL Semester in Environmental Sciences   |
| 1993-present | Supervisor, NSF-REU students, Toolik Lake, Alaska, and Abisko, Sweden          |
| 2006-2008    | Brown University, Course Lecturer  |
| 2008-present | Field Ecology course, University of Alaska, Toolik Lake                        |
| 2008-present | Logan Science Journalism Program, Toolik Lake AK                               |

#### Committees, Consulting, and Advice

|            |  |
|------------|--|
| 1982       | Conservation Law Foundation of New England, on off-road vehicle use in Cape Cod National Seashore.                   |
| 1984-86    | Thornton Burgess Society, Greenbriar Nature Center, Research Advisory Committee.                                     |
| 1987       | EPA, Advisory Panel on Research Needs in Climate Change  |
| 1987-88    | NSF, Advisory Panel on Long-Term Technological Needs of the LTER Program   |
| 1988-94    | Ecological Society of America, Membership Committee (Chairman, 1991-1994)  |
| 1989-91    | Year-Round Scientists' Council, Marine Biological Laboratory   |
| 1989-90    | Green Mountain Power Corporation, on effects of hydropower development on greenhouse gas emissions to the atmosphere |
| 1990-91    | Steering Committee, Land/Atmosphere/Ice Interactions, NSF Arctic Systems Science Program                             |
| 1990-95    | EPRI, CO <sub>2</sub> program Review Panel   |
| 1991       | EPA, Consultant on development of an Arctic North Slope Ecorestoration Research Strategy (ANSWERS)                   |
| 1991-1992  | Audit Committee, Marine Biological Laboratory  |
| 1992-1995  | Editorial Board, Ecology and Ecological Monographs   |
| 1992-1996  | Panel member, NSF Ecosystem Studies Program  |
| 1992-1993  | Site reviews of NSF-LTER sites at Cedar Creek, Minnesota, and Central Plains Experimental Range, Colorado            |
| 1993-1995  | Council member, Arctic Research Consortium (ARCUS)   |
| 1994       | Panel Member, NSF LTER Program   |
| 1994-1995  | Organizing committee, Workshop on future needs of Toolik Field Station   |
| 1995- 2006 | Interdisciplinary Advisory Board, Arctic and Alpine Research, Univ. Colorado   |

1996- present Steering Committee, Toolik Field Station, Institute of Arctic Biology  
 1996-98 Program Director, NSF Ecosystem Studies Program  
 1997-2004 Steering Committee, IGBP/GCTE Focus 1, "Ecosystem Physiology"  
 1997 Program Director, NSF Environmental Geochemistry and Biogeochemistry (EGB) Program (NSF Director's award for Collaborative Integration)  
 1998 Site reviews of NSF-LTER sites at Cedar Creek, Minnesota, Sevilleta NWR, New Mexico, and Luquillo NF, Puerto Rico  
 1998 Program Director, NSF/BIO Doctoral Dissertation Improvement Program  
 1998 Program Director, NSF Terrestrial Ecology and Global Change (TECO) Program  
 1998 Advisory Committee, Fritz Went Laboratory, Desert Research Institute, Univ. Nevada Reno  
 1999-present Editorial Board, ECOSYSTEMS  
 1999 Canadian National Science and Engineering Research Council (NSERC) Major Facilities Access Program (Panel Member)  
 1999 Site Review of Ocean Science Center, Memorial University of Newfoundland, for Canadian National Science and Engineering Research Council (NSERC) Major Facilities Access Program  
 2000-2002 Editorial Board, Plant and Soil  
 2000-2002 Executive Committee, US LTER Network  
 2000-2003 Steering Committee, ARCSS-LAII program  
 2000-2007 Steering Committee, Study of Environmental Arctic Change (SEARCH)  
 2003-2004 Science Fair Judge, Falmouth Academy  
 2004 University of Maryland Center for Environmental Research. Review team and site visit  
 2004-2007 Ecological Society of America, Vice President for Science  
 2008-present International Study of Arctic Change, Scientific Steering Group