Paul J. Hanson
December 18, 2023

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Research Expertise

Influence of climatic change on eco-physiological processes and ecosystems
Process-level physiological modeling
Deposition of trace gases to landscape surfaces
Physiology of woody plants
Air pollution stress physiology

Education

Ph.D.	University of Minnesota	Tree Physiology	1986
M.S.	University of Minnesota	Plant Physiology	1983
B.A.	St. Cloud State University	Biology (summa cum laude)	1981

Professional Experience

2012–present	Corporate Fellow, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee
2006–2020	Group Leader, Ecosystem Sciences Group, Environmental Sciences Division, Oak Ridge National Laboratory
2005–2012	Distinguished R&D Staff Member, Environmental Sciences Division, Oak Ridge National Laboratory.
2004–2009	Chief Scientist, Program for Ecosystem Research, U.S. Department of Energy
2001–2004	Senior R&D Staff Member, Environmental Sciences Division, Oak Ridge National Laboratory
1996–2001	Research Staff Member II, Environmental Sciences Division, Oak Ridge National Laboratory
1994–1998	Adjunct Associate Professor, Department of Ecology, University of Tennessee, Knoxville
1992–1995	Research Staff Member I, Environmental Sciences Division, Oak Ridge National Laboratory
1989–1992	Research Associate, Physiological Ecology Group, Environmental Sciences Division, Oak Ridge National Laboratory
1988–1989	Scientist, Automated Sciences Group, Oak Ridge, Tennessee
1986–1988	Postdoctoral Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory

Professional Activities

2005–2022	Subject Editor, *Global Change Biology*
2021, 2022	AGU Biogeosciences Fellows Committee
2018–2021	Member, U.S. Department of Energy's (DOE) Environmental Systems Science Data Infrastructure for a Virtual Ecosystem (ESS–DIVE) Archive Partnership Board (APB)
2009–2014	Member, North American Carbon Program, Carbon Cycle Science Steering Group (Two 3-year terms)
2013–2014	U.S. Global Changes Research Program Invited Reviewer, Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), Working Group I and Synthesis reports
2007–2012	Member, National Aeronautics and Space Administration's Oak Ridge National Laboratory Distributed Active Archive Center (DAAC) User Working Group
2007–2011	Member of U.S. Environmental Protection Agency's (EPA) Clean Air Science Advisory Committee (CASAC) NOx & SOx Secondary Review Panel
2009	Invited Congressional Testimony, 9 June 2009, Energy and Environment Subcommittee of the House Science and Technology Committee
2005–2008	Member of EPA's Clean Air Science Advisory Committee (CASAC) Ozone Review Panel
2002–2004	Member, National Institute for Global Environmental Change (NIGEC) National Technical Advisory Committee (NTAC)
2003	Panel member, U.S. Department of Agriculture's (USDA) Cooperative State Research, Education, and Extension Service (CSREES) Competitive Grants Program
1994–2004	Editorial Review Board, *Tree Physiology* (not 1999)
1995–2000	Associate Editor, *Journal of Environmental Quality* (two 3-year terms)
1998	Ad hoc member of an EPA Technical Qualifications Board
1996–1998	Advisory Board Southeast Regional Center of the National Institute for Global Environmental Change
1994–1995	Panel Member, DOE's Southeast Regional Center – National Institute for Global Environmental Change
1994–1996	Contributing Author, EPA, contributing to the revised Air Quality Criteria Document for Particulate Matter
1992, 1994	Panel Member, USDA's National Research Initiative Competitive Grants Program
1992	Grand Awards Judge, 43rd International Science and Engineering Fair.
1988–1990	Contributing Author, EPA, Air Quality Criteria Document for Oxides of Nitrogen

Awards and Honors

2020	Fellow, American Geophysical Union (AGU), awarded December 2020.
2020	Winner of the 2020 Nobel "Peat" Prize – International presented by MAC Ecohydrology, McMaster University for the article Hanson et al. 2020 *AGU Advances*: https://doi.org/10.1029/2020AV000163

2015	Significant Event Award for SPRUCE (Spruce and Peatland Responses Under Changing Environments), Oak Ridge National Laboratory
2008	Fellow, American Association for the Advancement of Science (AAAS), Section on Biological Sciences, elected November 2008
2004	Award for excellence in presentation of a paper, Soil Science Society of America, Division S-7, Annual meeting, October 31 – November 4, 2004, Seattle, Washington
2003	Award of Merit for a Book, Society for Technical Communication
2002	Award for excellence in presentation of a paper, Soil Science Society of America, Division S-7, Annual meeting, November 10–14, 2002, Indianapolis, Indiana
1995	Distinguished Scientific Achievement Award, Environmental Sciences Division Oak Ridge National Laboratory
1994	Award of Merit in Scholarly Articles, Society for Technical Communication
1988	Sigma Xi, elected to full membership
1986–1988	Postdoctoral Fellowship, Oak Ridge Associated Universities
1985	Graduate School Fellowship, University of Minnesota
1980	Phi Kappa Phi

Active Society Memberships

American Association for the Advancement of Science (AAAS) – Fellow
American Geophysical Union (AGU) – Fellow
Ecological Society of America (ESA) – Member
European Geophysical Union (EGU) – Life Member
Soil Science Society of America (SSSA) – Member

Students/Teachers Advised

Keith Rott 1987, Kelly Maas 1989, D. Susanne Ramer 1990, Cindy S. Fuhrer 1990, Stephanie Bohlman 1991–1992, Todd Tabberer 1993–94, Kristin Harter 1994–1995, James 'Ben' Stringfellow 1995, James Arnett 1995–1997, Tracy Misek 1996–1997, Jennifer Croker 1995–1997, M. Lala S. Chambers 1994–1997, T. Brendon Johnson 1996–1997, Morgan Castner 1997–1998, Mark Scannell 1999, Karen Voiles 1999, Philip Allen 2000–2001, Bridgette M. Boudreaux 2001 & 2005, Jason C. Fults 2001, Craig Wayson 2003–2005, Rebekah Wagner 2006–2007, Mats Fröberg 2006–2008, Jake Graham 2017-2020.

Faculty Sabbaticals Hosted

Yuling Fu, Chinese Academy of Sciences, 2009–2010; H.-J. Segschneider, Institut für Radioagronomie, Jülich, FRG, 1991; W. Hoffman, Denison University, Danville, Ohio, 1991–1992

Funded Proposals (2001– present)

Hanson, PJ et al. 2023. Science plan and progress report for the Terrestrial Ecosystem Science Scientific Focus Area for FY2024 to FY2028. U.S. Department of Energy, funded at $8.3M per year ($41.5 M total).

Hanson, PJ et al. 2019. Third triennial *Science Plan and Progress Report for the Terrestrial Ecosystem Science Scientific Focus Area (TES SFA).* U.S. Department of Energy, 2019 to 2022, Funded at $8.3M per year. Extended to include FY2022 and FY2023.

Hanson, PJ et al. 2015. Second triennial *Science Plan for the Oak Ridge National Laboratory Terrestrial Ecosystem Science Scientific Focus Area.* U.S. Department of Energy, 2016 to 2018, Funded at $8.255M per year

Hanson, PJ et al. 2012. *Extended Science Plan for the Oak Ridge National Laboratory Terrestrial Ecosystem Science Scientific Focus Area.* U.S. Department of Energy, 2013 to 2015, Funded at $8M per year

Hanson, PJ et al. *Science Plan for the Terrestrial Ecosystem Science Scientific Focus Area. U.S. Department of Energy, 2010 to 2012*, Funded at $7 to 8M per year

Hanson, PJ et al. *Science Plan for the Climate Change Response Science Focus Area.* U.S. Department of Energy, 2010 to 2013, Funded at $5M per year

Hanson, PJ et al. *Task 3 Component of the Science Plan for the Climate Change Forcing Science Focus*, U.S. Department of Energy, 2010 to 2013, ~$400K per year

Hanson PJ *Climate Change Response Science Focus Area. 2007–2009*, ~$2.5M per year

Hanson PJ *Program for Ecosystem Research Chief Scientist. 2004–2009*, ~$200,000 per year

Gu L, Hanson PJ, Pallardy SG, Wullschleger SD, Edwards NT. *Regulation of carbon sequestration and water use in an Ozark Forest: Proposing a new strategically located Ameriflux tower site in Missouri.* U.S. Department of Energy, 2003–2005, ~$1.397M over three years.

Hanson PJ, Tschaplinski TJ, Wullschleger SD, Augé RM. *Identifying Critical Thresholds for Plant/Ecosystem Response to Moisture Stress.* U.S. Department of Energy, 2002–2004, ~$900,000 over three years.

Hanson PJ, Trumbore SE, Gaudinski J, Southon J, Torn M, Jastrow J. *Enriched Background Isotope Study (EBIS)*, U.S. Department of Energy, 2002–2004, ~$2.7M over three years.

Hanson PJ. *Mechanisms of forest ecosystem adjustments to altered precipitation-the Walker Branch Throughfall Displacement Experiment (TDE).* Renewal proposal 2002–2006, $2.2M over five years.

Hanson PJ and others. *Mechanisms of Forest Ecosystem Adjustment to Altered Precipitation - The Walker Branch Throughfall Displacement Experiment (TDE)*. Renewal proposal 1999–2001, $2.6M over three years.

Publication Record and Metrics

ORCID ID: http://orcid.org/0000-0001-7293-3561

Web of Science ResearcherID Publons, December 2023
D-8069-2011 [https://www.webofscience.com/wos/author/record/D-8069-2011]
h-index = 68 with >17,018 citations for 201 publications

Scopus, December 2023
h-index = 68 with >18,180 citations for 200 publications, 790 Co-authors

Google Scholar metrics, December 2023
h-index 83; i10-index 198; with >27,600 citations for over 457 items

Published works and data sets (1 book; 241 articles; 40 data sets)
46 Publications with more than 100 citations as of January 2022

Book:

Hanson PJ, Wullschleger SD, Editors (2003) *North American Temperate Deciduous Forest Responses to Changing Precipitation Regimes.* Springer, New York, 421 p.

Articles, Book Chapters, and Key Reports:

1. Roth S, Griffiths NA, Kolka RK, Oleheiser KC, Carrell AA, Klingeman DM, Seibert A, Chanton JP, **Hanson PJ**, Schadt CW (2023) Elevated temperature alters microbial communities, but not decomposition rates, during 3 years of *in situ* peat decomposition. *mSystems* 8(5):e00337-23. doi: 10.1128/msystems.00337-23
2. Ma S, Jiang L, Wilson RM, Chanton J, Niu S, Iversen CM, Malhotra A, Jiang J, Huang Y, Lu X, Shi Z, Tao F, Liang J, Ricciuto D, **Hanson PJ**, Luo Y (2023) Thermal acclimation of plant photosynthesis and autotrophic respiration in a northern 2 peatland. *Environmental Research Climate* 2: 025003. doi: 10.1088/2752-5295/acc67e
3. Schädel C, Seyednasrollah B, **Hanson PJ**, Hufkens K, Pearson KJ, Warren JM, Richardson AD (2023) Using long-term data from a whole ecosystem warming experiment to identify best spring and autumn phenology models. *Plant Environment Interactions* 4:188-200. doi:10.1002/pei3.10118
4. Barreto C, Conceicão PH, de Lima EC, Stievano LC, Zeppelini D, Kolka RK, **Hanson PJ**, Lindo Z (2023) Large-scale experimental warming reduces soil faunal biodiversity through peatland drying. *Frontiers in Environmental Science* 11:1153683. doi:10.3389/fenvs.2023.1153683
5. Hou E, Ma S, Huang Y, Zhou Y, Kim H-S, López-Blanc E, Jiang L, Xia J, Tao F, Williams C, Mathew Williams E, Ricciuto D, **Hanson PJ**, Luo Y (2023) Across-model spread and shrinking in predicting peatland carbon dynamics under global change. *Global Change Biology* 29:2759-2775. doi: 10.1111/gcb.16643
6. Dusenge ME, Warren JM, Reich PB, Ward EJ, Murphy BK, Stefanski A, Villanueva R, Cruz M, McLennan DA, King AW, Montgomery RA, Hanson PJ, Way DA (2023) Boreal conifers maintain carbon uptake with warming despite failure to track optimal temperatures. *Nature Communications* 14:4667. https://doi.org/10.1038/s41467-023-40248-3.
7. Petro C, Carrell A, Wilson RM, Duchesneau K, Noble-Kuchera S, Song T, Iversen C, Childs J, Schwaner G, Chanton J, Norby RJ, **Hanson PJ**, Glass J, Weston D, Kostka JE (2023) Climate drivers alter nitrogen availability in surface peat and decouple N-fixation from CH_4 oxidation in the *Sphagnum* moss microbiome. *Global Change Biology* 29:3159-3176. doi://10.1111/gcb.16651.
8. Wood JD, Gu L, **Hanson PJ**, Frankenberg C, Sack L (2023) The ecosystem wilting point defines drought response and recovery of a *Quercus-Carya* forest. *Global Change Biology* 29:2015-2029. https://doi.org/10.1111/gcb.16582

9. Ofiti NOE, Altermatt M, Petibon F, Warren JM, Malhotra A, **Hanson PJ**, Wiesenberg GLB (2023) Warming and elevated CO_2 induced shifts in carbon partitioning and lipid composition within an ombrotrophic bog plant community. Environmental and Experimental Botany 206:105182. https://doi.org/10.1016/j.envexpbot.2022.105182.
10. Iversen CM, Latimer J, Brice DJ, Childs J, Vander Stel HM, Defrenne CE, Graham J, Griffiths NA, Malhotra A, Norby RJ, Oleheiser KC, Phillips JR, Salmon VG, Sebestyen SD, Yang X, **Hanson PJ** (2023) Whole-ecosystem warming increases plant-available nitrogen and phosphorus in an ombrotrophic bog. *Ecosystems* 26:86-113. https://doi.org/10.1007/s10021-022-00744-x
11. Carrell A, Lawrence T, Cabugao K, Carper D, Pelletier D, Lee J, Jawdy S, Grimwood J, Schmutz J, **Hanson P**, Shaw AJ, Weston D (2022) Habitat-adapted microbial communities mediate *Sphagnum* peatmoss resilience to warming. *New Phytologist* 234:2111-2125. doi: 10.1111/nph.18072.
12. Helbig M, Živković T, Alekseychik P, Aurela M, El-Madany TS, Euskirchen ES, Flanagan L, Griffis T, **Hanson PJ,** Helfter C, Hirano T, Humphreys E, Kiely G, Kolka R, Leahy P, Lohila A, Mammarella I, Nilsson M, Panov A, Parmentier FJW, Peichl M, Rinne J, Roman D, Sonnentag O, Tuittila ES, Ueyama M, Vesala T, Vestin P, Weldon S, Weslien P, Zaehle S (2022) Warming response of peatland CO_2 sink is sensitive to seasonality in warming trends. *Nature Climate Change* 12:743-749. https://doi.org/10.1038/s41558-022-01428-z.
13. Ma S, Jiang L, Wilson RM, Chanton JP, Brigham S, Niu S, Iversen CM, Malhotra A, Jiang J, Lu X, Huang Y, Keller J, Xu X, Ricciuto DM, **Hanson PJ**, Luo Y (2022) Evaluating alternative ebullition models for predicting peatland methane emission and its pathways via data-model fusion. *Biogeosciences* 19:2245-2262, https://doi.org/10.5194/bg-19-2245-2022.
14. Kolton M, Weston DJ, Mayali X, Weber PK, McFarlane KJ, Pett-Ridge J, Somoza MM, Lietard J, Glass JB, Lilleskove EA, Shaw AJ, Tringe S, **Hanson PJ**, Kostka JE (2022) Defining the Sphagnum Core Microbiome across the North American Continent Reveals a Central Role for Diazotrophic Methanotrophs in the Nitrogen and Carbon Cycles of Boreal Peatland Ecosystems. *mBio* 13:e03714-21. https://doi.org/10.1128/mbio.03714-21
15. Baysinger MR, Wilson RM, **Hanson PJ**, Kostka JE and Chanton JP (2022) Compositional stability of peat in ecosystem-scale warming mesocosms. *PLOS ONE* 17:e0263994. https://doi.org/10.1371/journal.pone.0263994
16. Graham JD, Ricciuto DM, Glenn NF, **Hanson PJ** (2022) Incorporating microtopography in a land surface model and quantifying the effect on the carbon cycle. *Journal of Advances in Modeling Earth Syste*ms 14, e2021MS002721. https://doi.org/10.1029/2021MS002721
17. Yuan F, Wang Y, Ricciuto DM, Shi X, Yuan F, Brehme T, Bridgham S, Keller J, Warren JM, Griffiths NA, Sebestyen SD, **Hanson PJ**, Thornton PE, Xu X (2021) Hydrological feedbacks on peatland CH_4 emission under warming and elevated CO_2: a modeling study. *Journal of Hydrology* 603:127137, https://doi.org/10.1016/j.jhydrol.2021.127137

18. Ofiti N, Solly E. **Hanson P**, Malhotra A, Wiesenberg G, Schmidt M (2021) Warming and elevated CO_2 promote rapid incorporation and accelerated degradation of plant-derived organic matter in an ombrotrophic peatland. *Global Change Biology* 28:883-898, doi: 10.1111/gcb.15955.
19. Horst AM, Santos-Medellín C, Sorensen JW, Zinke LA, Wilson RM, Johnston ER, Trubl GG, Pett-Ridge J, Blazewicz SJ, **Hanson PJ**, Chanton JP, Schadt CW, Kostka JE, Emerson JB (2021) Minnesota peat viromes reveal terrestrial and aquatic niche partitioning for local and global viral populations. *Microbiome* 9:233, https://doi.org/10.1186/s40168-021-01156-0
20. Wilson RM, Griffiths NA, Visser A, McFarlane KJ, Sebestyen SD, Oleheiser KC, Bosman S, Hopple AM, Tfaily MM, Kolka RK, **Hanson PJ**, Kostka JE, Bridgham SD, Keller JK, Chanton JP (2021) Radiocarbon Analyses Quantify Peat Carbon Losses With Increasing Temperature in a Whole Ecosystem Warming Experiment. *Journal of Geophysical Research: Biogeosciences* 126: e2021JG006511, https://doi.org/10.1029/2021JG006511
21. Heckman KA, Swanston CW, Torn MS, **Hanson PJ**, Nave LE, Porras RC, Mishra U, Bill M (2021) Soil organic matter is principally root derived in an Ultisol under oak forest. *Geoderma* 403,115385, https://doi.org/10.1016/j.geoderma.2021.115385
22. Meng L, Mao J, Ricciuto DM, Shi X, Richardson AD, **Hanson PJ**, Warren JM, Zhou Y, Li X, Zhang Li, Schädel C (2021) Evaluation and Modification of ELM Seasonal Deciduous Phenology against Observations in a Southern Boreal Peatland Forest. *Agricultural and Forest Meteorology* 308-309:108556, https://doi.org/10.1016/j.agrformet.2021.108556
23. Liang J, Wang G, Singh S, Jagadamma S, Gu L, Schadt CW, Wood JD, **Hanson PJ**, Mayes MA (2021) Intensified Soil Moisture Extremes Decrease Soil Organic Carbon Decomposition: A Mechanistic Modeling Analysis. *Journal of Geophysical Research – Biogeosciences*, 126: e2021JG006392, https://doi.org/10.1029/2021JG006392
24. Yuan F, Wang Y, Ricciuto DM, Shi X, Yuan F, **Hanson PJ**, Bridgham S, Keller J, Thornton P, Xu X (2021) An Integrative Model for Soil Biogeochemistry and Methane Processes: II. Warming and Elevated CO_2 Effects on Peatland CH_4 Emissions. *Journal of Geophysical Research – Biogeosciences*, 126: e2020JG005963, https://doi.org/10.1029/2020JG005963
25. Ricciuto DM, Xu X, Shi X, Wang Y, Song X, Schadt CW, Griffiths NA, Mao J, Warren JM, Thornton PE, Chanton J, Keller JK, Bridgham S, Gutknecht J, Sebestyen SD, Finzi A, Kolka RK, and **Hanson PJ** (2021) An interactive model for soil biogeochemistry and methane processes: I. model structure and sensitivity analyses. *Journal of Geophysical Research -Biogeosciences*, 126: e2019JG005468, https://doi.org/10.1029/2019JG005468
26. Huang X, Lu D, Ricciuto DM, **Hanson PJ**, Richardson AD, Lu X, Weng E, Nie S, Jiang L, Hou E, Steinmacher IF, Luo Y (2021) A Model-Independent Data Assimilation (MIDA) module and its applications in ecology. *Geoscientific Model Development* 14:5217–5238, https://doi.org/10.5194/gmd-2021-33
27. Salmon VG, Brice DJ, Bridgham S, Childs J, Graham J, Griffiths NA, Hofmockel K, Iversen CM, Jicha TM, Kolka RK, Kostka J, Malhotra A, Norby

RJ], Phillips JR, Ricciuto DR, Schadt CW, Sebestyen SD, Shi X, Walker AP, Warren JM, Weston DJ, Yang X, **Hanson PJ** (2021) Nitrogen and phosphorus cycling in an ombrotrophic peatland: A benchmark for assessing change. *Plant and Soil*, 466:649-674, https://doi.org/10.1007/s11104-021-05065-x

28. Defrenne CE, Childs J, Fernandez CW, Taggart M, Nettles WR, Allen MF, **Hanson PJ**, Iversen CM (2021) High-resolution minirhizotrons advance our understanding of roots-fungal dynamics in an experimentally-warmed peatland. *Plants, People, Planet* 3:640-652. https://doi.org/10.1002/ppp3.10172.
29. Dusenge ME, Ward EJ, Warren JM, Stinziano JR, Wullschleger SD, **Hanson PJ**, Way DA (2021) Warming induces divergent stomatal dynamics in co-occurring boreal trees. *Global Change Biology* 27:3079-3094, https://doi.org/10.1111/gcb.15620
30. Wilson RM, Tfaily MM, Kolton MM, Petro C, **Hanson PJ**, Heyman HM, Kyle JE, Hoyt DW, Eder EK, Purvine SO, Kolka RK, Sebestyen SD, Griffiths NA, Schadt CW, Kostka J, Chanton JP (2021) Soil metabolome response to whole-ecosystem warming at the Spruce and Peatland Responses Under Changing Environments experiment. *Proceedings of the National Academy of Sciences* 118: e2004192118. https://doi.org/10.1073/pnas.2004192118.
31. Poyatos R, Granda V, Flo V, Mencuccini M, Steppe K, Martínez-Vilalta J, SAPFLUXNET contributors [**Hanson PJ**, Norby RJ Wullschleger SD] (2021) Global transpiration data from sap flow measurements: the SAPFLUXNET database. *Earth System Science Data* 13:2607-2649, doi:10.5194/essd-13-2607-2021.
32. Warren JM, Jensen AM, Ward EJ, Guha A, Childs J, Wullschleger SD, **Hanson PJ** (2021) Divergent species-specific impacts of whole ecosystem warming and elevated CO_2 on vegetation water relations in an ombrotrophic peatland. *Global Change Biology* 27:1820-1835, doi: 10.1111/gcb.15543
33. Shi X, Ricciuto DM, Thornton PE, Xu X, Yuan F, Norby RJ, Walker AP, Warren JM, Mao J, **Hanson PJ**, Meng L, Weston D, Griffiths NA (2021) Extending a land-surface model with Sphagnum moss to simulate responses of a northern temperate bog to whole ecosystem warming and elevated CO_2. *Biogeosciences* 18:467-486, https://doi.org/10.5194/bg-18-467-2021
34. McPartland MY, Montgomery RA, **Hanson PJ**, Phillips JR, Kolka RK, Palik B (2020) Vascular plant species response to warming and elevated carbon dioxide in a boreal peatland. *Environmental Research Letters* 15:124066, https://doi.org/10.1088/1748-9326/abc4fb
35. Malhotra A, Brice D, Childs J, Graham JD, Hobbie EA, Vander Stel H, Feron SC, **Hanson PJ**, Iversen CM (2020) Peatland warming strongly increases fine-root growth. *Proceedings of the National Academy of Sciences* 117:17627-17634, doi:10.1073/pnas.2003361117
36. **Hanson PJ**, Griffiths NA, Iversen CM, Norby RJ, Sebestyen SD, Phillips JR, Chanton JP, Kolka RK, Malhotra A, Oleheiser KC, Warren JM, Shi X, Yang X, Mao J, Ricciuto DM (2020) Rapid net carbon loss from a whole-ecosystem warmed peatland. *AGU Advances* 1, e2020AV000163, doi:10.1029/2020AV000163

37. Hopple AM, Wilson, RM, Kolton, M, Zalman, CA, Chanton JP, Kostka J, **Hanson PJ**, Keller JK, Bridgham SD (2020) Massive peatland carbon banks vulnerable to rising temperatures. *Nature Communication* 11:2373. doi:10.1038/s41467-020-16311-8
38. Graham JD, Glenn NF, Spaete LP, **Hanson PJ** (2020) Characterizing peatland microtopography using gradient and microform-based approaches. *Ecosystems* 23:1464-1480. doi:10.1007/s10021-020-00481-z
39. Paschalis A, Fatichi S, Zscheischler J, Ciais P, Bahn M, Boysen L, Chang J, De Kauwe M, Estiarte M, Goll D, **Hanson PJ**, Harper AB, Hou E, Kigel J, Knapp AK, Larsen KS, Li W, Lierert S, Luo Y, Meir P, Ogaya R, Parolari AJ, Peng C, Peñuelas J, Pongratz J, Rambal S, Schmidt IK, Shi H, Sternberg M, Tian H, Tschumi E, Ukkola A, Vicca S, Viovy N, Wang Y-P, Wang Z, Wu D, Zhu Q (2020) Rainfall-manipulation experiments as simulated by terrestrial biosphere models: where do we stand? *Global Change Biology* 26:3336-3355. doi:10.1111/gcb.15024.
40. Kluber LA, Johnston ER, Allen SA, Hendershot JN, **Hanson PJ**, Schadt CW (2020) Constraints on microbial communities, decomposition and methane production in deep peat deposits. *PLOS ONE* 15(2): e0223744. doi: 10.1371/journal.pone.0223744.
41. **Hanson PJ**, Walker AP (2020) Invited Commentary: "Advancing global change biology through experimental manipulations: Where have we been and where might we go?" *Global Change Biology* 26:287-299. doi:10.1111/gcb.14894.
42. Norby RJ, Childs J, **Hanson PJ**, Warren JM (2019) Rapid loss of an ecosystem engineer: Sphagnum decline in an experimentally warmed bog. *Ecology and Evolution* 9:12571-12585. doi:10.1002/ece3.5722.
43. Ward EJ, Warren JM, McLennan DA, Dusenge ME, Way DA, Wullschleger SD, **Hanson PJ** (2019) Photosynthetic and respiratory responses of two bog shrub species to whole ecosystem warming and elevated CO_2 at the boreal-temperate ecotone. *Frontiers in Forests and Global Change* 2:54, doi:10.3389/ffgc.2019.00054.
44. Carrell AA, Kolton M, Glass JB, Pelletier DA, Warren MJ, Kostka JE, Iversen CM, **Hanson PJ**, Weston DJ (2019) Experimental warming alters the composition, diversity and N_2 fixation activity of the peat moss (*Sphagnum fallax)* microbiomes. *Global Change Biology* 25:2993-3004. doi:10.1111/gcb.14715.
45. Jensen AM, Warren JM, King AW, Ricciuto DM, **Hanson PJ**, Wullschleger SD (2019) Simulated projections of boreal forest peatland ecosystem productivity are sensitive to observed seasonality in leaf physiology. *Tree Physiology* 39:556-572. doi:10.1093/treephys/tpy140.
46. Liang J, Wang G, Ricciuto DM, Gu L, **Hanson PJ**, Wood JD, Mayes MA (2019) Evaluating the E3SM Land Model at a temperate forest site using flux and soil water measurements. *Geoscientific Model Development* 12:1601-1612. doi:10.5194/gmd-12-1601-2019.
47. Huang Y, Stacy M, Jiang J, Sundi N, Ma S, Saruta V, Jung CG, Shi Z, Xia J, **Hanson PJ**, Ricciuto D, Luo Y (2019) Realized ecological forecast through an

interactive ecological platform for assimilating data (EcoPAD, v 1.0) into models. *Geoscientific Model Development* 12:1119–1137, doi:10.5194/gmd-12-1119-2019.

48. Asbjornsen H, Campbell JL, Jennings KA, Vadeboncoeur MA, McIntire C, Templer PH, Phillips RP, Bauerle TL, Dietze MC, Frey SD, Groffman PM, Guerrieri R, **Hanson PJ**, Kelsey EP, Knapp AK, McDowell NG, Meir P, Novick KA, Ollinger SV, Pockman WT, Schaberg G, Wullschleger SD, Smith MD, Rustad L (2018) Guidelines and considerations for designing precipitation manipulation experiments in forest ecosystems. *Methods in Ecology and Evolution* 9:2310-2325, doi:10.1111/2041-210X.13094.
49. Krassovski MB, Lyon GE, Riggs JS, **Hanson PJ** (2018) Near real time environmental monitoring and large volume data collection over slow communication links. Geoscientific Instrumentation. *Geoscientific Instrumentation, Methods and Data Systems* 7:289-295, doi:10.5194/gi-7-289-2018.
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39. Poyatos R, Granda V, Flo V, Molowny-Horas R, Steppe K, Mencuccini M, Martínez-Vilalta J Data Providers: **Hanson PJ,** Wullschleger SD (2020) SAPFLUXNET: A global database of sap flow measurements. (Version 0.1.4) [Data set]. Zenodo. doi:10.5281/zenodo.3697807

Abstracts and Presentations (2015–present)

1. **Hanson PJ** and SPRUCE Project Participants (2020) Ombrotrophic Peatland Responses to Warming and Elevated CO_2: Implications for Ecosystem Carbon Exchange, Productivity and Greenhouse Gas Production After 3-Years of Manipulation. Invited Talk. Northern Arizona University, 31 January 2020.
2. **Hanson PJ**, Norby RJ, Phillips JR, Warren JM, Griffiths NA, Iversen CM, Shi X, Ricciuto DM (2019) Ombrotrophic Peatland Responses to Warming and Elevated CO_2: Implications for Ecosystem Carbon Exchange, Productivity and Greenhouse Gas Production after 3-Years of Manipulation. AGU Fall Meeting, Abstract Number: B31C-03, Oral talk, Session: B31C, 9–13 December 2019.

3. **Hanson PJ**, Phillips JR, Norby RJ, Warren JM, Griffiths NA, Ricciuto DM (2019) Peatland Responses to Warming and Elevated CO_2: CO_2 and CH_4 Flux Responses, the status of Vegetation Net Primary Production and Implications for Ecosystem Carbon Exchange After 3-Years of Manipulation. EGU Annual Meeting, EGU2019-11610 | Orals | Session BG2.15, 8–12 April 2019.
4. **Hanson PJ** (2018) Peatland ecosystem responses to warming and the implications for ecosystem carbon gain or loss: A SPRUCE project overview., Boise State University, 22 October 2018. (Invited Presentation)
5. **Hanson PJ**, Phillips JR, Nettles WR, Heiderman R (2017) Recent carbon cycle dynamics in an ombrotrophic peatland: implications from warming and eCO_2 treatments and the role of vegetation layers in the flux of CO_2 and CH4, B42C-01. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
6. Dusenge ME, Stinzianol JR, Warren JM, Ward EJ, Wullschleger SD, **Hanson PJ**, Way DA (2017) Thermal acclimation of photosynthesis and respiration differ across conifer species in a mature boreal peatland, B14A-04. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
7. Graham J, Glenn NF, Spaete L, **Hanson PJ** (2017) Ecosystem structure and function in the SPRUCE chambers at fine resolution, B31D-2011. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
8. Hopple A, Brunik K, Keller J, Pfeifer-Meister L, Woerndle G, Zalman C, **Hanson PJ**, Bridgham S (2017) How does whole ecosystem warming of a peatland affect methane production and consumption? B42C-02. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
9. Krassovski M, **Hanson PJ**, Riggs JS, Nettles IV WR (2017) Near real time/low latency data collection for climate warming manipulations and an elevated CO_2 SPRUCE experiment, IN31C-0087. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
10. Liang J, Ricciuto DM, Wang G, Gu L, **Hanson PJ**, Mayes MA (2017) A mechanistic diagnosis of the simulation of soil CO_2 efflux of the ACME Land Model, B41F-2034. AGU Fall Meeting, New Orleans, LA, 11-15 December 2017.
11. Luo Y, Huang Y, Jiang J, Shuang M, Saruta V, Liang G, **Hanson PJ**, Ricciuto DM, Milcu A, Roy J (2017) Integration of research infrastructures and ecosystem models toward development of predictive ecology, B31H-03. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017. (Invited)
12. Shi X, Ricciuto DM, Thornton PE, **Hanson PJ**, Xu X, Mao J, Warren J, Yuan F, Norby RJ, Sebestyen S, Griffiths N, Weston DJ, Walker A (2017) Representing Northern Peatland Hydrology and Biogeochemistry with ALM. B43G-2216. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
13. Shuang MA, Huang Y, Jiang J, Ricciuto DM, **Hanson PJ**, Luo Y (2017) Acclimation of methane production weakens ecosystem response to climate warming in a northern peatland. B42C-04. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
14. Shuang MA, Huang Y, Stacy M, Jiang J, Sundi M, Ricciuto DM, **Hanson PJ**, Luo Y, Saruta V (2017) EcoPAD - An interactive platform for near real-time ecological forecasting by assimilating data into model, B43I-01. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017. (Invited)

15. Steinweg JM, Kostka JE, **Hanson PJ,** Schadt CW (2017) Temperature sensitivity differences with depth and season between carbon, nitrogen, and phosphorus cycling enzyme activities in an ombrotrophic peatland system, B51D-1829. AGU Fall Meeting, New Orleans, LA, 11–15 December.
16. Phillips JR, **Hanson PJ**, Warren J, Ward E, Brice D, Graham J (2017) Peatland Woody Plant Growth Responses to Warming and Elevated CO_2 in a Southern-boreal Raised Bog Ecosystem, B43G-2217. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
17. Ward EJ, Dusenge ME, Warren J, Murphy BK, Way D, King AW, McLennan D, Montgomery R, Stefanski A, Reich PB, Aguilar MC, Wullschleger S, Villanueva RB, **Hanson PJ** (2017) Ecophysiology at SPRUCE: Impacts of whole ecosystem warming and elevated CO_2 on leaf-level photosynthesis and respiration of two ericaceous shrubs in a boreal peatland, B32B-04. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
18. Warren J, Ward EJ, Wullschleger SD, **Hanson PJ** (2017) Increased transpiration and plant water stress in a black spruce bog exposed to whole ecosystem warming, B11K-04. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
19. Wilson R, Tfaily M, Chanton J, Rich VI, Saleska SR, Holmes B, Langford L, **Hanson PJ,** Bridgham SD, Hopple A, Keller J, Cory A, Kostka JE (2017) Controls on methanogenesis in organic-rich anaerobic environments, B42C-08. AGU Fall Meeting, New Orleans, LA, 11–15 December 2017.
20. **Hanson PJ**, Phillips JR, Graham J, Norby RJ, Warren JM, Wullschleger SD, Griffiths NA, Spaete L, Glenn N (2017) Peatland Responses to Warming and Elevated CO_2: Early CO_2 and CH_4 Flux Responses and the Status of Vegetation Net Primary Production, ESA Annual Meeting, Portland, Oregon, 5–10 August 2017.
21. Ward EJ, Dusenge ME, Warren JM, Way DA, Wullschleger SD, **Hanson PJ** (2017)
    Ecophysiology at SPRUCE: Impacts of whole ecosystem warming and elevated CO_2 in a boreal peatland forest. ESA Annual Meeting, Portland, Oregon, 5–10 August 2017.
22. **Hanson PJ**, Griffiths N, Sebestyen S, Ricciuto D (2017) Whole-ecosystem-warming and elevated-CO_2 Results through 1.5 years of manipulation. Invited Presentation #1185 in the session on Climate Change Effects on Northern Peatlands: Results of Manipulative Experiments I, Society of Wetland Scientists 2017 Annual Meeting, San Juan, Puerto Rico, 5–8 April 2017.
23. Hopple A, Brunik K, Pfeifer-Meister L, Keller J, Woerndle G, Medvedeff C, **Hanson PJ**, Bridgham S (2017) How does whole-ecosystem warming of a peatland affect methane production? Invited Presentation #1556 in the session on Climate Change Effects on Northern Peatlands: Results of Manipulative Experiments I, Society of Wetland Scientists 2017 Annual Meeting, San Juan, Puerto Rico, 5–8 April 2017.
24. Rush J, Medvedeff C, Hanna E, Woerndle G, Bridgham S, **Hanson PJ**, Keller J (2017) Effects of Temperature on Humic Substance Reduction in a Northern Minnesota Peatland. Invited Presentation #1463 in the session on Climate Change

Effects on Northern Peatlands: Results of Manipulative Experiments I, Society of Wetland Scientists 2017 Annual Meeting, San Juan, Puerto Rico, 5–8 April 2017.

25. Shi X, Ricciuto D, **Hanson PJ**, Thornton P, Xu X, Mao J (2017) Representing northern peatland hydrology and biogeochemistry with ALM land surface model. Invited Presentation #1177 in the session on Climate Change Effects on Northern Peatlands: Results of Manipulative Experiments II, Society of Wetland Scientists 2017 Annual Meeting, San Juan, Puerto Rico, 5–8 April 2017.
26. **Hanson PJ**, McFarlane KJ, Griffiths NA, Ricciuto DM, Iversen CM, Kolka RK (2017) Peatland Carbon Cycle Responses to Warming and Elevated CO_2: Early responses from the SPRUCE in situ manipulations. 2017 Joint NACP and AmeriFlux Principal Investigators Meeting, Bethesda, Maryland, 27–30 March 2017.
27. **Hanson PJ** (2017) U.S. Eastern Forest Ecosystems and Drought Chronic and Acute Manipulation Insights (C-Nutrient Cycle Interactions). USDA Forest Service National Drought Meeting, San Antonio, Texas, 21–23 March 2017 (invited talk).
28. **Hanson PJ**, Ricciuto DM, McFarlane KJ, Chanton P, Griffiths NA, Kolka RK, and additional Project Participants (2016) Peatland carbon impacts from warming and elevated CO_2: initial responses from the SPRUCE in situ manipulations. Conference Abstract, 2016 The 10th INTECOL International Wetlands Conference, 19–24 September 2016, Changshu, China, p. 185.
29. Hopple A, Keller JA, Medvedeff CA, **Hanson P**, Pfeifer-Meister L, Bridgham SD (2016) How does deep warming of a peatland affects methane production? Conference Abstract, 2016 The 10th INTECOL International Wetlands Conference, 19–24 September 2016, Changshu, China, p. 190.
30. Kluber LA, Hendershot JN, Allen S, Yip DZ, Yang Z, **Hanson PJ,** Schadt CW (2016) Microbial community responses and limitations to deep peat heating at the SPRUCE experiment in Northern Minnesota. COS 90-7, ESA Annual Meeting, Fort Lauderdale, Florida, 7–12 August 2016.
31. **Hanson PJ**, Riggs JS, Nettles WR, Phillips JR, Krassovski M, Hook LA (2016) Field performance of the SPRUCE whole-ecosystem warming facility for tall stature peatland vegetation. PS 18-46, ESA Annual Meeting, Fort Lauderdale, Florida 7–12 August 2016.
32. Kolka RK, **Hanson PJ** (2016) Spruce and Peatland Responses Under Climatic and Environmental Change (SPRUCE) Experiment. 15th International Peat Congress. Kuching, Malaysia, 15–19 August 2016.
33. Chanton J, Wilson R, Tfaily MM, Sebestyen SD, Medvedeff C, McFarlane KJ, Kolka RK, Kostka JE, Keller J, **Hanson PJ**, Guilderson TP, de La Cruz F, Cooper WT, Bridgham SD, Barlaz M (2015) The Stability of Peatland Carbon Stores to Global Change: Evidence for Enhanced Methane and Carbon Dioxide Production. B44B-01: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
34. Guilderson TP, McFarlane KJ, McNicol G, **Hanson PJ**, Chanton J, Wilson R, Bosworth R, Singleton MJ (2015) Sources of Below-Ground Respired Carbon in a Northern Minnesota Ombrotrophic Spruce Bog and the Influence of Heating Manipulations. B41C-0460: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.

35. Iversen CM, Norby RJ, Childs J, McCormack ML, Walker AP, **Hanson PJ**, Warren J, Sloan VL, Sullivan PF, Wullschleger S, Powell AS (2015) Linking Belowground Plant Traits With Ecosystem Processes: A Multi-Biome Perspective. B51K-03: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
36. Matthews E, Varner RK, Peng C, **Hanson PJ** - Conveners (2015) Natural Wetlands and Open Waters in the Global Methane Cycle: Modeling, Observations, and Challenges I. B41C: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
37. McFarlane KJ, Iversen CM, Phillips JR, Brice DJ, **Hanson PJ** (2015) Holocene Carbon Accumulation Rates in the SPRUCE Bog Prior to Warming and Elevated CO_2 Treatment. B11H-0540: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
38. Shi X, Ricciuto DM, Xu X, Thornton PE, **Hanson PJ**, Mao J, Sebestyen S, Griffiths N (2015) Representing Northern Peatland Hydrology and Biogeochemistry within the Community Land Model. B41C-0431: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
39. Xu X, Yuan F, **Hanson PJ**, Wullschleger SD, Thornton PE, Tian H, Riley WJ, Song X, Graham DE, Song C (2015) Four decades of modeling methane cycling in terrestrial ecosystems: Where we are heading? B41C-0429: AGU Fall Meeting, San Francisco, California, 14–18 December 2015.
40. **Hanson PJ**, Norby RJ, King AW, Glenn Wilson G (2015) Robert J. (Bob) Luxmoore – Soil physicist, plant physiologist, forester, pioneer elevated CO_2 researcher, modeler, activist, mentor and colleague. *Soil Science Society of American Annual Meeting*, Minneapolis, Minnesota, 17 November 2015, Session 181 Talk #1. (Invited talk)
41. Keller JK, Bridgham SD, Chanton J, **Hanson PJ**, Hopple A, Kostka JE, Medvedeff CA, Pfeifer-Meister L, Wilson R, McFarlane K, Guilderson TP, McNicol G (2015) Initial responses of methane cycling to deep peat heating in a bog ecosystem. Session 107 Talk #6, *Soil Science Society of American Annual Meeting*, Minneapolis, Minnesota, 17 November 2015.
42. Estiarte M, Vicca S, Peñuelas J, Bahn M, Beier C, Emmett BA, Fay PA, **Hanson PJ**, Hasibeder R Kigel J, Kröel-Dulay G, Larsen KL, Lellei-Kovács E, Limousin JM, Ogaya R, Ourcival JM, Sala OE, Smith AR, Schmidt IK, Sternberg M, Tielbörger K, Tietema A, Janssens I (2015) ANPP-precipitation relationships in multi-year drought experiments in natural ecosystems. OOS 58-8, Ecological Society of America Annual Meeting, August 9–14, 2015.
43. **Hanson PJ** (2015) Chronic and acute precipitation manipulations in eastern deciduous forests: build wide, measure deep and be patient. OOS 58-7 Ecological Society of America Annual Meeting, August 9–14, 2015.

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