**RICHARD D. BOWDEN**

Allegheny College Citizenship: U.S.A.

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Last update: 18 June, 2024 http://sites.allegheny.edu/envsci/faculty/richard-bowden/

Education:

Ph.D., M.S., M. Phil., 1987, Yale University, School of Forestry and Environmental Studies, CT.

M.S., 1981, Michigan Technological University, Biology Dept, MI.

B.A., 1978, Northland College, WI.

Research and Teaching Experience:

2006-present Allegheny College (Professor: 2006-present; Associate Professor: 1997-2006; Assistant Professor: 1990-1997)

2005, Summer U. Michigan Biological Station, Professor

1987-1990 The Ecosystems Center, Postdoctoral Research Associate

Feb.-June 1987 Yale University, Postdoctoral Research Associate

Research and Professional Interests:

Forest Ecosystems, Natural and Human Disturbance of Forest Ecosystems, Carbon and Nitrogen Cycling, Global Climate Change, Atmospheric Nitrogen Deposition, Service Learning and Experiential Education, Environmental Sustainability, Biofuels

Highlighted items represent 2024-2025 additions or continuing activities.

Professional Responsibilities:

Judge, Research Science Consortium, Tom Ridge Environmental Center, Erie, PA Annual Student Conference, 2019, 2023-present

Advisor, Woods and Grounds Committee, Mount Saint Benedict Monastery, Erie, PA, 2022-present

Associate Editor, Frontiers in Forests and Global Change, Forest Soils, 2022-present

Associate Editor, Forests. 2022-present

Member, Northwest Pennsylvania Woodland Association (NWPWA) Advisory Board, 1999-present, Vice-President 2014-2017.

Member, Advisory Board, Foundation for Sustainable Forestry, 2018-present, treasurer 2022-present.

Member, 2018, 2023, 2028 North America Forest Soils Conference Steering Committee, 2013-present

Judge, Annual Sigma Xi Conference, Penn State-Behrend, 2015, 2016, 2017, 2018, 2019, 2021, 2023, 2025

Member, Seton Catholic School Board, 2003-present; President, 2011-2014

Member, Executive Committee, 2000-present; Pennsylvania Environmental Resource Consortium Executive Committee, Chair 2001-2009; President 2011-2012

Carnegie Science Award Selection Committee, 2019

Judge, PA Jr. Academy of Sciences: 2010, 2011, 2012, 2017-2020, 2024

Community Sustainability Session Moderator, Pennsylvania Environmental Research Consortium, Annual Meeting, State College, PA, 2014

Co-Chair, NSF LTER 2015 All Scientists Meeting, Steering Committee 2014-2015

Member, Long-Term Ecological Research Program, 2012 All Scientists Meeting Steering Committee

Co-Director, Penn’s Woods Project, 2010-2016

Member, Steering Committee, PA Great Lakes Region Nature Tourism Initiative, 2006-2009

Member, Executive Committee, Allegheny College Center for Economic and Environmental Development, 1995-1996, 2006-2010

Member, Executive Committee, Northeast Campus Sustainability Consortium, 2004 - 2015

Member, Pennsylvania Wild Resource Conservation Program Advisory Committee, 2009 – 2012.

Sustainable Forestry Project Co-Director, Allegheny College Center for Economic and Environmental Development, 2002-2010

Ecotourism Project Director, Allegheny College Center for Economic and Environmental Development, 1997-2010.

Member, Pennsylvania Game Commission, WMU-1B Citizens Advisory Committee, 2007

Reader, College Board Advanced Placement Exam, Environmental Sciences, Nebraska, 2007, 2009

Member, Seton Catholic School Core Team for Development, 2002-2006, Chair:, 2002-2004, 2005-2006

Member, Ecological Society of America, Odum Award Subcommittee for Excellence in Ecology Education, 2000-2003

Member, French Creek Project Science Committee, 1995-1997

Member, French Creek Project Advisory Committee, 1995-1996

Member, Crawford County Well Head Protection Steering Committee, 1995-1996

Project Coordinator and Student Advisor, 1993-1995, Harvard Forest NSF REU Summer Program

Advisor, Northeast Center for the National Institute for Global Environmental Change summer fellows, 1992-1995

Advisor, PA Jr. Academy of Sciences contestants: 1992-1993, 1995-1996

Academic Responsibilities:

Search Committee Member, Director of Orientation and Advising 2025

Chair, Student Enrichment Committee (formerly Campus Life and Community Standards Committee) 2024-present

Search Committee Member, Allegheny Public Safety Director 2024

Advisor, Campus vegetation management, Allegheny College Physical Plant 2022-2025

Campus Safety Office Traffic Appeals Committee, 2023-25

Allegheny College Campus Ecosystem Task Force, 2022-present

Faculty advisor, Environmental Science and Sustainability Newsletter, 2017-present

ESS contact for Semester in Ecosystem Science Program, Woods Hole, MA, 2005-present

Admissions Dept. Master’s Classes, “Climate Change Knows No Politics; Greening the Meadville Community: Partnering Students with Local Development” (2017-2025)

Faculty Mentor, 2023-2024

Editor, ESS Report: Outward -Facing Course Activities and Projects in the Department of Environmental Science and Sustainability. A Report Submitted to the President and Provost of Allegheny College. 2024.

Member, Search Committee, Allegheny College VP for Enrollment Management, 2024

Field Trip leader, World Symposium on Sustainable Development in Universities, 2022

Review of U.S. Environmental Geology Minors for development of AC Environmental Geology Minor, 2022

Member, Civic Engagement Advisory Committee, 2011 – 2020

Member, VESA Steering Committee, 2008? – 2020

Recruiting sessions for prospective football students, 2017-2019

Chair, Institutional Review Board, 2014-2016, 2018-2020, member 2012-2014, spring 2022

AC Commencement Marshal, 2019

Entrance Advising, 2016-2018, 2022

HS Enrichment Program: Forest Management Course 2018-2019

Adult Enrichment Program: Climate Change Course 2018-2019

Faculty Leader, Alternative Spring Break, Roanoke, VA, Spring, 2017, Nashville, TN, Spring 2016

Environmental Science Departmental Seminar Series Coordinator, 2017.

Chair, Finance and Facilities Committee Forest Management Subgroup 2014-2016

Member, Allegheny College Climate Change Initiative, 2007

Member, Allegheny College Presidential Environmental Task Force, 2006-2008

Member, Allegheny College Library and Information Technology Committee, 2005-2008

Chair, Allegheny College, Department of Environmental Science, 1998-2002, Fall 2011

Member, Allegheny College Campus Life Committee, 1998-2002 (Chair 2000-2002)

Member, Allegheny College Faculty Council, 1995-1997

Member, Allegheny College Judicial Board, 1993-1995

Courses Taught:

Conservation of Natural Resources, Principles of Environmental Analysis, Environmental Research Methods, Experimental Advising I,II, Introduction to Environmental Science, Senior Research Seminar, Junior Research Seminars (Sustainable Landscaping, Art and the Environment, Land Use, Forest Conservation, Ecotourism, Wildlife Habitat Management), Rocky Mountains: Natural Resource Controversies and Compromises, Forest Ecology and Management, Biogeochemistry, Threatened Ecosystems, Climate Change

Honors:

Allegheny College Julian Ross Award for Excellence in Teaching, 2023

Carnegie Science Award, University/Post-Secondary Educator, 2016

Allegheny College Teacher-Scholar Chair, 2000-2003

Journal of Environmental Quality, 1997 Editor's Citation for Excellence in Manuscript Review

Newton Bobb Speaker, Northland College, WI, 1990

Professional Fellowships

University of Michigan Biological Station Summer Research Fellow, 2006

Harvard University Bullard Fellow, 2004-2005

Assistantships

Yale University Research Assistantship, 1985-1987

Yale University Graduate Fellowship, 1980-1984

Michigan Technological University Teaching Assistantship, 1978-1980

Northland College Scholarship, 1974-1978

Publications (*\* present or former undergraduate author;* *29 student authorships):*

*In preparation*

68. Shen,X., G. Yin,, Y. Cao,, R.D. Bowden, I. Wrightson, M. Simpson, K. Lajtha, J. Wang. 2025. Long-term detrital input manipulation alters black carbon persistency in forest soils. To be submitted to the Journal of Environmental Science & Technology.

*Submitted*

67. Wrightson. I, R.D. Bowden, J-J. Wang, K. Lajtha, M.J. Simpson. 2025. Sustained microbial reorganization after 30 years of variations in litter deposition underpin the persistence of soil organic matter molecular classes. Submitted to Sci. Tot. Env.

Published

66. Pearce, K.A., **R.D. Bowden**, B.A. Choate, K. Boulton, K. Royal,\* A.L. Loch,\* M.A. Miller,\* B. Foley\*, and E. Tekelenberg.\* 2025. Expanding sustainability to include our non-human partners: College campuses as models of wildlife habitat. pp 455–479. In: Filho, W.L., Newman, J., Lange Salvia, A., Viera Trevisan, L., Corazza, L. (eds) North American and European Perspectives on Sustainability in Higher Education. World Sustainability Series. Springer, Cham. https://doi.org/10.1007/978-3-031-80434-2\_26.

65. **Bowden, R.D**., M.J. Simpson, N. Paz Saucedo,\* K. Brozell,\* J. DiGiacomo,\* K. Lajtha. 2024. Litter and root sources of soil organic matter in a temperate forest: 30 years in the DIRT. Soil Sci. Soc. Am. 88: 593-601. doi.org/10.1002/saj2.20634.

64. **Bowden, R.D.,** K. Ams, T. Bensel, M. Bethurem, K. Boulton, L. Branby, C. Bradshaw-Wilson, D. Byrnes, I. Carbone, B. Choate, L. Demi, W. Kedzierski, E. Pallant, K. Pearce, C. Shaffer, J. Swann-Quinn. 2023. College-community environmental collaborations: Guidance for successful community-based projects and research. In *Educating the Sustainability Leaders of the Future*. Leal Filho, W., A. Lange Salvia, E. Pallant, B. Choate, K. Pearce, Eds. Springer Nature, Switzerland. DOI: 10.1007/978-3-031-22856-8\_22.

63. **Bowden, R.D.**, T. Bensel, G. Dunkle, B. Kozalla,\* A. Maloney. 2023. Academic and non-profit environmental organization collaboration: A case study on forest conservation with Allegheny College and the Foundation for Sustainable Forests. In *Educating the Sustainability Leaders of the Future*. Leal Filho, W., A. Lange Salvia, E. Pallant, B. Choate, K. Pearce, Eds. Springer Nature, Switzerland. DOI: 10.1007/978-3-031-22856-8\_25.

62. Buck, P., S. Barnhart, **R.D. Bowden**, B. Culbertson, J. Hooper, M. Mumper, D. Scicchitano, K. Shultes, T. Simpson. 2023. The Pennsylvania Environmental Resource Consortium: A state-wide collaborative network for sustainable outreach, education, and action. In *Educating the Sustainability Leaders of the Future*. Leal Filho, W., A. Lange Salvia, E. Pallant, B. Choate, K. Pearce, Eds. Springer Nature, Switzerland. DOI: 10.1007/978-3-031-22856-8\_29.

61. Swann-Quinn, J., E. Pallant, K. Boulton, J. Michael, S. McRae,\* **R.D. Bowden**. 2023. Growing a resilient campus forest: Opportunities, barriers, solutions. In *Educating the Sustainability Leaders of the Future*. Leal Filho, W., A. Lange Salvia, E. Pallant, B. Choate, K. Pearce, Eds. Springer Nature, Switzerland. DOI: 10.1007/978-3-031-22856-8\_27.

60. Castañeda-Gómez, L. K. Lajtha, **R.D. Bowden**, F. Nahidha, M. Jauhar, J. Jia, X. Feng, M.J. Simpson. 2023. Soil organic matter molecular composition with long-term detrital alterations is controlled by site-specific forest properties. Global Change Biology 29:243-259. doi.org/10.1111/gcb.16456

59. Wang, Y., Y. Liu, R.K Chu, **R.D. Bowden**, K. Lajtha, M.J. Simpson, J. Wang. 2022. Characterization of sequentially extracted soil organic matter by electrospray ionization and atmospheric pressure photoionization Fourier transform ion cyclotron resonance mass spectrometry. ACS Earth Space Chem. 6: 2142–2148. doi.org/10.1021/acsearthspacechem.2c00180.

58. **Bowden, R.D**., A. Caylor,\* G. Hemmelgarn,\* M. Kresse,\* A. Martin,\* M. Althouse. 2022. Prescribed browsing by goats controls multiflora rose in a black cherry-red maple deciduous forest at the Erie National Wildlife Refuge in northwestern PA. Natural Areas J. 42(3):196-205. [doi.org/10.3375/21-30](https://doi.org/10.3375/21-30)

57. Pierson, D., L. Evans, K. Kayhani**. R.D. Bowden**, K.N. Nadelhoffer, M. Simpson, K. Lajtha. 2021. Mineral stabilization of soil carbon is suppressed by live roots, outweighing influences from litter quality or quantity. Biogeochemistry 154:433–449. https://doi.org/10.1007/s10533-021-00804-9.

56. Pierson, D.N., H. Peter-Contesse, **R.D. Bowden**, K. Nadelhoffer, K. Kayhani, L. Evans, K. Lajtha. 2020. Competing processes drive the resistance of soil carbon to alterations in organic inputs. Front. Environ. Sci. 9. April 2021.[doi.org/10.3389/fenvs.2021.527803](https://doi.org/10.3389/fenvs.2021.527803).

55. Li, L., W Huang, M. Yang, Y. Liu, **R.D. Bowden**, M.J. Simpson, K. Lajtha, L.Tian, J. Wang. 2020. Chlorination of forest-derived dissolved organic matter: Long-term nitrogen deposition does not increase formation of toxic disinfection byproducts. Water Research. 2020 Oct 15;185:116271. doi: 10.1016/j.watres.2020.116271. Epub 2020 Aug 4.

54. Wang, J-J, Y. Liu, **R.D. Bowde**n, K. Lajtha, A.J. Simpson, W-L Huang, M.J. Simpson. 2020. Long-term nitrogen addition alters the composition of soil-derived dissolved organic matter. ACS Earth Space Chem. 4 (2):189–201. https://doi.org/10.1021/acsearthspacechem.9b00262

53. **Bowden**, R.D., S. J. Wurzbacher,\* S.E. Washko,\* L. Wind,\* A. Rice,\* A. Coble,\* N. Baldauf,\* B. Johnson,\* J.-J. Wang, M.J. Simpson, K. Lajtha. 2019. Long-term nitrogen addition decreases organic matter decomposition and increases forest soil carbon. *Soil Science Society of America Journal* [83(S1](https://acsess.onlinelibrary.wiley.com/toc/14350661/2019/83/S1)):S82-S95. doi:10.2136/sssaj2018.08.0293.

52. Wang, J.-J., **R.D. Bowden**, K. Lajtha, S.E. Washko,\* S.J. Wurzbacher,\* M.J. Simpson. 2019. Long-term nitrogen addition suppresses microbial degradation, enhances soil carbon storage, and alters the molecular composition of soil organic matter. Biogeochemistry 142:299–313. https://doi.org/10.1007/s10533-018-00535-4.

51. Lajtha, K., **R.D. Bowden**, S. Crow, I. Fekete, Z. Kotroczó, A. Plante, M.J. Simpson, K.J. Nadelhoffer. 2018. The detrital input and removal treatment (DIRT) network: Insights into soil carbon stabilization. Sci. Total Environ. 640–641: 1112–1120. doi: 10.1016/j.scitotenv.2018.05.388.

50. Reynolds, L.L., K. Lajtha, **R.D. Bowden**, M.M. Tfaily, B.R. Johnson, S.D. Bridgham. 2018. The path from litter to soil: Insights into soil C cycling from long-term input manipulation and high-resolution mass spectrometry. J. Geophys. Res. Biogeosciences 123(5). doi: 10.1002/2017JG004076.

49. Reynolds, L.L., K. Lajtha, **R.D. Bowden**, B.R. Johnson, S.D. Bridgham. 2017. The carbon quality-temperature hypothesis does not consistently predict temperature sensitivity of soil organic matter mineralization in soils from two manipulative ecosystem experiments. Biogeochemistry 136(3). doi: 10.1007/s10533-017-0384-z.

48. Wang, J.-J., O. Pisani, L.H. Lin, O.O.Y. Lun, **R.D. Bowden**, K. Lajtha, A.J. Simpson, M.J. Simpson. 2017. Long-term litter manipulation alters soil organic matter turnover in a temperate deciduous forest. Sci. Total Environ. 607-608. doi: 10.1016/j.scitotenv.2017.07.063.

47. Lajtha, K., **R.D. Bowden**, S. Crow, I. Fekete, Z. Kotroczó, A. Plante, M.J. Simpson, K.J. Nadelhoffer. 2017. The Detrital Input and Removal Treatment (DIRT) Network. Reference module in earth systems and environmental sciences. Ref. Modul. Earth Syst. Environ. Sci. [online]. doi: 10.1016/B978-0-12-409548-9.09774-8.

46**. Bowden, R. D.,** L. Deem,\* A. F. Plante, C. Peltre, K. Nadelhoffer, K. Lajtha. 2014. Litter input controls on soil carbon in a temperate deciduous forest. Soil Society of America Journal 78:S66-S75.

45. Fekete, I., Z. Kotroczó, C. Varga, P.T. Nagy, J.A. Tóth, R.D. **Bowden**, G. Várbíró, K. Lajtha. 2014. Alterations in forest detritus input influence soil carbon concentration and soil respiration in a Central-European deciduous forest. Soil Biology and Biochemistry 74: 106-114.

44. Lajtha, K., K.L. Townsend, M.G. Kramer, C. Swanston, **R.D. Bowden**, K. Nadelhoffer. 2014.Changes to particulate versus mineral-associated soil carbon after 50 years of litter manipulation in forest and prairie. experimental ecosystems. Biogeochemistry 119:341–360.

43. Lajtha, K., **R.D. Bowden**, K. Nadelhoffer. 2014. Litter and root manipulations provide insights into soil organic matter dynamics and stability. Soil Society of America Journal 78:S261-S269.

42. Mayzelle, M., M. Krusor, K. Lajtha, **R. D. Bowden,** J. Six. 2014. Effects of decreasing carbon saturation deficit on temperate forest soil carbon cycling. Soil Society of America Journal 78:S76-S83.

41. Frey, S.D., S. Ollinger, K. Nadelhoffer, **R. Bowden**, E. Brzostek, A. Burton, B. Caldwell, S. Crow, C. Goodale, S. Grandy, A. Finzi, M. Kramer, K. Lajtha, J. LeMoine, M. Martin, W. McDowell, R. Minocha, J. Sadowsky, P. Templer, K. Wicking. 2014. Chronic nitrogen additions suppress decomposition and sequester soil carbon in temperate forests. Biogeochemistry 121:305-306. doi:10.1007/s10533-014-9970-5.

40. Sandra Wayman,\* **R.D. Bowden**, R. Mitchell. 2013. Seasonal changes in shoot and root nitrogen distribution in switchgrass (*Panicum virgatum*). Biomass and Bioenergy Research 7:243-252.

39. Giasson, M., A.M. Ellison, **R.D. Bowden**, P.M. Crill, E.A. Davidson, J.E. Drake, S.D. Frey, J.L. Hadley, M. Lavine, J.M. Melillo, J.W. Munger, K.J. Nadelhoffer, E. Nicoll, S.V. Ollinger, K.E. Savage, P.A. Steudler, J. Tang, RK. Varner, S.C. Wofsy, D.R. Foster, A.C. Finzi. 2013. Soil respiration in a northeastern US temperate forest: a 22-year synthesis. Ecosphere 4(11): Article 140. doi.org/10.1890/ES13.00183.1.

38. Smithwick, E.A.H., D.M. Eissenstat, G.M. Lovett, **R.D. Bowden**, L.E. Rustad, C.T. Driscoll. 2013. Root stress and nitrogen deposition: Consequences and research priorities. New Phytologist 197:712–719.

37. Klotzbücher, T, S. Strohmeier, K. Kaiser, **R. D. Bowden**, K. Lajtha, H. Ohm, K. Kalbitz. 2012. Lignin properties in topsoils of a beech/oak forest after 8 years of manipulated litter fall: relevance of altered input and oxidation of lignin. Plant and Soil. doi.org/10.1007/s11104-012-1489-8.

36. Crow, S.E., K. Lajtha, **R.D. Bowden**, Y. Yano, J. Brant, B.A. Caldwell, E. Sulzman. 2009. Increased coniferous needle inputs accelerate decomposition of soil carbon in an old-growth forest. For. Ecol. Manage. 258:2224-2232.

35. Sollins, P., M. Kramer, C. Swanston, K. Lajtha, T. Filley, A.K. Aufdenkampe, R. Wagai, **R.D. Bowden**. 2009. Sequential Density Fractionation across Soils of Contrasting Mineralogy: Evidence for both microbial- and mineral-controlled soil organic matter stabilization. Biogeochemistry. 96: 209-231.

34. Crow, S.E., K. Lajtha, T.R. Filley, C.W. Swanston, **R.D. Bowden**, B.A. Caldwell. 2009. Sources of plant-derived carbon and stability of organic matter in soil: implications for global change. Global Change Biology 15: 2003-2019.

33. Kotroczó,Z., Z. Krakomperger, M. Papp, **R.D. Bowden**, J.A. Tóth. 2007. Long-term change in the composition and structure of an oak forest at Sikfokut, North Hungary. Termeszetvedelmi Kozlemenyek 13:93-100.

32. Crow, S, E.W. Sulzman, W.D. Rugh, **R.D. Bowden**, K. Lajtha. 2007. Isotopic analysis of respired CO2 during decomposition of separated soil organic matter. Soil Biology Biochem. 38: 3279-3291.

31. Tóth J.A., K. Lajtha, Z. Kotroczó, Z. Krakomperger, B. Caldwell, **R.D. Bowden,** M. Papp. 2007. The effect of climate change on soil organic matter decomposition. Acta Silvatica et Lignaria Hungarica 3, 75–85.

30. Sollins, P., C. Swanston, M. Kleber, T. Filley, M. Kramer, S. Crow, B. A. Caldwell, K. Lajtha, **R.D. Bowden**. 2006. Organic C and N stabilization in a forest soil: Evidence from sequential density fractionation. Soil Biol. Biochem. 38:3313-3324.

29. Chan, A.S.K. P.A. Steudler, **R.D. Bowden**, J. Gulledge, C. Cavanaugh. 2005. Consequences of nitrogen fertilization on soil methane consumption in a productive temperate deciduous forest. Biol. Fert. Soils. 41:182-189.

28. Sulzman, E., J. Brant, **R.D. Bowden**, K. Lajtha. 2005. Contribution of aboveground litter, belowground litter, and rhizosphere respiration to total soil CO2 efflux in an old growth coniferous. Biogeochemistry 73:231-256.

27. **Bowden, R.D**., E. Davidson, K. Savage, C. Arabia,\* P.A. Steudler. 2004. Chronic nitrogen additions reduce total soil respiration and microbial respiration in temperate forest soils at the Harvard Forest. J. For. Ecol. Manage. 196:43-56.

26. **Bowden, R.D**., E. Pallant. 2004. Maintaining a college-community ecotourism project: Faculty initiative, institutional vision, student participation, and community partnerships. In *Sustainability on Campus: Stories and Strategies for Change*. Geoffrey Chase and Peggy Barlett, eds. MIT Press. pp 197-213.

25. Aber, J., A. Magill, K. Nadelhoffer, J. Melillo, P. Steudler, J. Hendricks, **R.D. Bowden**, W. Currie, W. McDowell, G. Berntson. 2004. Exploring the process of nitrogen saturation. Chapter 12 *in* D. Foster, J. Aber (eds.), Forests in Time: The Environmental Consequences of 1000 Years of Change in New England. Yale University Press pp. 259-279.

24. Nadelhoffer, K.J., R.D. Boone, **R.D. Bowden**, J.D. Canary, J. Kaye, P. Micks, A. Ricca, J.A. Aitkenhead, K. Lajtha, W.H. McDowell. 2004. The DIRT experiment: litter and root influences on forest soil organic matter stocks and function. Chapter 15 *in*: D. Foster, J. Aber (eds.), Forests in Time: The Environmental Consequences of 1000 Years of Change in New England. Yale University Press, pp. 300-315.

23. Foster, D., J. Aber, **R.D. Bowden**, J. Melillo, F. Bazzaz. 2004. Comparison between physical disturbance and novel stresses. Chapter 14. In: D. Foster, J. Aber (eds.), Forests in Time: The Environmental Consequences of 1000 Years of Change in New England. Yale University Press, pp. 296-297.

22. Foster, D., S. Cooper-Ellis, A. Barker Plotkin, G. Carlton, **R.D. Bowden**, A. Magill, J. Aber. 2004. Simulating a catastrophic hurricane. Chapter 11. In: D. Foster, J. Aber (eds.), Forests in Time: The Environmental Consequences of 1000 Years of Change in New England. Yale University Press, pp. 235-258.

21. Nadelhoffer, K., **R.D. Bowden**, R. Boone, K. Lajtha. 2003. Controls on forest soil organic matter development and dynamics: Chronic litter manipulation as a potential international LTER activity. Pp 3-9 in: K. Lajtha, K. Vanderbilt (eds.), Cooperation in Long Term Ecological Research in Central and Eastern Europe: Proc. ILTER Regional Workshop, 22-25 June, Budapest, Hungary. Oregon State University, Corvallis, Oregon.

20. **Bowden, R.D**., G. Rullo,\* G.R. Stevens,\* P.A. Steudler. 2000. Soil fluxes of carbon dioxide, nitrous oxide, and methane at a productive temperate deciduous forest. J. Env. Qual. 29:268-276.

19. **Bowden, R.D**., K.M. Newkirk, G. Rullo.\* 1998. Carbon dioxide and methane fluxes by a forest soil under laboratory-controlled moisture and temperature conditions. Soil Biol. Biochem. 30:1591-159.

18. Foster, D.R., J.D. Aber, J.M. Melillo, **R.D. Bowden**, F. Bazzaz. 1998. Forest response to natural disturbance versus human-induced stresses. Arnoldia 58:35-40.

17. Foster, D.R., J.D. Aber, J.M. Melillo, F. Bazzaz, **R.D. Bowden**. 1997. Forest response to disturbance and anthropogenic stress. Bioscience 47:437-445. [Reprint](http://webpub.allegheny.edu/employee/r/rbowden/publications/1997_Foster_et_al_BioSc.pdf)

16. Magill, A.H., J.D. Aber, J.J. Hendricks, **R.D. Bowden**, J.M. Melillo, P.A. Steudler. 1997. Biogeochemical response of forested ecosystems to simulated chronic nitrogen deposition. Ecol. Appl. 7:402-415.

15. Millikin,\* C.S., **R. D. Bowden**. 1996. Soil respiration in pits and mounds following an experimental forest blowdown. Soil Sci. Soc. Am. J. 60:1951-1953.

14. **Bowden, R.D**. 1995. Using natural attributes of islands to examine the influence of biodiversity on ecosystem function. P. 221-226. In Islands: Biological diversity and ecosystem function, P. Vitousek, H. Adsersen, L. Loope (eds.) Springer Verlag, Heidelberg.

13. Castro, M.S., P.A. Steudler, J.M. Melillo, J.D. Aber, **R.D. Bowden**. 1995. Atmospheric methane consumption by temperate forest soils. Glob. Biogeochem. Cyc. 9:1-10.

12. **Bowden, R.D.**, M.S. Castro, J.M. Melillo, Steudler, J.D. Aber. 1993. Fluxes of greenhouse gases between soils and the atmosphere in a temperate forest following a simulated hurricane. Biogeochem. 21:61-71.

11. **Bowden, R.D.**, K.J. Nadelhoffer, R.D. Boone, J.M. Melillo, J.B. Garrison.\* 1993. Contributions of aboveground litter, belowground litter, and root respiration to total soil respiration in a temperate mixed hardwood forest. Can. J. For. Res. 23:1402-1407.

10. Aber, J.D., A. Magill, R. Boone, J.M. Melillo, P. Steudler, **R.D. Bowden.** 1993. Plant and soil responses to three years of chronic nitrogen additions at the Harvard Forest, Petersham, MA. Ecol. App. 3:156-166.

9. **Bowden, R.D.** 1991. Inputs, outputs, and accumulation of nitrogen in an early successional moss (*Polytrichum*) ecosystem. Ecol. Monogr. 61:207-223.

8. **Bowden, R.D.**, J.M. Melillo, P.A. Steudler, J.D. Aber. 1991. Effects of nitrogen additions on annual nitrous oxide fluxes from temperate forest soils in the northeastern United States. J. Geophys. Res. 96:9321-9328.

7. Steudler, P., J. Melillo, **R. D. Bowden**, M. Castro, A. Lugo. 1991. The effects of natural and human disturbances on soil nitrogen dynamics and trace gas fluxes in a Puerto Rican wet forest. Biotropica 23:356-363.

6. Wang, D., A. Lugo, F.H. Bormann, **R.D. Bowden.** 1991. Comparison of nutrient-use efficiency and biomass production in five tropical tree taxa. For. Ecol. Manage. 46:1-21.

5. Raich, J.W., **R.D. Bowden**, P.A. Steudler. 1990. Comparison of two static chamber techniques for determination of CO2 efflux from forest soils. Soil Sci. Soc. Am. J. 54:1754-1757.

4**. Bowden, R.D.**, P.A. Steudler, J.M. Melillo, J.D. Aber. 1990. Annual nitrous oxide fluxes from temperate forest soils in the northeastern United States. J. Geophys. Res. 95:13997-14005.

3. Steudler, P.A., **R.D. Bowden**, J.M. Melillo, J.D. Aber. 1989. Influence of nitrogen fertilization on methane uptake in temperate forest soils. Nature 341:314-316.

2. **Bowden, R.D.**, G.T. Geballe, W.B. Bowden. 1989. Foliar uptake of 15N from simulated cloud water by red spruce (*Picea rubens*) seedlings. Can. J. For. Res. 19:382-386.

1. Melillo, J.M., P.A. Steudler, J.D. Aber, **R.D. Bowden.** 1989. Atmospheric deposition and nutrient cycling. pp. 263 - 280. In: M.O. Andreae and D. Schimel (eds.), Exchange of trace gases between terrestrial ecosystems and the atmosphere. John Wiley and Sons, Chichester.

Published Reviews, Reports, Abstracts *(\* present or former undergraduate author; 298 student authorships*):

44. Hunter, R. M. (editor),\* B.C. Biro,\* S.J. Csonka,,\* K.M. Cousineau,\* G. Dowden,\* W.T. Johnson,\* A.A. Klim,\* Q.L. McCrea,\* R.K. Pegher,\* M.O. Simons,\* I.A. Styers,\* L.K. Tovanche,\* **R.D. Bowden**. 2025. Recommendations for Sustainable Landscaping and Features at the Cussewago Square Project. Allegheny College Department of Environmental Science and Sustainability Publication 2025-1.

43. Loch, A.L.,\* M.A. Miller,\* K.E. Royal,\* C.T. Andolina,\* B. Arthur,\* O.C. Ave,\* E.F. Junkin,\* J.R. Lutz,\* K.T. Murphy,\* D.A. Nalesnik,\* A. Swanson,\* **R.D. Bowden**. 2024. Allegheny College campus wildlife habitat management plan. Allegheny College Department of Environmental Science and Sustainability Publication 2024-2.

42. Ave, O.C.,\* K.R. Greenlaw,\* H.B. Kneiser,\* J.R. Lutz,\* M.A. Miller,\* K.T. Murphy,\* D. Torrance,\* **R.D. Bowden** 2024**.** Developing a resilient forest on the Allegheny College campus. Allegheny College Department of Environmental Science and Sustainability Publication 2024-1.

41. Caylor, A. (ed.),\* M.G. Kresse (ed.),\* C.F. Castle,\* R.S. Forsha,\* J.M. Holder,\* M.W. Johnston,\* B.L. Mickley,\* I.M. Petronka,\* R.M. Petula,\* J.T. Pittman,\* M.J. Savino,\* M.G. Sherman,\* O. Spiker,\* J.P. Steele,\* D.N. Studer,\* J.I. Sullivan,\* J.P. Tokasz,\* S. Winter,\* **R.D. Bowden**. 2021. Prescribed browsing by goats controls multiflora rose in a black cherry-red maple deciduous forest at the Erie National Wildlife Refuge in northwestern PA. Allegheny College Department of Environmental Science and Sustainability Publication 2021-1.

40. **Bowden, R.D**., R. Forsha,\* Julia M. Holder,\* B.J. Kozalla.\* 2021. Prescribed goat browsing to control invasive multiflora rose at the Erie National Wildlife Refuge. Tracking Invasive Species with Pennsylvania MapInvasives. Fall 2021 Newsletter. <https://storymaps.arcgis.com/stories/7be31aaaf3944bd1bac170536f2e1bad/print>.

39. Brozell, K. (ed.),\* S. MCrae (ed.),\* O. Maack\* (ed.), L. Curtis,\* S. Degrendel,\* C. Flynn,\* L. Gilmore,\* A.N. Graf,\* C.A. Harris,\* M. Heasley,\* H.O. Heutsche,\* S.L. Mayer,\* L.S. McCann,\* J.T. Rawls,\* S.I. Schmidt,\* F. Schulte,\* K.W. Thompson,\* T.P. Weighart,\* **R.D. Bowden**. 2020. Deer browsing impact on forest regeneration within properties of the French Creek Valley Conservancy. Allegheny College Department of Environmental Science and Sustainability Publication 2020-3.

38. Brown, J. (ed.),\* M. McCampbell (ed.),\* A. Adesiji,\* C. Aldana,\* D. Antinozzi,\* A. Arden,\* H. Baker,\* L. Benko,\* R. Bower,\* B. Capron,\* I. Chick,\* A. Fernandez,\* N. Ferreira,\* L. Kellett,\* J. Lovullo,\* E. Melanfant,\* E. McNamara,\* J. Raphael,\* E. Shanabrook,\* A. Spiro,\* A. Terasavage,\* A. Tolmachoff,\* E. Vallejo,\* Z. Wilson,\* **R.D. Bowden**. 2020. Impact of forest edges on invasive plant species in northwest Pennsylvania. Allegheny College Department of Environmental Science and Sustainability Publication 2020-2.

37. Hemmelgarn, G.L. (ed.),\* A.N. Martin (ed.),\* R.M. Ankney,\* V. Bajek, \* M.G. Carrigan,\* R.A. Carter,\* A. Caylor,\* T.A. Clay,\* G.E. Dancewicz-Helmers,\* J.L. Drozd,\* F.J. Faiello,\* S.A. Foster,\* S.G. Galley,\* T.D. Gates,\* L.M. Gutzmer,\* S.L. Hall,\* D.H. Harrison-Peters,\* L. Kellett\*, B.J. Kozalla\*, M.G. Kresse,\* I. Krzys,\* M.R. Malley,\* I.R. Pettita,\* M. Savino,\* B.B. Slack-Foust,\* S. Spotts,\* **R.D. Bowden**. 2020. Damage to trees caused goats when used to control multiflora rose in a northwestern Pennsylvania hardwood forest. Allegheny College Department of Environmental Science and Sustainability Publication 2020-4.

36. Tisch, A. (ed.),\* V Bajek,\* A.L. Blaisdell,\* L. Blum,\* N.A. Fischer,\* S.G. Galley,\* T.D. Gates,\* D.L. Heffner,\* S.E. Hill,\* S.H. Holler,\* E.D. Kauchak,\* L.E. Lewis,\* M.R. Malley,\* A.N. Martin,\* E. Smith,\* S.M. Spotts,\* N.M. Storer,\* S.G. Thompson,\* I.S. Wolter,\* **R.D. Bowden**. 2020. Aquatic macroinvertebrates in streams within and outside of the Erie National Wildlife Refuge. Allegheny College Department of Environmental Science and Sustainability Publication 2020-1.

35. Plano, C.,\* (ed.) **R.D. Bowden**, E. Cavagnaro,\* L.M. Deem,\* C.L. DiPerna,\* K.Y. Fisher,\* M.M. Hanafin,\* B.C. Hedin,\* C.M. Hubel,\* K.J. Krauskopf,\* A.V. Krol,\* M.T. Larkin,\* N.E. Loyacona, N.E. Machado,\* E.A. Nikovic,\* C.E. Plano,\* David J. Schuster,\* J. Seltzer,\* R.C. Stelzer,\* G.G. Tetelman,\* J.M. Wagg,\* B.A. Walker,\* S.J. Wyckoff,\* G.E. Zinobile.\* 2012. Ash and nutrient concentrations in switchgrass (*Panicum virgatum*) cultivars and ecotypes in northwestern Pennsylvania. Allegheny College Center for Environmental and Economic Development Publication CEED-2012-1.

34. Johnson, C.,\* **R.D. Bowden**. 2010. Potential for wind power at Acutec Precision Machining, Inc. Saegertown, PA. Allegheny College Center for Environmental and Economic Development Publication CEED-2010-2.

33. Gallagher, J. (ed.),\* P. McLaughlin (ed.),\* **R.D. Bowden**, G. Bush,\* D.Certo,\* S. Clark,\* C. Columbus,\* M. Danielson,\* N. Darrow,\* N. Eckstrom,\* K. Feltz,\* S. Ford,\* C. Gamble,\* L. Gearhart,\* E. Helverson,\* R. Hutchinson,\* J. Koehler,\* C. Lichtinger,\* T. Miller,\* A. Nies,\* B. F. O’Leary,\* M.R. Pasquali,\* J. Piette,\* A. Sicker,\* S. Sliger,\* P. Sotherland,\* S. VanSickle,\* K. Voyer-Colbath\*, S.C. Wilhelm,\* G. Wood,\* M. Young,\* M.A. Zheleznyak.\* 2010. Aboveground and belowground biomass, carbon, and nitrogen content of two strains of switchgrass in northwestern Pennsylvania. Allegheny College Center for Environmental and Economic Development Publication CEED-2010-1

32. **Bowden, R.D.** 2009. Teaching scientists to teach in the same manner that they conduct research. Review of *Pathways to Scientific Thinking*, by Diane Ebert-May and Janet Hodder, Sinauer Press. Quarterly Review of Biology 84 (no3.).

31. **Bowden, R.D**., E. Pallant, D. Goldstein, E. Straus,\* K. Biondi,\* K. Blair,\* N. Cash,\* E. Czolowski,\* N. Fuhrman,\* J. Gathmann,\* A. Gorski,\* A. Hall,\* J.P. Hendrickson,\* T. Hollies,\* A. Ingley,\* C. LaRochelle,\* C. McClusky,\* C. McShea,\* E. Mellick,\* C. Moon,\* C. O'Neill,\* A. Patrick,\* K. Pawlak,\* G. Raspanti,\* R. Recker,\* C. Wagner,\* S. Rigotti,\* E. Winter,\* S. Zaret.\* 2009. Siting wind turbines at Acutec Precision and Manufacturing, Inc., Saegertown, Pennsylvania: An Environmental impact assessment. Allegheny College Center for Environmental and Economic Development. Publication CEED-2009-1.

30. Wayman, S. (ed.),\* A.M. Trunzo (ed.),\* **R.D. Bowden**, K. Castillo,\* S. Elliot,\* K. Flood,\* L. Gardner,\* J. Gaudi,\* P. Grella,\* S. Kane,\* I. Lawson,\* J. Longobardo,\* X. Lu,\* K. Minto,\* C. Moore-Seymore,\* D. Roth.\* 2009. Variability of soil carbon and nitrogen in switchgrass and big bluestem fields in northwestern Pennsylvania. Allegheny College Center for Environmental and Economic Development. Publication CEED-2009-2.

29. Alexander,\* L., A. Conroy, **R.D. Bowden**, L.C. Buseck,\* R. Campbell,\* J. Campbell-Heredia,\* L. Cover,\* J. Fago,\* M. Findley,\* E. Gordon,\* B. Greiner,\* R. Hollihan,\* A. Lee,\* T. Ludwig,\* B. Marcy-Quay,\* M. Martin,\* A. Pfeifer,\* M. Robelo,\* L. Scalera,\* A. Silling,\* N. Silva,\* E. Thornton,\* T. Wetsell,\* K. Wills.\* 2008. Biomass, carbon, nitrogen, and ash content in stands of switchgrass and big bluestem in northwestern Pennsylvania. Allegheny College Center for Environmental and Economic Development. Publication CEED-2008-2

28. Trunzo, A. (ed.),\* **R. Bowden,** K. Castillo,\* S. Elliot,\* K. Flood,\* L. Gardner,\* J. Gaudi,\* P. Grella,\* S. Kane,\* I. Lawson,\* J. Longobardo,\* X. Lu,\* K. Minto,\* C. Moore-Seymore,\*, D. Roth,\* S. Wayman.\* 2008. Grease is the word: Feasibility of biodiesel production in Meadville, PA. Allegheny College Center for Environmental and Economic Development. Publication CEED-2008-1.

27. Kotroczó, Z., Z. Krakomperger, M. Papp, **R.D. Bowden, J.** Tóth. 2005. Thirty-one years of change in vegetation composition of a Central European oak forest at the Sikfokut ILTER. Ecol. Soc. Am. Abstracts, 90th Annual Meeting.

26. Chan, A.S.K. P.A. Steudler, **R.D. Bowden**, J. Gulledge, C. Cavanaugh. 2003. Consequences of nitrogen fertilization on soil methane oxidation in a productive temperate deciduous forest. Am. Soc. Agron.

25. Arabia, C.,\* E. Davidson, K. Savage, P. Steudler, **R. Bowden.**  2002.  Long-term suppression of soil respiration by nitrogen deposition:  Contribution of microbial decomposition.  p20. In A. B. Plotkin, J.S. Pallant and D. Recos-Smith ( eds.)   Abstracts of the 13th Ann. Harvard Forest Ecol. Symp.  28 March 2002.

24. Sipe, T.W, C.M. McClaugherty, **R.D. Bowden.** 2000. The effects of nearground enriched carbon dioxide on photosynthesis in forests with different land use legacies. Ecol. Soc. of Am. 86th Annual Meeting Abstracts. P344.

23. Lajtha, K., B. Caldwell, K. Nadelhoffer, **R. Bowden**, D. Coleman, W. Currie, S. Hobbie, W.B. McDowell, M. Meade-Callahan, J. Moore. 2000. DIRT: A cross-continental, experimental study of forest SOM and N dynamics. LTER All Scientists Meeting, Snowbird, UT. Ecol. Soc. Am. Abstracts, 85th Annual Meeting.

22. **Bowden, R.D.**, G. Rullo,\* G.R. Stevens,\* P.A. Steudler. 1999. Soil fluxes of carbon dioxide, methane, and nitrous oxide at a productive temperate deciduous forest. Ecol. Soc. Am. Abstracts, 84th Annual Meeting.

21. Kunkle\*, J.M, T.W. Sipe, **R.D. Bowden**, C.M. McClaugherty. 1999. Growth rates and biomass allocation of tree seedlings across forests with three different land-use legacies in central Massachusetts. Ecol. Soc. Am. Abstracts, 84th Annual Meeting.

20. Bixler,\* K.S., T.W. Sipe, C.M. McClaugherty, **R.D. Bowden.** 1998. Spatial variation of sunfleck regimes in forests with different land-use legacies in central Massachusetts. Ecol. Soc. Am. Abstracts, 83th Annual Meeting.

19. Norris,\* M. D., **R. Bowden**, C. McClaugherty, T. Sipe. 1997. Forest composition following abandonment of agricultural land at the Harvard Forest LTER. Ecol. Soc. Am. Bull. 78:154.

18. Hunker, V.L.\*, **R. Bowden**, T. Sipe, C. McClaugherty. 1997. Root-soil relationships in red maple and red oak seedlings at three Harvard Forest LTER land-use sites. Ecol. Soc. Am. Bull.78:113 .

17. **Bowden, R.D.**, A. Lawrence,\* K. Kryger.\* 1996. Depth distribution of soil nitrogen and potential net N mineralization and nitrification in two temperate forests. Ecol. Soc. Am. Bull. 77:48.

16. Canary, J.D., R.D. Boone, K.J. Nadelhoffer, **R.D. Bowden**, J. Kaye\*. 1996. Estimates of above- and belowground litter inputs to a forest soil using CO2 fluxes measured by two methods. Ecol. Soc. Am. Bull. 77:68.

15. Stiles,\* K., G.R. Stevens,\* **R. D. Bowden.** 1995. Immediate influence of nitrogen fertilization on trace gases in a temperate forest. Ecol. Soc. Am. Bull. 76:254.

14. Foster, D. R., J. Aber, J. Melillo, **R. D. Bowden**, F. Bazzaz. 1995. Temperate forest response to natural catastrophic disturbance and chronic anthropogenic stress. Ecol. Soc. Am. Bull. 76:327.

13. **Bowden, R.D.**, K.M. Newkirk, C.S. Millikin,\* G. Rullo.\* 1994. Effects of soil moisture and temperature on fluxes of carbon dioxide and methane in a temperate forest soil. Ecol. Soc. Am. Bull.

12. **Bowden, R.D.**, M.S. Castro, J.M. Melillo, P.A. Steudler, J.D. Aber. 1993. Fluxes of greenhouse gases between soils and the atmosphere in a temperate forest following a simulated hurricane. Ecol. Soc. Am. Bull. 74:170.

11. Millikin\*, C.S., **R.D. Bowden**. 1993. Effects of pit and mound disturbance on CO2 effluxes following a simulated hurricane blowdown in a temperate forest. Ecol. Soc. Am. Bull. 74:361.

10. **Bowden, R.D.**, K.J. Nadelhoffer, R.D. Boone, J.M. Melillo, J.B. Garrison.\* 1992. Contributions of root respiration and above- and belowground litter to total soil respiration in a temperate mixed hardwood forest. Ecol. Soc. Am. Bull. 71:118.

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8. **Bowden, R.D.**, P.A. Steudler, J.M. Melillo, M.S. Castro. 1991. Trace gas fluxes between the atmosphere and soils of subtropical forests in Puerto Rico. Ecol. Soc. Am. Bull. 70:97.

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5. **Bowden, R.D.**, P.A. Steudler, J.M. Melillo, J.D. Aber. 1989. The influence of N fertilization on annual nitrous oxide fluxes in a red pine plantation and mixed hardwood forest in Massachusetts. Ecol. Soc. Am. Bull. 70:67.

4. **Bowden, R.D.**, G.T. Geballe, W.B. Bowden. 1987. Foliar uptake of 15N- labelled cloudwater nitrogen by red spruce (*Picea rubens*) seedlings. Ecol. Soc. Am. Bull. 68:267.

3. **Bowden, R.D.** 1985. Retention of precipitation nitrogen by moss (*Polytrichum*) ecosystems in central New Hampshire. Ecol. Soc. Am. Bull. 66:145.

2. **Bowden, R.D.** 1984. The nitrogen budget of a developing moss ecosystem in central New Hampshire. Ecol. Soc. Am. Bull. 65:98.

1. **Bowden, R.D.** 1983. Nitrogen dynamics in an early successional moss ecosystem. Ecol. Soc. Am. Bull. 64:92.

Presentations, Posters, Seminars *(\*Present or former undergraduate author; 145 student authorships*)

130. Clifford\*, A.J., M.A. Curtis,\* G. Dowden, \* A.I. Fernandez,\* D.T Graham, \* K.R. Hoehl, \* J.R. Huang, \* W. T. Johnson,\* M.M. Karstens,\* K.R. Leach,\* Z.L. Molgaard,\* J.B. Morgan,\* L.N. Obergefell,\* A.K. Ritley,\* L.K. Tovanche,\* A. Vanderhoof,\* Y. Laskaris, **R.D. Bowden**. Goats Don’t Work: Prescribed Browsing by Goats Fails to Control Multiflora Rose in a Temperate Deciduous Forest at the Erie National Wildlife Refuge in Northwestern PA. Presented at the Regional Science Consortium 20th Annual Research Symposium. Tom Ridge Environmental Center, Erie, PA., November 2024.

129. **Bowden, R.D**. 2024. Invited Seminar. Too Much of a Good thing: Nitrogen Addition Decreases Organic Matter Decomposition and Increases Soil Carbon in a Temperate Deciduous Forest. July 2024. Eagle Hill Institute Seminar Series, Steuben., ME.

128. Wrightson, I., **R.D. Bowden**, K. Lajtha, M. J. Simpson. 2024. Long-term changes in litter quantity and quality alters soil organic matter composition and dynamics in a temperate forest. Goldschmidt Conference.

127. **Bowden, R.D.** 2024. Invited Panelist. Solar horizons: Policy updates and hot topics. Steptoe and Johnson Alternative and Renewable Energy Webinar Series. April 2024.

126. **Bowden, R.D**. 2024. Invited Seminar. Too much of a good thing: Nitrogen addition decreases organic matter decomposition and increases soil carbon in a temperate deciduous forest. Mercyhyurst University, April, 2024.

125. Laskaris, Y., G. Deming, **R.D. Bowden**. 2023. Multiflora Rose Management: Five years of prescribed goat grazing from the perspectives of three collaborators. Western Pennsylvania Conservancy iMapInvasives Webinar Series. Oct 12, 2023.

124. Pearce, K.A., **R.D. Bowden**, B.A. Choate, K. Boulton, K. Royal,\* A.L. Loch,\* M.A. Miller,\* B. Foley,\* and E. Tekelenberg.\* 2023. Expanding sustainability to include our non-human partners: College campuses as models of wildlife habitat. Presented at the Transatlantic Symposium on Sustainable Development: North American and European Perspectives on Sustainability in Higher Education, Massachusetts Institute of Technology, Cambridge, MA, United States, October 2-4, 2023.

123. DeSanto,\* J., R. Ditzenberger,\* L. Hammer,\* A. Hanas,\* I. Henry,\* K. Hollerich,\* N. Kocherzat,\* H. Landis,\* D. Nalesnik,\* E. Readshaw,\* E. Rybka,\* E. Scott,\* P. Siebler,\* G. Sorger,\* J. Spindel,\* W. Vowler,\* A. Westbrook,\* **R.D. Bowden**. 2023. Effects of beech leaf disease on different sizes of American beech trees in northwestern Pennsylvania. Presented at the Regional Science Consortium 19th Annual Research Symposium. Tom Ridge Environmental Center, Erie, PA., 8 November 2023. Presented at the Regional Science Consortium 19th Annual Research Symposium. Tom Ridge Environmental Center, Erie, PA., 8 November 2023.

122. Paz Saucedo,\* N., K. Brozell,\* J. DiGiacomo,\* M. Simpson,\* K. Lajtha,\* **R.D. Bowden**. 2023. What controls soil organic matter in a temperate forest? Three decades in the DIRT. Presented at the Regional Science Consortium 19th Annual Research Symposium. Tom Ridge Environmental Center, Erie, PA., 8 November 2023.

121. **Bowden, R.D**., G. Deming,Y. Laskaris, 2023. Multiflora rose management: Five years of prescribed goat grazing from the perspectives of three collaborators. Presented at Western Pennsylvania Conservancy iMapInvasives Webinar Series, October 12, 2023.

120. **Bowden, R.D**., M. Simpson, N. Paz Saucedo, \*K. Brozell,\* J. DiGiacomo, \*K. Lajtha. 2023. Long-term controls on soil carbon in a temperate forest: 30 years in the DIRT. Presented at the 14th North American Forest Soils Conference, Eugene, OR. July 16-21, 2023.

119. **Bowden, R.D**. 2023. Invited Seminar. Too much of a good thing: Nitrogen addition decreases organic matter decomposition and increases soil carbon in a temperate deciduous forest. University of Toronto, Scarborough. May, 2023.

118. **Bowden, R.D**., K. Ams, T. Bensel, M. Bethurem, K. Boulton, L. Branby, C. Bradshaw-Wilson, D. Byrnes, I. Carbone, B. Choate, L. Demi, W. Kedzierski, E. Pallant, K. Pearce, C. Shaffer, J. Swann-Quinn. 2022. College-Community Environmental Collaborations: Guidance for successful community-based projects and research. S5th World Symposium on Sustainable Development at Universities (WSSD-U-2022), Allegheny College, May 2022.

117. **Bowden, R.D**., T. Bensel, G. Dunkle, B. Kozalla,\* A. Maloney. 2022. Academic and non-profit environmental organization collaboration: A case study on forest conservation with Allegheny College and the Foundation for Sustainable Forests. 5th World Symposium on Sustainable Development at Universities (WSSD-U-2022), Allegheny College, May 2022.

116. Buck, P., S. Barnhart, **R.D. Bowden**, B. Culbertson, J. Hooper, M. Mumper, D. Scicchitano, K. Shultes, T. Simpson. 2022. The Pennsylvania Environmental Resource Consortium: A state-wide collaborative network for sustainable outreach, education, and action. 5th World Symposium on Sustainable Development at Universities (WSSD-U-2022), Allegheny College, May 2022.

115. Swann-Quinn, J., E. Pallant, K. Boulton, J. Michael, S. McRae, **R.D. Bowden**. 2022. Growing a resilient campus forest: Opportunities, barriers, solutions. 5th World Symposium on Sustainable Development at Universities (WSSD-U-2022), Allegheny College, May 2022.

114. Castañeda-Gómez, L. K. Lajtha, **R.D. Bowden**, F. Nahidha, M. Jauhar, J. Jia, X. Feng , M.J. Simpson. 2021. Responses of soil organic matter molecular biogeochemistry to altered detrital inputs are determined by site-specific ecosystem properties: A comparison across temperate forests. Am. Geophysical Union 2021 Annual Meeting.

113. Lajtha, K., D Pierson, **R. Bowden**, K. Nadelhoffer, M. Simpson. 2020. Root activity, root death, and the stability of soil organic matter. 2020. Goldschmidt Virtual 2020 Conference. Geochemical Society and the European Association of Geochemistry.

112. Simpson, J., K. Lajtha, **R. Bowden**. 2020.Integrative molecular biogeochemistry of soil organic matter with long-term litter manipulation in temperate forests. 2020. Goldschmidt Virtual 2020 Conference. Geochemical Society and the European Association of Geochemistry.

111. **Bowden, R.D**., M. Simpson, K. Nadelhoffer, A.F. Plante, S. Crow, L. Deem, A. Simpson, I. Fekete, Z. Kotroczó, J-J. Wang, O. Pisani, L.H. Lin, O. O.Y. Lun, K. Lajtha. 2019. The Detrital Input and Removal Treatment (DIRT) Project: Exploring soil C storage and chemistry. Presented at the Annual Harvard Forest Research Symposium. March 2019.

110. **Bowden, R.D**., S.Wurzbacher,\* S. Washko,\* L. Wind,\* A. Rice,\* J.-J. Wang, M. Simpson, K. Lajtha. 2018. Long-term nitrogen addition decreases organic matter decomposition and increases soil carbon in a temperate deciduous forest. North American Forest Soils Conference, Quebec City, Quebec. June 10-14, 2018 (Presented as poster and invited rapid-fire presentation).

109. **Bowden, R.D**. 2018. Bousson Experimental Forest. One-hour TV program for Crawford County Outdoors, with Duane Koller, June 2018.

108. **Bowden, R.D.,** 2016. Can forest soils clean carbon out of the atmosphere? Soil carbon in temperate forest ecosystems. Invited seminar, Hubbard Brook Experimental Forest Annual Summer Seminar Series. Hubbard Brook Experimental Forest, NH.

107. Stuart, S.,\* **R.D. Bowden**. 2015. The Carbon Athletic Conference. Annual meeting of the Pennsylvania Environmental Resource Consortium, State College, PA.

106. **Bowden, R.D.,** L.Deem.\* 2015. Controls on forest soil carbon. NSF Long-Term Ecological Research All-Scientists Meeting. Estes Park, Co.

105. Schock, J.,\* M. Keeley, **R.D. Bowden**. 2015.Hemlock: A documentary. NSF Long-Term Ecological Research All-Scientists Meeting. Estes Park, Co.

104. Pallant I.,\* D. Conant, L. Nagel, C. Soff, A. Walker, **R.D. Bowden**. 2015. Basking in the sun:  Can solar power work for the municipality of Meadville PA?”

103. **Bowden, R.D.,** C. Bradshaw-Wilson, B. Choate, B. Davis, B. Haywood, C. Waggett, E. Pallant**.**  2015. Teaching environmental research by doing it in an entry-level course. Annual Meeting of the Association of Environmental Science and Studies, San Diego, CA.

102. **Bowden, R.D**. L. Deem,\* A. F. Plante, C. Peltre, K. Nadelhoffer, K. Lajtha. 2014. DIRT beyond the Harvard Forest: Litter input controls on soil carbon in a temperate deciduous forest in Pennsylvania. Harvard Forest Research Annual Research Symposium. Petersham, MA.

101. Lajtha, K., F. Peterson, K. Nadelhoffer, **R.D. Bowden.** 2014.Twenty years of litter and root manipulations: Insights into multi-decadal soil organic matter dynamics at the Harvard Forest. Annual Harvard Forest Research Symposium, Petersham, MA.

100. **Bowden, R.D.** 2014. Digging into the DIRT Experiment: Soil carbon dynamics and storage in forest ecosystems. 2014 Harvard Forest Summer Seminar Series. Petersham, MA.

99. Reynolds, L., M. Tfaily, K. Roscioli, K. Lajtha, **R. Bowden**, B. Johnson, S. Bridgham. 2014. Linking SOM content, chemistry, and decomposition: Complex responses to input manipulation and long-term incubation. Am. Geophysical Union. San Francisco, CA.

98. Nadelhoffer, K, **R.D. Bowden**, S. Crow, K. Lajtha. 2014. Detritus inputs and forest soil organic matter formation: Is there a linear relationship between detrital input rates and soil carbon accumulation? Soil Science Society of America Annual Meeting. Long Beach, CA.

97. **Bowden, R.D**. 2013. Teaching and research at a small undergraduate college. Yale University 30th Annual Doctoral Conference, Nov. 2013. New Haven, CT.

96. Wurzbacher, S.,\* **R.D. Bowden.** 2013. Long-term nitrogen additions increase soil C in an eastern US deciduous forest. Twelfth North American Forest Soils Conference, Whitefish, MT.

95. **Bowden, R.D**., L. Deem,\* A. F. Plante, C. Peltre, K. Nadelhoffer, K. Lajtha. 2013. Litter Controls on Soil Carbon Quantity and Quality in an Eastern Deciduous Forest. Twelfth North American Forest Soils Conference, Whitefish, MT.

94. **Bowden, R.D**. 2013. Forest litter influence on soil organic matter quantity and quality: The ability of soils to store carbon. US Forest Service, Irvine PA. Feb 2013.

93. **Bowden, R.D**. 2012. Forest soil C quantity and quality: Twenty years of the DIRT Experiment. Invited Presentation. UC-Davis. 2012. U. Pennsylvania.

92. Frey, S., **R. Bowden**, E. Brzostek, A. Burton, B. Caldwell, S. Crow, C. Goodale, S. Grandy, A. Finzi, M. Kramer, K. Lajtha, M. Martin, W. McDowell, R. Minocha, K. Nadelhoffer, S. Ollinger, P. Templer, K. Wicking. 2012. [Temperate forest soils sequester as much carbon as trees in response to nitrogen deposition](http://asm2012.lternet.edu/content/temperate-forest-soils-sequester-much-carbon-trees-response-nitrogen-deposition). National Science Foundation Long-Term Ecological Research Program All-Scientists Meeting. Estes Park, CO. September, 2012.

91. Reynolds, L. K. Lajtha, **R.D. Bowden**, B. Johnson, S. Bridgham. 2012. [The DIRT on Q10: Differential temperature response of soils depleted of labile inputs.](http://asm2012.lternet.edu/content/dirt-q10-differential-temperature-response-soils-depleted-labile-inputs)  National Science Foundation Long-Term Ecological Research Program All-Scientists Meeting. Estes Park, CO. September, 2012.

90. **Bowden, R.D**. 2012. Campus food waste: Fueling city vehicles and greening the campus lawn. With K. Boulton, M. Pasquali.\* 2012. Northeast Campus Sustainability Consortium, Syracuse, NY.

89. **Bowden, R.D**. 2011. Long-term controls on forest soil C quantity and quality: The dirt on the DIRT Experiment.”, With K. Lajtha, S.E. Crow, A.F. Plante, J. LeMoine, S.J. Wurzbacher, K.J. Nadelhoffer. 2011. Invited presentation, Eighth North Forest Ecology Workshop, Blacksburg, VA.

88. **Bowden, R.D,** A. Trunzo,\* S. Wayman,\* C. Johnson,\* E. Pallant, D. Goldstein, J.C. Soff, C. Ernst, R. Smith. Hands-on undergraduate instruction in renewable energy: Linking student research and community partners. 2011. Advancement of Sustainability in Higher Education 2011 Conference and Expo, Pittsburgh, PA.

87. **Bowden, R.D,** J. Chriest, J.C. Soff, A. Trunzo,\* S. Wayman,\* K. Castillo,\* S. Elliot,\* K. Flood,\* L. Gardner,\* J. Gaudi,\* P. Grella,\* S. Kane,\* I. Lawson,\* J. Longobardo,\* X. Lu,\* K. Minto,\* C. Moore-Seymore,\* D. Roth.\* 2011. Greasing a solution to a complex problem: A college-municipal community effort to turn used cooking oil into biodiesel fuel. 2011 Annual meeting of the Association of Environmental Studies and Sciences, in Burlington, VT.

86. **Bowden, R.D**., T. Bensel, S. Gillen\*, L. Deem,\* K. Ream,\* A. Trunzo,\* T. Weiss.\* 2011. The Penn’s Woods Project: Forest science education for high school students. Pennsylvania Forest Festival, Pennsylvania State University2011 Annual Convention of the Society of American Foresters, Honolulu, HI.

85. **Bowden, R.D**., S. Wurzbacher,\* A. Trunzo.\* 2011. Chainsaws and hikers - An unlikely mix? Yes, but foresters need to partner actively with forest recreationists. Presented at the Society of American Foresters Allegheny Region Annual Meeting. 2011.

84. **Bowden, R.D**. 2011. Long-term controls on forest soil C quantity and quality: The dirt on the DIRT Experiment, Invited presentation. West Virginia University Biology Department Seminar Series. 2011.

83. **Bowden, R.D,** T. Bensel, S. Gillen,\* L. Deem,\* K. Ream,\* A. Trunzo,\* T. Weiss.\* 2011. The Penn’s Woods Project: Forest science education for high school students. Pennsylvania Forest Festival, Pennsylvania State University.

82. **Bowden, R.D**., S Wayman,\* C. Ernst, R. Mitchell. 2010. Above- and belowground biomass, and nitrogen retranslocation in switchgrass.” Presented at the Annual Meeting of the Soil Science Society of America, Long Beach, CA. 2010.

81. Trunzo, A.,\* P. Carey,\* E. Straus,\* T. Bensel, **R. Bowden**. 2009. Forest education for high school students. Pennsylvania Undergraduate Research at the Capitol Symposium. Harrisburg, PA. October, 2009.

80. Wayman, S.A.,\* A. Trunzo,\* T. Weiss,\* **R. Bowden**. 2009. The secret underground life of switchgrass: Exploring belowground processes. 2009.Pennsylvania Undergraduate Research at the Capitol Symposium. Harrisburg, PA. October, 2009.

79. **Bowden, R.D**., K. Lajtha, A. Plante. 2009. Soil organic matter dynamics: A cross-ecosystem approach. Workshop at the National Science Foundation Long-Term Ecological Research Program All-Scientists Meeting. Estes Park, CO. September, 2009.

78. [**Bowden**](mailto:rbowden@allegheny.edu)**, R**., E. Fager,\* K. Nadelhoffer, J. LeMoine. 2009. [Decomposition of roots and leaves in a northern temperate forest.](http://a-c-s.confex.com/crops/2009am/s7/papers/index.cgi?username=53625&password=506482) Annual Meeting of the Soil Science Society of America. Pittsburgh, PA. November 2009.

77. **Bowden, R.D**, S.D. Frey, S. Ollinger, R. Maclean, M. Day, K. Nadelhoffer, J. LeMoine, A. Finzi, E. Brzostek, C. Goodale, A. Melvin, M. Weiss. 2009. Organic matter responses to chronic nitrogen additions at the Harvard Forest*.* National Science Foundation Long-Term Ecological Research Program All-Scientists Meeting. Estes Park, CO. September, 2009.

76. Frey, S., S. Ollinger, R. MacLean, M. Day, K. Nadelhoffer, J. LeMoine, **R. Bowden**, A. Finzi, C. Goodale, K. Lajtha, W. McDowell, A. Melvin, P. Templar, S. Trumbore, M. Weiss. 2009. Nitrogen saturation – A 20-yr synthesis. 20th Annual Harvard Forest Ecology Symposium. March, 2009. Harvard Forest, Petersham, MA.

75. **Bowden, R.D**. 2009. Using vegetation to capture and reduce carbon emissions: Forest carbon sequestration, biofuel studies and native wildflower gardens. National Wildlife Federation Campus Ecology Habitat Restoration & Protection on Campus Web Conference, February, 2009.

74. **Bowden, R.D**. 2009. Earth, wind, and fire: Singing the praises of geothermal, wind, and biodiesel energy at Allegheny College. National Wildlife Federation Campus Ecology Onsite Renewable Energy: Wind, Solar & Geothermal Web Conference, March, 2009.

73. **Bowden, R.D**. 2008. Faces of change: Environmental sustainability on small college campuses. Otterbein University Symposium on Sustainability. Columbus, OH. April, 2008.

72. Klotzbucher, T., K. Klaiser, K. Lajtha, **R.D. Bowden**, K. Kalbitz. 2008. Effects of plant litter input on lignin degradation in forest soils. Eurosoil Conference. Vienna, Austria, August 2008.

71. Crow, S.E., **R.D. Bowden**, B. Caldwell, T. Filley, K. Lajtha, J. Brant, E. Sulzman. 2008. Sources of long-term soil organic matter varies by forest type; But how stable is it? Tenth North American Forest Soils Conference. Virginia Tech, Blacksburg, VA. 2008.

70. Robinson, S.M., E. Evetts, W. Taylor, **R.D. Bowden**, J.A. Toth, W. H McDowell, K. Lajtha, J.A. Aitkenhead-Peterson. 2008. Above- and below-ground litter: Controls on retention and release of dissolved C and N. Soil Science Society of America Annual Meeting, Houston, TX. October 2008.

69. DeHart, J.L., E. Pallant, **R. Bowden**, A. Geffen, J. Law,\* L. Lee, B. Rietnour, S. Rigotti,\* R. Simko, A. Werner.\* 2008. Green Honchos: How Allegheny College’s Taskforce for Environmental Responsibility created eco-minded administrators. American Association for Sustainability in Higher Education. Raleigh NC, November 2008.

68. Robinson,\* S.E. Evetts,\* W. Taylor,\* **R. Bowden**, L. Lajtha, W.H. McDowell, J.A. Aitkenhead-Peterson. 2007. Above-and belowground litter manipulation: Impact of the retention and release of dissolved C and N. Geological Society of America/American Society of Agronomy Annual Meetings. Houston, TX. October 2007.

67. **Bowden, R.D,** C.E. Waggett, K. Greely, R. O’Brien, J.E. Nickell, E. Pallant, J. DeHart, E. Kirk, A. Geffen. 2007. Allegheny College Climate Change Initiative (ACCCI): Mobilizing support for campus climate change efforts. Ball State Conference on Sustainability in Higher Education. Muncie, IN. September 2007.

66. **Bowden, R.D**. 2007. Environmental sustainability through student-faculty-community partnerships:  Moving from research to action. Invited Seminar, Loyola University-Chicago. May, 2007.

65. **Bowden, R**., D. Brown. 2006. [College-community environmental sustainability initiatives: Local and state partnerships in Pennsylvania](javascript:popUp('consortium/w8.htm')). Invited Seminar, Third Annual Conference of the Northeast Campus Sustainability Consortium, Yale University, November, 2006.

64. **Bowden, R.D**. 2006. Nature tourism in northwest Pennsylvania. Invited Seminar, Great Lakes Region, P[ennsylvania Tourism Office](http://www.visitpa.com/visitpa/contact.pa;jsessionid=4757970FA2BB81E733DBD129802A3305), Tom Ridge Environmental Center, Erie, PA. June 2006.

63. **Bowden, R.D**. 2006. Enhancing environmental sustainability education through university-community partnerships. Invited seminar, University of Debrecen. Debrecen, Hungary. May, 2006.

62. Sollins, P., M. Kramer, C. Swanston, K. Lajtha, T. Filley, A.K. Aufdenkampe, R. Wagai, **R.D. Bowden**. 2006. Stabilization of soil organic C and N: Evidence form sequential density fractionation. American Society of Agronomy Annual Meetings, Indianapolis, IN. November 2006.

61. Crow, S. T. Filley, C. Swanston, B. Caldwell, **R.** **Bowden**. 2006. Above- and belowground litter controls on forest soil dynamics. Soil Sci. Soc. Am. Annual Meeting.

60. **Bowden, R.D.,** L. Nagel,\* Z. Kotroczó,Z. Krakomperger, M. Papp, J.A. Tóth. 2006. Long-term change in vegetation composition and biomass in a Central European oak forest at the Sikfokut International Long-Term Ecological Research (ILTER) Site, Hungary. NSF Long-Term Ecological Research Site All-Scientists Meeting, Estes Park, CO. September, 2006.

59. Nagel, L.\* **Bowden, R.D**., J.A. Tóth , J. Aitkenhead-Peterson, K. Lajtha. 2006. Rapid changes in soil carbon and organic matter at the Sikfokut International Long-Term Ecological Research Site, northeast Hungary. NSF Long-Term Ecological Research Site All-Scientists Meeting, Estes Park, CO. September, 2006.

58. Sulzman, E., J. Brant, D. Myrold, K. Lajtha, B. Caldwell**, R. Bowden**. 2006. Components of soil CO2 efflux in an old growth coniferous forest: A tale of roots, microbes, and priming. NSF Long-Term Ecological Research Site All-Scientists Meeting, Estes Park, CO. September, 2006.

57. **Bowden, R.D**. K.J. Nadelhoffer, P. Micks, J. LeMoine, L. Nagel.\* 2006. Contributions of autotrophic and heterotrophic sources to total soil respiration in temperate forests: Site productivity controls on aboveground and belowground carbon allocation. NSF Long-Term Ecological Research Site All-Scientists Meeting, Estes Park, CO. September, 2006.

56. **Bowden, R.D**., D. Brown, S. Just, K. Baratan, T. Emmett, H. Greenberg; S. Kabala, R. McKinistry. 2005.

The Pennsylvania Consortium for Interdisciplinary Environmental Policy: A policy-relevant research collaboration between Pennsylvania academic institutions and state environmental agencies.

Greening of the Campus VI: Extending Connections, Ball State University, September 2005.

55. Kirk, E., J. Palmer, D. Goldstein, S. Onyeiwu, **R.** **Bowden**, K. Bakken, T. Bensel, K. Greely, J. DeHart, C. Waggett, A Geffen, E. Pallant, 2005. Sustainability is working in the rust belt. Greening of the Campus VI: Extending Connections, Ball State University, September 2005.

54. Sollins, P., C. Swanston, M. Kleber, K. Lajtha, M. Kramer, T. Filley, S. Crow, **R. Bowden**, D. Beilman. 2005. Organic C and N stabilization in a forest soil: evidence from sequential density fractionation.

22nd International Meeting on Organic Geochemistry. September 2005. Seville, Spain

53. Sollins, P., C. Swanston, M. Kleber, K. Lajtha, M. Kramer, T. Filley, S. Crow, **R. Bowden**, D. Beilman. 2005. Organic C and N stabilization in a forest soil: evidence from sequential density fractionation.

Second International Conference on Mechanisms of Soil Organic Matter Stabilization and Destabilization in Soils. October, 2005. Monterey, CA.

52. **Bowden, R.D**. 2005. CEEDs of change: College-community collaborations for environmental sustainability. University of Michigan Biological Station, Summer Seminar Series, July 2005.

51. **Bowden, R.D**. 2005. Soil Respiration in an old-growth coniferous forest: Contributions of organic matter and the rhizosphere**.** Invited seminar, Lake Balaton Limnological Institute, Tihany, Hungary. May, 2005.

50. **Bowden, R.D**. 2005. Soil respiration in an Old-Growth Coniferous Forest: Contributions of organic matter and the rhizosphere. Invited seminar, University of Debrecen. Debrecen, Hungary. May, 2005.

49. **Bowden, R.D**. 2005. Rapid changes in soil carbon and organic matter at Sikfokut DIRT Plots. Invited seminar, University of Debrecen. Debrecen, Hungary. May, 2005.

48. **Bowden, R.D**. 2005. Hands-on research and service learning: Extending sustainability education from the classroom into the community at Allegheny College. Invited Seminar, Harvard Forest Seminar Series. February 2005.

47. **Bowden, R.D**. 2004. Colonial agriculture and modern forest soils:  Legacies of past land use on soil patterns and processes. Invited Seminar, University of New Hampshire, Complex Systems Research Center, November, 2004.

46. **Bowden, R.D**. 2004. Agricultural legacies in modern forest soils. Invited Seminar, Harvard Forest, October 2004.

45. **Bowden, R.D**. 2004. Hands-on research and service learning: Extending sustainability education from the classroom into the community at Allegheny College. Presenter and Facilitator for “Sustainability and Community Outreach: The Need, the Benefits, and the Challenges,” at the Northeast Campus Sustainability Summit Northeast Conference on Environmental Sustainability, University of New Hampshire, September, 2004.

44. **Bowden, R.D**. 2004. Historic Land Use Alters Modern Forest Soils. Invited seminar, University of Debrecen. Debrecen, Hungary. July, 2004.

43. Baros, B., C. Waggett, A. Coble,\* J. Krempecki,\* G. Dunkle,\* **R.D. Bowden**. 2004. Environmental microbiology: A multidisciplinary, multi-class approach. 11th Annual ASM Conference for Undergraduate Educators. Xavier University, Louisiana.

42. **Bowden, R.D.**, E. Davidson, K. Savage, C. Arabia, P.A. Steudler. 2004. Nitrogen additions reduce microbial respiration in temperate forest soils at the Harvard Forest LTER. Mid-Atlantic Regional Meeting of the Ecological Society of America. April 27-28, 2004. Franklin and Marshall College, Lancaster, PA.

41. Lajtha, K., Y. Yano, E. Sulzman, **R. Bowden**, B. Caldwell, K. Nadelhoffer, J. Toth, K. Vanderbilt. 2003. Detrital control of soil organic matter dynamics: An experimental approach. International Conference on Mechanisms and Regulation of Organic Matter Stabilisation in Soils. October 5-8, 2003, Schloss Hohenkammer, Munich Germany. Sponsored by the Deutsche Bodenkundeliche Gesellschaft.

40. Caldwell, B.A., **R. Bowden**, K. Lajtha, K. Nadelhoffer, E. Sulzman, J. Toth, K. Vanderbilt. 2003. Detrital controls on microbial processing of SOM in four forests. International Conference on Mechanisms and Regulation of Organic Matter Stabilisation in Soils. October, 2003, Schloss Hohenkammer, Munich Germany. Sponsored by the Deutsche Bodenkundeliche Gesellschaft.

39. **Bowden, R.D.**, E. Davidson, K. Savage, C. Arabia,\* P.A. Steudler, 2003. Chronic nitrogen additions reduce total and microbial respiration in temperate forest soils at the Harvard Forest LTER.Tenth N. Am. Forest Soils Conf., July, 2003, Sault Ste. Marie, Canada.

38. Caldwell, B.A., B. Baros, **R. Bowden**, M. Copeland,\* S. Crow, K. Lajtha, P. Micks, K. Nadelhoffer, B. McDowell, E. Sulzman, J. Toth, K. Vanderbilt. 2003. Influence of detrital inputs on carbon processing in forest soils. Tenth N. Am. Forest Soils Conf., July, 2003, Sault Ste. Marie, Canada.

37. **Bowden, R.D**. 2003. Sustainability on campus: Stories and strategies for change. Panel Discussant. Greening of the Campus V. Ball State University, Muncie, IN. September 2003.

36. **Bowden, R.D**. 2003. From nutrient cycling to environmental policy: The influence of Hubbard Brook on watershed research and environmental protection. Hubbard Brook Ecosystem Study Annual Cooperator’s 33. Meeting. July 2003.

35. **Bowden, R.D**. 2003. Agricultural legacies in New England forests: Impacts of 19th century agriculture on soils and soil C in 21st century forests.” Invited seminar at Oregon State University, Department of Crop and Soil Science, Corvallis, OR. April 2003.

34. **Bowden, R.D**. 2002. Do soil nitrogen and site productivity influence soil respiration? A tale of two forests. Invited seminar, Oregon State University Department of Botany and Plant Pathology, Corvallis, OR. October 2002.

33. **Bowden, R.D**. 2002. Soil Nitrogen and Soil Respiration: Influence of Site Productivity and N Deposition. Invited seminar at University of Debrecen. Debrecen, Hungary. May, 2002.

32. **Bowden, R.D**. 2001. Does soil have memory: Agricultural legacies in modern forests. Pymatuning laboratory of Ecology, University of Pittsburgh, July 2001.

31. **Bowden, R.D,** T. Bensel. 2000. Forming partnerships. Allegheny Region, Society of American Foresters Annual Conference. Titusville, PA. February 2000.

30. McClaugherty, C.M., T.W. Sipe, **R.D. Bowden**. 2000. Near-ground light and carbon resource allocation in temperate forests with contrasting historical land uses. 166th National Meeting of Amer. Assoc. Advance. Sci. Annual Meeting.

29. **Bowden, R.D**. 1999. A national model of collaboration for sustainability: Allegheny College and its watershed. Co-Presenter, The National Town Meeting for a Sustainable America, Detroit, MI, May 1999.

28. **Bowden, R.D**. 1998. Catastrophic natural disturbance versus chronic human stress: Does the forest notice a difference? Appalachian Environmental Laboratory, Frostburg, MD, October 1998.

27. **Bowden, R.D**. 1998. Impacts of catastrophic natural disturbance and anthropogenic stress on forest ecosystem processes. USDA Forestry Sciences Laboratory, Warren, PA. April 1998.

26. **Bowden. R.D.**, C. McClaugherty, T. Sipe, K. Clark\*, C. Giffen\*, C. Meredith\*, S. Stewart.\* 1998. Legacies of agricultural activities in New England forest soils. Ninth N. American Forest Soils Conference, August 9-14, 1998, Tahoe City, CA.

25. Sipe, T. W., **R.D. Bowden**, B. Danner,\* C.J. Giffen.\* 1998. Spatial variation in forest floor CO2 enrichment and its implications for photosynthesis in forests with different land‑use legacies. Ecol. Soc. Am. , 83th Annual Meeting.

24. **Bowden, R.D.**, C.A. McClaugherty, R. Bakker,\* K. Clark,\* C. Giffen,\* C. Meredith,\* S. Stewart.\* 1998. Historic agricultural land-use alteration of temperate forest soil at the Harvard Forest LTER. Ecol. Soc. Am. Abstracts, 83th Annual Meeting.

23. **Bowden, R.D**. 1997. Big, bad hurricanes vs. quiet, invisible alteration: Ecosystem response to natural disturbance and human stress. Rutgers University, May 1997.

22. **Bowden, R.D**. 1995. Disturbance in forest ecosystems: Natural disasters vs. human stresses. Northland College, February 1995.

21. **Bowden, R.D**. 1995. Natural vs. human disturbance in a temperate forest ecosystem: Will the real disturbance please stand up? Institute of Ecosystem Studies, September 1995.

20. **Bowden, R.D**. 1993. Discussion Leader. Biological diversity and ecosystem function: Islands as model ecosystems. Workshop sponsored by Scientific Committee on Problems of the Environment, Nassau, Bahamas, October 1993.

19. **Bowden, R.D.**, K.J. Nadelhoffer, R.D. Boone, J.M. Melillo and J.B. Garrison,\* K.X. Cario.\* 1993. Soil respiration: Contributions of aboveground litter, belowground litter, and root respiration in two temperate mixed hardwood forests. Proceedings of NSF Long-Term Ecological Research All Scientists and International Summit Meeting, Estes Park, CO, Sept. 18-24, 1993.

18. **Bowden, R.D.**, K.J. Nadelhoffer, R.D. Boone, J.M. Melillo,J.B. Garrison,\* K.X. Cario.\* 1993. Soil respiration: Contributions of aboveground litter, belowground litter, and root respiration in two temperate mixed hardwood forests. Proceedings of the Eighth North American Forest Soils Conference, Gainesville, FL, May 1993.

17. **Bowden, R.D**. 1993. Plant and soil responses to three years of chronic nitrogen additions at the Harvard Forest LTER. Hubbard Brook Annual Cooperators Meeting, NH. July, 1993.

16. **Bowden, R.D**. 1992. Effects on soil respiration, soil chemistry, and litterfall of deer browsing in the Allegheny National Forest. with K. McCracken,\* B. Drbal,\* and G. Gumbert.\* U.S. Forest Service, Warren, PA, May 1992.

15. **Bowden, R.D**. 1992. Effects of physical and chemical disturbances on fluxes of greenhouse gases in temperate and tropical forests. Wabash College, January 1992.

14. **Bowden, R.D**. 1992. Effects of physical and chemical disturbances on fluxes of greenhouse gases in temperate and tropical forests. The Harvard Forest, MA, June 1992.

13. **Bowden, R.D**. Effects of physical and chemical disturbances on fluxes of trace gases at the Harvard Forest. The Harvard Forest, MA, June 1991.

12. **Bowden, R.D**. 1991. Carbon dioxide respiration from temperate forest soils: Linkages to temperature, moisture, and nitrogen cycling. U.S. Forest Service, Warren, PA, February 1991.

11. **Bowden, R.D**. 1990. Controls on CO2 and N2O fluxes in forests. Trace Gas Symposium -Understanding global change: What controls the fluxes of trace gases? Marine Biological Laboratory, July 1990.

10. **Bowden, R.D**. 1990. Fluxes of atmospheric trace gases from tropical forest soils in Puerto Rico, U.S. Forest Service. Institute for Tropical Forestry, Puerto Rico, April 1990.

9. **Bowden, R.D**. 1990. The greenhouse effect: Causes and consequences of global warming. Northland College, March 1990.

8. **Bowden, R.D**. 1990. Fluxes of atmospheric greenhouse gases from temperate forest soils receiving chronic atmospheric nitrogen deposition. University of Washington, February 1990.

7. **Bowden, R.D**. 1989. Annual nitrous oxide fluxes from temperate forest soils in the northeastern United States. 1990 Fraunhofer-Institut fur Atmosphärische Umweltforschung, Garmisch-Partenkirchen, FRG, June 1989.

6. **Bowden, R.D**. 1987. The nitrogen budget of a moss ecosystem developing on glacial outwash sands in New Hampshire. University of Gottingen, FRG, October 1987.

5. **Bowden, R.D**. 1985. The nitrogen budget of a moss ecosystem developing on glacial outwash sands in New Hampshire. The Ecosystems Center, Marine Biological Laboratory, MA, May 1985.

4. **Bowden, R.D**. 1985. The nitrogen budget of a moss ecosystem developing on glacial outwash sands in New Hampshire. University of Wisconsin, May 1985.

3. **Bowden, R.D**. 1985. The nitrogen budget of a moss ecosystem developing on glacial outwash sands in New Hampshire. Cornell University, March 1985.

2. **Bowden, R.D**. 1984. The nitrogen budget of a moss ecosystem developing on glacial outwash sands in New Hampshire. Harvard Forest, April 1984.

1. **Bowden, R.D**. 1984. Nitrogen cycling in the northern hardwood forest ecosystem. U.S. Army, Cold Regions Research and Engineering Laboratory, NH, February 1984.

Invited Community Workshops & Seminars, Local Contributions, Organization Presentations

37. **Bowden, R.D.** 2024. Seminar: Have you had a conversation with your forest? Balancing your values and wishes with what your forest can provide. Northwest PA Woodland Association Workshop: What to do before selling timber. March 2024.

36. **Bowden, R.D**. 2022. Forestry. Invited Workshop. Crawford County Conservation Camp, Aug 2022.

35. **Bowden, R.D**. 2022. Invited Seminar. Conneaut Lake Ecology. The Catholic Community of Meadville.

34. **Bowden, R.D**. 2021. Crew Leader. French Creek Valley Conservancy.

33. **Bowden, R.D**. 2021. Wilderness Lodge Cross-Country Ski Area Strategic Planning Meeting.

32. **Bowden, R.D.** 2021. Invited Seminar. Forest Ecology. Presented to the Catholic Community of Meadville.

31. **Bowden, R.D**. 2021. Invited Workshop. Forests and Forestry, Crawford County Conservation Camp.

30. **Bowden, R.D**. 2021. Invited Seminar. Bousson Experimental Forest. The Catholic Community of Meadville.

29. **Bowden, R.D**. 2019. Invited Seminar. Floods on French Creek. The Catholic Community of Meadville, July 2019.

28. **Bowden, R.D.** 2018. Facilitator. Loving the Land Conference. Foundation for Sustainable Forestry. May 2018.

27. **Bowden, R.D**. 2018. Invited Seminar: Aquatic Ecology. The Catholic Community of Meadville, July 2018.

26. **Bowden, R.D**. 2018. Invited Seminar: Resource use and consumption: Environmental consequences. The Catholic Community of Meadville, July 2018.

25. **Bowden, R.D.** 2018**.**  Invited Discussion Leader:  Local Showing of “Saving Snow.”  Wilderness Lodge.  February 2018.

24. **Bowden, R.D.** 2017. Invited Seminar: The Papal Environmental Encyclical. The Catholic Community of Meadville, July 2017.

23. **Bowden, R.D.**  2017**.** Facilitator. Loving the Land Conference, Foundation for Sustainable Forests, May 2017.

22. **Bowden, R.D**. 2015. Presenter. Forests and wildlife. Loving the Land Conference, Foundation for Sustainable Forests.

21. **Bowden, R.D**. 2014. Forest Biology Workshop. Loving the Land Conference. Foundation for Sustainable Forests. Spartansburg, PA.

20. **Bowden, R.D**. 2013. Forest Ecology Field Trip Leader. Loving the Land Conference. Foundation for Sustainable Forests. May 2013.

19. **Bowden, R.D**. 2009. Global climate change: Is it real? Should we care?” Crawford County Conservation District Earth Day Seminar. April, 2009.

18. **Bowden, R.D**. 2008. Biomass energy: What’s the role for northwestern Pennsylvania? Presented at the 2008 Annual Forest Landowner’s Conference. Allegheny College. March, 2008.

17. **Bowden, R.D**. 2008. Is there a role for energy from biomass in northwestern Pennsylvania? Presented at the Pennsylvania Woodland Owners Association. Waterford, PA. February, 2008.

16. **Bowden, R.D**. 2007. Forest research at Allegheny College. Forest Landowners Conference, Allegheny College, January, 2007.

15. **Bowden, R.D**. 2007. Climate change: Is it real? Should we care?” Erie County Township Supervisors Training Session, Waterford, PA. March, 2007.

14. **Bowden, R.D**. 2005. Meadville Community Energy Project Visioning Session, December 2005.

13. **Bowden, R.D**. 2004. Workshop on Root Biology. Invited participant. University of Michigan Biological Station, Pellston, MI. June 2004.

12. **Bowden, R.D**. 2004. Press Moderator. PCIEP release of 2003 PA Environment Indicators Report, PA DEP, Harrisburg, PA. March 2004.

11. **Bowden, R.D**. 2004. Pennsylvania Consortium for Interdisciplinary Environmental Policy: 2004 State of the Consortium Address. Pennsylvania Consortium for Interdisciplinary Environmental Policy Annual Meeting, Harrisburg, PA. October 2004.

10. **Bowden, R.D**. 2003. Pennsylvania Consortium for Interdisciplinary Environmental Policy: 2003 State of the Consortium Address. Pennsylvania Consortium for Interdisciplinary Environmental Policy Annual Meeting, Harrisburg, PA. October 2003.

9. **Bowden, R.D**. 2002. Pennsylvania Consortium for Interdisciplinary Environmental Policy: 2002 Annual Update. Pennsylvania Consortium for Interdisciplinary Environmental Policy Annual Meeting, Harrisburg, PA. October 2002.

8. **Bowden, R.D**. 2002. The Hemlock Woolly Adelgid: Threat to ecological and economic viability of Pennsylvania’s Hemlock Forests. Northwest Pennsylvania Woodland Association., Spartansburg, PA. March 2002.

7. **Bowden, R.D**. 2000. Allegheny College Greenway Project. Presentation at the Allegheny Watershed Network French Creek Water Trail Roundtable. April, 2000.

6. **Bowden, R.D**. 1999. Ecotourism in Northwest Pennsylvania. Canadohta Lake Area Business Association, July 1999.

5. **Bowden, R.D**. 1998. Workshop on ecotourism in northwest Pennsylvania, Allegheny College, March 7, 1998, Project Director and Conference Convener.

4. **Bowden, R.D**. 1998. Forestry and wildlife in northwest Pennsylvania: Seeking balance. Allegheny College, April 17, 1998, Conference Convener.

3. **Bowden, R.D**. 1997. Envisioning a sustainable forest industry in Northwest Pennsylvania: ARoundtable Discussion.  Allegheny College, April 1997, Conference Convener.

2. **Bowden, R.D**. 1995. Geography of French Creek. French Creek Project Workshop. Meadville, PA, October 1995.

1. **Bowden, R.D**. 1993. Global environmental change. Meadville (PA) Bird and Tree Club. December 1993.

Extramural Grants Received (18 grants totaling $1,996,734.)

Native American Views of Ecosystem Management and Sustainability. Great Lakes Colleges Association New

Initiatives Program. 2013-2014. $6,998.

“Long-term controls on forest soil C quantity and quality: A strengthening sabbatical application”. USDA-National Institute of Food and Agriculture-Agriculture and Food Research Initiative Foundational Program. $35,500. March 1, 2012 – March 1 2013. Grant 2011-03746. “ROA: Long-term detrital controls on soil organic matter stabilization”. NSF ROA award through Oregon State University. 17,109. May 18, 2011 – August 31 2014.

“High School Forest Conservation Education Modules: Preparing Students to Understand Conservation and Management of Penn’s Woods,” Submitted to Pennsylvania Dept. of Conservation and Natural Resources Wild Resource Conservation Program, 2009-2010, $40,375.

“Leaf and Root Litter Decomposition: Soil OM Contributions” National Science Foundation Long-Term Supplement Award to the Harvard Forest Long-Term Ecological Research Site. 2008-2009. $4,990

“Forest Education in Northwest PA”, with Terry Bensel, Rees Foundation, 2006-7, $25,000.

Proposal for Wind Power Feasibility Study. With D. Goldstein, E. Pallant, Acutec Precision Machining, Inc., Saegertown, Pa. 2007-8. $4,500.

Plan to Develop a PCIEP Proposal: Forests and Energy: High School Education Modules Linking Forests and Energy, PA Department of Environmental Protection, 2007, $3,200.

“Allegheny College Environmental Science Department Leadership Initiative in Global Environmental Sustainability,” A.W. Mellon Foundation, with T. Bensel, J. Dehart, E. Pallant, J. Palmer, C. Waggett, S. Wissinger, 2006, $300,000.

“University of Michigan Biological Station Research Fellowship Award.” 2006. $5,000.

“Detritus input and removal treatments (DIRT): A collaborative project with the Sikfokut ILTER site, Hungary.” NSF LTER III Supplement DEB-0080592. 2004-2006. (With J. Aitkenhead-Peterson). $14,292.

“Does soil have memory? Alterations in forest soils and soil nutrients following 175 years of forest regrowth.” Harvard University Bullard Fellowship. 2004-2005. $24,000.

“Adaptation and Implementation of a Watershed Model: The French Creek Watershed Research Program at Allegheny College. 2002-2005. NSF-CCLI, $166,449. NSF. (with R O’Brien and S. Wissinger).

NSF-REU Supplemental support for “Collaborative Research: Dirt: A cross-continental, experimental study of forest SOM and N dynamics.” 2003. NSF. $6,000.

NSF-REU Supplemental support for “Collaborative Research: Dirt: A cross-continental, experimental study of forest SOM and N dynamics.” 2002. NSF. $10,550.

“Collaborative Research: Dirt: A cross-continental, experimental study of forest SOM and N dynamics.” 2000-2003. NSF. $295,942. (with K. Lajtha, Oregon State U. and W. McDowell, U. New Hampshire).

“Tourist Opportunities in Northwest Pennsylvania” 2001-2002. (with M. Keeley). State of Pennsylvania. Subcontract with Crawford County Convention and Visitor’s Bureau. $7,000.

“Development of a web page for nature tourism in northwest PA”. 1999. Pennsylvania Center for Economic Development, with Crawford County Convention and Visitor’s Bureau $2000.

"CRUI: The impact of land-use legacies on forest soil-plant-atmosphere interactions," 1995-2000, NSF, $853,067. (with T.W. Sipe, Franklin and Marshall College, C.A. McClaugherty, Mt. Union College).

"REU program in forest ecology at the Harvard Forest", 1993-1996, NSF, $150,000.

"Effects of White-tail Deer (*Odocoileus viginiana*) densities on soil invertebrate distribution, abundance, and diversity in a temperate forest." 1994, U.S. Forest Service, $380.

"Effects of soil moisture and temperature on fluxes of carbon dioxide and methane in a temperate forest soil", 1993-1994, Dept. of Energy, National Institute for Global Environmental Change, $14,000.

"Factors influencing atmospheric trace gas fluxes between temperate forest soils and the atmosphere", 1992, NSF, $11,424.50.

"Improvement of Soil and Ecosystem Analysis Laboratory," 1991, NSF, $41,074.

"Global Warming: The influence of forest ecosystems on greenhouse gases in the atmosphere", 1991, Pew Midwest Science Cluster, $3,300.

"Influences of white-tailed deer browsing on litterfall and soil respiration in the Allegheny Plateau forests", 1991, U.S. Forest Service, $1,461.25.

Allegheny College Grants Received (14 grants totaling $55,032)

“Assessing controls on soil carbon storage at a long-term field experiment.” Allegheny College Faculty Development Award, 2023. $956.

“Soil Organic Matter Research.” Allegheny College Faculty Development Award, 2011. $200.

“Root and leaf litter chemistry and decay.” Allegheny College Faculty Development Award, 2008. $2,500.

“Decomposition of Above- and Belowground Derived Litter,” Allegheny College Faculty Development Award, 2007, $2,500.

“Forest Ecosystem and Ecotourism Research - 2006,” Shanbrom Fund (awarded to Maria Pyrdek (’07)), 2006, $1,000.

“Creation of Web-based Course Resources for Forest Ecosystems and Management.” Demmler Teaching Endowment, 2005. $2,750.

“Forest Ecology Summer 2005 Research,” Shanbrom Fund (awarded to Laura Nagel (’07)), 2005, $1,000.

“Forest Ecology Summer 2005 Research,” Wells Student Research Fund (awarded to Laura Nagel (’07)), 2005, $1,000. “Ecotourism: Development of Local Ecotours.” Center for Economic and Environmental Development, 2005-2006. $6,575.

“Proposal to Examine Soil Carbon Dynamics in Forested Ecosystems,” Wells Student Research Fund (awarded to Laura Nagel and Anna Bartosewicz), 2004-2005, $3,497.

“Ecotourism: Promotion of Bus Ecotours.” Center for Economic and Environmental Development, 2004-2005. $4,800.

“Ecotourism: Development of Bus Ecotours.” Center for Economic and Environmental Development, 2003-2004. $4,850.

“Ecotourism: Development of Bus Tours.” Center for Economic and Environmental Development, 2002-2003. $4,960.

“Ecotourism Development.” Center for Economic and Environmental Development, 2001-2002, $3,925.

"Effects of catastrophic forest disturbance on fluxes of atmospheric trace gases between forest soils and the atmosphere." 1991, Howard Hughes Medical Institute, $12,519.

"Factors influencing atmospheric trace gas fluxes between temperate forest soils and the atmosphere," 1992, Howard Hughes Medical Institute, $2,000.

Proposals Pending:

none

Reviews:

Environmental Protection Agency P3 Awards Panel, 2011

NSF Ecosystems Panel. 2010

Smartwood Certified Forestry, Peer-Reviewer, 1999, Site Assessment Team Member, 2000.

NSF Coweeta Hydrologic Laboratory Long-Term Ecological Research Site Review Team, Chairman, 1999

NSF Collaborative Research at Undergraduate Institutions Review Panel Member, 1999.

U.S. Department of Agriculture Review Panel Member, National Research Initiative Competitive Grants Program, 1995-1997

National Science Foundation Committee of Volunteers Member, Ecological Studies Cluster, 1995.

Proposal reviews: Environmental Protection Agency, National Science Foundation, U.S. Dept. of Agriculture, Israel Science Foundation, Montana Office of Science, Mount Union College Student Research Awards, Social Sciences and Humanities Research Council of Canada

Manuscript reviews (49 different journals): Acta Oecologia, Agricultural and Forest Meteorology,], American Naturalist, Annals of Forest Science, Arid Environments, Atmospheric Environment, Australian Journal of Soil Science, Biogeochemistry, Biology and Fertility of Soils, Bioscience, Canadian Journal of Forest Research, Climate Change and Ecology, Ecological Modelling, Earth’s Future, Ecology, Ecosphere, Ecosystems, Fire, Forest Ecology and Management, Forest Science, Forests, Frontiers in Forests and Global Change, Geophysical Research Letters, Geosciences, Global Biogeochemical Cycles, Global Change Biology, Global Change Biology – Bioenergy, Journal of Environmental Management, Journal of Environmental Quality, Journal of Forestry, Journal of Geophysical Research, Journal of Great Lakes Research, J. Soil Science and Plant Nutrition, Natural Areas Journal, Northeastern Naturalist, PA Academy Sciences, Pedosphere, Plant and Soil, Plants, PLoS One, Proceedings 10th Central Hardwood Forest Conference, Restoration Ecology, Science of the Total Environment, Scientific Reports, Soil and Tillage Research, Soil Research, Soil Biology and Biochemistry, Soil Science Society of America Journal, Urban Ecosystems

Book reviews: Benjamin Cummings Publishing, Cambridge University Press, Dushkin Publishing Co., Freeman Press, Wiley Press, Yale University Press. University Press of New England, Wm. C. Brown Publishers, Roberts and Company Publishers

Academic Program Reviews: Skidmore College Department of Environmental Science (2023), Mount Union College (2017), Berry College (2017), Dickinson College Department of Environmental Studies (February 2005), Capital College Department of Biology (March 2005), Creighton University Department of Environmental and Atmospheric Sciences (April 2005)University of Kentucky Geology Dept., Environmental Science Program Planning, (1994)

Faculty Reviews: Stockton University, Ursinus College.

Personal Hobbies and Interests:

Hiking, camping, canoeing, kayaking, gardening, downhill skiing, cross-country skiing, hunting, fishing, history, Special Olympics, golf