Zoe G. Cardon

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Cardon is an ecosystems ecologist with roots in mechanistic plant physiology. She is fascinated by how plants contribute to ecosystem function both aboveground (as primary producers and gatekeepers of water flow from biosphere to atmosphere) and belowground (particularly as partners with microbes and soils in the fundamental terrestrial commodities exchange -- the rhizosphere). Her work is interdisciplinary and collaborative, combining development of genetically engineered microbiosensors, *in situ* imaging, and stable isotope techniques, with systems modeling, plant & microbial organismal, and "omics" approaches.

EDUCATION AND POSTDOCTORAL TRAINING

DOE Global Change Distinguished Postdoctoral Fellow, UC Berkeley, F. S. Chapin III advisor (1994-96)

Ph.D., Department of Biological Sciences, Stanford University, 1994. *Cellular and Physiological Investigations of Stomatal Regulation*, Joseph Berry advisor.

B.S. Biology, B.A. Spanish, Utah State University, 1988; College of Science valedictorian; graduation *Magna Cum Laude*. Keith Mott, research advisor.

PROFESSIONAL POSITIONS

Marine Biological Laboratory (MBL), Woods Hole, MA

2008 - current	Senior Scientist, The Ecosystems Center
2006-2007	Adjunct Associate Scientist, The Ecosystems Center
Fall 2003	Visiting Scientist, The Ecosystems Center

University of Connecticut, Storrs, CT

2005-2007	Associate Director, Center for Integrative Geosciences
2005-2007	Graduate Program Director, Center for Integrative Geosciences
2003-2007	Associate Professor, Ecology and Evolutionary Biology
2003-2005	Head, Biology Honors Program (Depts. of Ecology and Evolutionary Biology; Physiology and Neurobiology; Molecular and Cell Biology)
1997-2003	Assistant Professor, Ecology and Evolutionary Biology

Harvard University, Cambridge, MA

Fall 2002	Sarah Blaffer Hrdy Fellow in Conservation Biology, OEB Department

Bowdoin College, Brunswick, ME

1996-1997	Assistant Professor, Biology Department

AFFILIATED POSITIONS

University of Chicago, Chicago, IL

2016 – ongoing	The Microbiome Center (2016-2025) and CASE Joint Appointment (2018-ongoing)

Brown University, Providence, RI (as part of the Brown-MBL graduate program)

2017 - 2022	Adjunct Professor, Ecology and Evolutionary Biology Department
2016-2017	Professor (MBL), Ecology and Evolutionary Biology Department
2010-2015	Professor (MBL), Geological Sciences Department

SELECTED HONORS

Fellow, American Association for the Advancement of Science (AAAS) (named in 2022)
Governing Board, Ecological Society of America (elected term 2020-2022)
Invited speaker, Friday Evening Lecture Series, Marine Biological Laboratory, "*Plant Roots as Underground Allies on our Changing Planet.*" (2022)
User Executive Committee of the Environmental Molecular Sciences Laboratory (EMSL) at Pacific Northwest National Laboratory (elected term 2020-2023)
Fellow, Ecological Society of America (named in 2018)
Invited speaker, 100th annual Ecological Society of America meeting, Ignite Session "*Advances, Frontiers, Applications, and Challenges within and across Ecological Disciplines: a Celebration of ESA's Centennial, and a Roadmap for the Next 100 Years*", Baltimore, Maryland, (2015)
President (elected term 2009-2011) and Secretary (elected term 2002-2004), Physiological Ecology Section, Ecological Society of America
Sarah Blaffer Hrdy Fellow in Conservation Biology, Organismic and Evolutionary Biology, Harvard University (2002)
University of Connecticut University-wide Outstanding Faculty Advisor (1999)
Department of Energy Global Change Distinguished Postdoctoral Fellow (1993-95)
National Defense Science and Engineering Graduate Fellow (1990-93)
National Science Foundation Graduate Fellow (1988-90)
Phi Kappa Phi James R. Slater Fellow, for excellence in plant sciences (1988-89)
National Merit Scholar (1983-87)
Presidential Scholar (1983)

INVITED SYMPOSIA, SERIES AND DEPARTMENTAL TALKS

Symposia:

Invited speaker, DOE ESS PI Meeting, Breakout session: "*Lateral Connectivity Across Coastal Ecosystems*", Reston, VA April (2025)
Invited speaker, DOE ESS Joint Investigators Meeting, Breakout session: "*Recent highlights in hydrobiogeochemistry*" Reston, VA, April (2024)
Invited speaker, American Geophysical Union symposium, B43B-01"*Plant virus effects on rhizosphere root-microbe-mineral interactions*." AGU, San Francisco, CA (2023)
Invited keynote speaker, "*There Ought to Be an Equation for That: A Symposium Celebrating the Extraordinary Career of Joseph Berry*", Carnegie Institution for Science Department of Global Ecology, Palo Alto, CA (2022) https://berrysymposiumdraft.my.canva.site/
Invited Plenary speaker, EMSL Integration Meeting, Pacific Northwest National Lab (2021)
Invited speaker, American Geophysical Union symposium "*Plants-microbes-minerals: interactions that drive soil organic matter cycling*", AGU, San Francisco, CA (2019)
Invited speaker, American Society of Agronomy symposium "*Water movement in soil and plants*", ASA-CSA-SSA annual meeting, San Antonio,TX (2019)
Invited Keynote speaker, Goldschmidt Conference, session 12d "*Interactions between Soil and Biota as Controls on Ecosystem Function from Canopy to Rhizosphere*", Geochemical Society and the European Association of Geochemistry, Boston, MA (2018)
Invited speaker, Goldschmidt Conference, session 12f "*Identifying and Modeling Mechanistic Drivers of Elemental Cycles Across the Critical Zone*", Geochemical Society and the European Association of Geochemistry, Boston, MA (2018)

Invited speaker, Hydrology Section and Biogeosciences Section session "*Hydrobiogeochemical interactions among plants, soil and microorganisms at molecular to single plant scales*." American Geophysical Union (AGU) Fall Meeting, San Francisco, CA, (2016)
Invited speaker, Ignite Session organized by the Ecological Society of America's overall Science Committee: "A*dvances, Frontiers, Applications, and Challenges within and across Ecological Disciplines: a Celebration of ESA's Centennial, and a Roadmap for the Next 100 Years*", 100th annual Ecological Society of America meeting, Baltimore, MD, (2015)
Invited speaker, Harvard University Plant Biology Initiative Symposium, "*Plants and Climate Change: From Leaves to Ecosystems*" (2015)
Invited speaker, MBL Celebration of Discovery (2015)
Invited speaker, AGU session "*B32D: Ideas in Terrestrial Biogeochemistry: Tell the Story*", San Francisco, CA, December (2014)
Invited speaker, 5th ASM Conference on Beneficial Microbes, invited main talk for "*Ecology of Host-Microbial Interactions*" session. Washington DC, September 2014
Invited Plenary speaker, DOE TES/SBR Joint Investigators Meeting, Plenary Session IIII "*Plant Genomics to Ecosystem Function*", Washington DC May (2014)
Invited Plenary speaker, DOE Environmental Molecular Sciences Laboratory meeting "*Plants, Microbes, and their Interactions*" (2013)
Invited speaker, Keystone Symposium on Microbial Communities as Drivers of Ecosystem Complexity, Breckenridge, Colorado (2011)
Invited speaker, Ecological Society of America meetings, organized oral session "*Missing Links in the Root-Soil Organic Matter Continuum*" (2009)
Invited speaker, Soil Science Society of America meetings, symposium "*Towards a Predictive Understanding of Belowground Ecosystem Responses to Global Change*" (2006)
Invited speaker, Ecological Society of America meetings, organized oral session "*Rhizosphere Functioning in Carbon and Nitrogen Cycles*" (2006)
Invited speaker, Ecological Society of America meetings, organized oral session "*Sensors and Sensor Networks*" (2005)
Invited Keynote speaker, Soil Ecology Society Meeting, keynote "*Resource Exchange in the Rhizosphere*" (2005)
Invited speaker, Global Change in Terrestrial Ecosystems workshop, Oxford,UK "*Carbon Below Ground*" (1995).

Departmental or Series Seminars:

University of Hawai'i at Mānoa, Marine Biology Graduate Program (2024)
Harvard Forest, Harvard University (2021)
Oregon State University, Harward Lecture (2020 – postponed due to COVID)
Northern Arizona University, Department of Biological Sciences (2018)
Cornell University, IGERT: Cross-Scale Biogeochemistry and Climate (2017)
University of Chicago, Department of Ecology and Evolution (2016)
University of Massachusetts, Amherst, Plant Biology Graduate Program (2016)
University of Maryland, Dept of Plant Science and Landscape Architecture (2015)
Stonybrook University, Ecology and Evolution Dept. (2014)
University of Massachusetts, Amherst, Microbiology Dept. (2013)
Harvard Forest, Petersham, MA October (2011)
University of Vermont, Plant and Soil Science Department (2011)

Michigan State University, graduate student invitee for MCB department (2010)
Boston University, Biology Department, Boston University (2010)
Brown University, Dept. of Geological Sciences (2009)
Bowdoin College,Biology Dept. (2008)
The Ecosystems Center, Marine Biological Laboratory (2007)
UMass Boston, Boston, MA, Department of Biology (2007)
MIT, ESI (Earth System Initiative) (2006)
Michigan State University, Department of Plant Biology (2005)
University of Massachusetts, Amherst, OEB Program (2004)
Tufts University, Biology Department (2004)
The Ecosystems Center, Marine Biological Laboratory (2003)
Univ. of Michigan, Ecology and Evolutionary Biology Department (2003)
MIT, Earth Atmosphere and Planetary Sciences Dept. (2003)
Cornell University, Biogeochemistry and Biocomplexity Seminar Series (2002)
Biosphere II, Columbia University, Oracle, AZ (2002)
University of Illinois, Chicago, Dept. of Biology, and Argonne National Lab (2002)
Columbia Earth Institute (Lamont-Doherty Earth Science Colloquium) (2002)
Harvard University, Organismic and Evolutionary Biology Department (2002)
Queens College, Department of Biology (2001)
Carnegie Institution of Washington, Department of Plant Biology, Stanford, CA (2001)
The Ecosystems Center, Marine Biological Labs, Woods Hole, MA (2001)
Institute of Ecosystem Studies, Milbrook, NY (2001)
Boston University, Dept. of Biology, Boston, MA (2000)
SUNY Albany, Atmospheric Sciences Research Center (1998)
University of Conneticut, Dept. of Ecology and Evolution, Storrs, CT (1997)
University of New Hampshire, Dept. of Natural Resources. Durham, NH (1996)
The Ecosystems Center, Marine Biological Laboratory, Woods Hole. MA. (1996)
University of Denver, Denver, Colorado. (1995)
Bowdoin College, Brunswick, Maine (1995)
University of California, Berkeley, Department of Integrative Biology (1994)
James Cook Univ. of North Queensland, Botany Dept., Townsville, Australia. (1992)
Australian National University, RSBS, Canberra, Australia. (1992)

General Public Seminars, Webinars & Radio Interviews

Plant Roots as Underground Allies on our Changing Planet. MBL Friday Evening Lecture (2022) https://www.mbl.edu/events/friday-evening-lectures/2022-friday-evening-lectures

Surprising Things Plant Roots Do. Thursday evening talk for The 300 Committee Land Trust (2022). https://www.youtube.com/watch?v=Cn0APoU3iwg

Wildlands and Woodlands: A Vision for Sustaining Forested and Natural Landscapes. Sponsored by the MBL's Falmouth Forum and by The 300 Committee. Co-interviewee with David Foster, interviewer Mindy Todd, *The Point*, WCAI. (2021)

Death Defying Down-regulation Among Algae Living High and Dry in Desert Ecosystems. https://mbl.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=0b75e805-de0b-4cdf-933a-ac77010853ae Ecosystems Center and Semester in Environmental Science Webinars, MBL (2020). Co-presenter with Elena Lopez Peredo.

Picture a Scientist. One hour live panel discussion focusing on women in science after movie screening, sponsored by the MBL. Co-panelist with K. Gribble, S. Nemes, J. Gitlin. (2020).

Shades of Green Energy. Austin, TX. Discussion about sustainability and ecology, associated with the "Austin Night for Nature" event, Ecological Society of America meeting (2011). https://archive.org/details/ShadesOfGreenEnergyAugust42011EcologicalSocietyOfAmerica

TRAINING WORKSHOPS

Invited senior mentor, "Theory of Microbial Symbiosis" workshop 2024 (https://manoa.hawaii.edu/holobiont/) , a three week workshop for early career scientists at the Hawaii Institute for Marine Biology introducing early career theoretical investigators to biological issues pertaining to microbial symbioses. Feretti et al. (2025) resulted.

Invited senior mentor, "Woodstoich" 2019, a project-focused week for early career scientists studying ecological stoichiometry. Special suite of papers resulted, introduced by Evans-White et al. (2019) in *Frontiers in Ecology and Evolution* resulted.

SOCIETY MEMBERSHIPS

American Association for the Advancement of Science (AAAS)
American Geophysical Union (AGU)
American Society for Microbiology (ASM)
Ecological Society of America (ESA)

SERVICE ON NATIONAL COMMITTEES AND INSTITUTIONAL BOARDS

U.S. Department of Energy (DOE), triennial reviewer, Lawrence Livermore National Laboratory μBIOSPHERES SFA (2024)

U.S. DOE, triennial reviewer, Oak Ridge National Laboratory SPRUCE (2023)

Elected to the Governing Board of the Ecological Society of America, Member-At-Large (term 2020-2022). Governance Subcommittee, Finance Committee, Nominations Committee, and Adhoc Governance and Leadership Committee.

Elected to the User Executive Committee of the Environmental Molecular Sciences Laboratory (EMSL) at Pacific Northwest National Laboratory (term 2020-2023)

U.S. DOE, triennial reviewer, Oak Ridge National Laboratory SPRUCE (2019)

Invited member, sub-committee of the Department of Energy's Biological and Environmental Research Advisory Committee (BERAC) evaluating current and future utilization of DOE's National User Facilities for research aligned with BER's *Grand Challenges*. (2017-2018). Report: https://science.osti.gov/-/media/ber/pdf/community-resources/2018/BERAC_UserFacilities_Report.pdf?la=en&hash=7567B911F08BA759D1CE94AB11C4CAFE5E77C6D8

Invited participant, the National Microbiome Initiative, White House Office of Science and Technology Policy, Washington, DC, including Kavli Futures Symposium "*Cracking the Microbiome: Developing Experimental Tools to Understand Microbial Function*" (2015), OSTP forum "*Microbiome Innovation: Roadmap to the Future*", (2015), OSTP workshop "*The Microbiome: Developing a Roadmap for Discovery*" (2015), and OSTP launch of the "*National Microbiome Initiative*" (2016).

U.S. Department of Energy, triennial reviewer, Oak Ridge National Laboratory SPRUCE (2015)

U.S. Department of Energy, triennial reviewer, Joint Genome Institute (2014)

Organizer, Ecological Society of America Annual Meeting, fund-raising concert at the Moody Theatre, Austin, TX, to showcase local environmental groups. 20 groups participated (2011)
President (elected), Physiological Ecology Section, Ecological Society of America (2009-2011)
Invited member of nominating committee to establish the Board of Directors for the National iPlant Collaborative (http://www.iplantcollaborative.org/) (2008)
Invited member of the Program Leaders Committee, NSF-funded Statistical and Applied Mathematical Sciences Institute (SAMSI) program on statistics for control of wireless sensing networks and analysis of data streams (2007-2008)
Secretary (elected), Physiological Ecology Section, Ecological Society of America (2002-2004)
Invited member, international panel to review the National Phytotron at Duke (2001)

INVITED WORKSHOPS AND ASSOCIATED PUBLICATIONS

Invited speaker, Heising-Simons Foundation-funded workshop, "*Uniting modelers, microbiologists, and biogeochemists to improve wetland methane prediction*." (Nov, 2025)
Invited participant, American Academy of Microbiology (Academy) and American Geophysical Union (AGU) Colloquium *"The Role of Microbes in Mediating Methane Emissions – Act Today to Prepare for Tomorrow*" (2023)
Invited workshop, plenary speaker, *EcoSENSE Workshop - Emerging Sensing Capabilities and Ecosystem Testbeds for Investigating Soil-plant-microbial Interactions Across Genome to Ecosystem Scales.* (2021) Lawrence Berkeley National Laboratory, Berkeley, CA.
Invited DOE-funded workshop, *Opportunities in Biological and Environmental Research Uniquely Enabled by the APS Upgrade (APS-U)*, Argonne National Laboratory (2018). Report: aps.anl.gov/sites/www.aps.anl.gov/files/APS-Uploads/PUBLICATION-FILES/Workshop%20to%20Identify%20Opportunities%20in%20Biological%20and%20Environmental%20Research.pdf
Invited NSF-funded workshop, University of Chicago, "*The Subterranean Macroscope: Sensor Networks for Understanding, Modeling, and Managing Soil Processes*" (2017)
Invited workshop, Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, "*Breakthrough Science & Technologies (BS&T) Workshop*" (2017)
Invited workshop, White House Office of Science and Technology Policy, *"The Microbiome: Developing a Roadmap for Discovery",* Washington, DC., (2015)
Invited workshop, *"Belowground Carbon Cycling Processes at the Molecular Scale: New Tools for User Research"*, Environmental Molecular Sciences Laboratory at Pacific Northwest National Lab, Richland, WA (2013)
Invited workshop, American Academy of Microbiology colloquium *"Incorporating microbes into climate models",* Dallas, TX (2011) Report: https://www.ncbi.nlm.nih.gov/books/NBK561255/pdf/Bookshelf_NBK561255.pdf
Invited workshop, NSF *"Frontiers in Belowground Carbon Cycling Research"* (2003). Report: https://doi-org.library.proxy.mbl.edu/10.1890/1540-9295(2004)002[0522:CCIS]2.0.CO;2

PATENT

2021. Scalable, large-area optical sensing platform with compact light delivery and imaging system. Patent number: 11035794 Date of Patent: June 15, 2021.
Inventors: Xufeng Zhang, Supratik Guha, Zoe G. Cardon

PUBLICATIONS

Publications focused on the rhizosphere, microbiomes, salt marsh and soil

Vineis JH, Bulseco AN, **Cardon ZG**, Bowen JL. Microbial consortia are sequentially buried over millennia and degrade complex carbon in salt marsh sediments. *eLife. In Press*

Hrabe de Angelis I, Ruff SE, Aardema HM, Basic S, Brüwer JD, Slagter HA, Weber J, Calleja ML, **Cardon ZG,** Dragoneas A, Leefke AL, Nillius B, Raj SS, Walter D, Weber B, Fuchs BM, Haug GH, Pöschl U, Schiebel R, Pöhlker C . Latitudinal diversity gradients and selective microbial exchange at the Atlantic ocean-air interface. *Journal of Geophysical Research –Atmospheres*. *In Press.*

Garcia Arredondo M, Perez Castro S, Mendoza F A, Mardis G, Koch C, Tfaily MM, **Cardon ZG**, Keiluweit M. (2026) Nutrient stress reduces the extent but increases the intensity of root-driven destabilization of mineral-associated organic matter. *Communications Earth & Environment*. https://doi.org/10.1038/s43247-026-04008-7

Stein IR, **Cardon ZG.** (2026) Belowground growth is the primary driver of radial oxygen loss from *Typha angustifolia* to sediment. *New Phytologist* 252: 1832-1842. https://doi.org/10.1111/nph.71593.

Bölscher T, Li H, Sroka-River A, Winnick M, **Cardon ZG**, Keiluweit M. (2026)The efficacy of root exudate-driven mineral-associated organic matter destabilization is significantly altered by the presence of soil matrix. *Soil Biology and Biochemistry* 222:110276 https://doi.org/10.1016/j.soilbio.2026.110276

DiSalvo B, Paul BG, **Cardon ZG** (2025). Complete genome sequence of *Thioclava* strain BDS19, isolated from coastal marsh sediment. *Microbiology Resource Announcements*. https://doi.org/10.1128/mra.00855-25

MacDonald AA, Dowling QS, and **Cardon ZG** (2025) Beech leaf disease reduces nitrogen retranslocation at leaf fall, altering litter chemistry. *Oecologia* 207, 153 (2025). https://doi.org/10.1007/s00442-025-05790-5

Bolscher T, **Cardon ZG**, Garcia Arredondo M, Grand S, Griffen G, Hestrin R, Imboden J, Jamoteau F, Lacroix EM, Perez Castro S, Persson Per, Riley W, and Keiluweit M. (2025) Dynamics and vulnerability of mineral-organic associations in the rhizosphere. *Nature Communications* 16:5527. https://doi.org/10.1038/s41467-025-61273-4

Ferretti P, Martignoni MM, McManus LC, Sakal T, Liaghat A, Stevens B, Dahlin KJM, Souza LS, **Cardon ZG**, Silveira CB, Bordenstein SR, and Roughgarden J. (2025) Theory of host-microbe symbioses: challenges and opportunities. *Cell Host & Microbe* 33(7):1052 – 1056. https://doi.org/10.1016/j.chom.2025.05.001.

Peredo EL, Thomas S, and **Cardon ZG**. (2025) Draft genome sequence of *Mycobacterium* sp. SA01 isolated from *Sporobolus alterniflorus* seedlings collected in Cape Cod (USA). *Microbiology Resource Announcements* 14(2) e01025-24 https://doi.org/10.1128/mra.01025-24

Garcia Arredondo M, Kew W, Chu R, Jones M, Boiteau R, **Cardon ZG**, Keiluweit M (2024). Differential exudation creates biogeochemically distinct microenvironments during rhizosphere evolution. *Environmental Science and Technology.* 58:18713−18722. https://doi.org/10.1021/acs.est.4c04108

Zhou Y, O'Meara T, **Cardon ZG**, Wang J, Sulman BN, Giblin A, Forbrich I. (2024) Simulated plant-mediated oxygen input has strong impacts on fine-scale porewater biogeochemistry and weak impacts on integrated methane fluxes in coastal wetlands. *Biogeochemistry* https://doi.org/10.1007/s10533-024-01155-x

Sulman BN, Wang J, LaFond-Hudon S, O'Meara T, Yuan F, Molins S, Hammond G, Forbrich I, **Cardon ZG**, Giblin AE. (2024) Integrating tide-driven wetland soil redox and biogeochemical interactions into a land surface model. *Journal of Advances in Modeling Earth Systems.* 16, e2023MS004002. https://doi.org/10.1029/2023MS004002

Ahkami AH, Qafoku O, Roose T, Mou Q, Luu, **Cardon ZG**, Wu Y, Chou C, Fisher JB, Varga T, Handakumbura P, Aufrecht JA, Bhattacharjee A, Moran JJ. (2024) Emerging sensing, imaging, and computational technologies to unravel nano- and macro-scale rhizosphere dynamics – review and research perspectives. *Soil Biology and Biochemistry* 189:109253.

Pérez Castro S, Peredo EL, Mason O, Vineis J, Bowen J, Mortazavi B, Ganesh A, Ruff SE, Paul B, Giblin AE, **Cardon ZG** (2023) Diversity from single nucleotide variant to metagenome scales among sulfur cycling bacteria in Massachusetts and Alabama salt marsh. *Applied and Environmental Microbiology,* 89(11):10.1128/aem.00988-23

Rand DM, Nunez JCB, Williams S, Rongl S, Burley JT, Neil KB, Spierer AN, McKerrow W, Johnson DS, Fayton TJ, Skvir N, Ferranti DA, Greenhill M, Lyons A, Okami N, Morgan DM, Raynes Y, Kinney K, Brown BRP, Giblin AE, **Cardon ZG.** (2023) Parasite manipulation of host phenotypes inferred from transcriptional analyses in a trematode-amphipod system. *Molecular Ecology.* DOI: 10.1111/mec.17093

Arredondo M, Fang Y, Jones M, Yabusaki SB, **Cardon ZG**, Keiluweit, M. (2023) Resolving dynamic mineral-organic interactions in the rhizosphere by combining *in-situ* microsensors with plant-soil reactive transport modeling. *Soil Biology and Biochemistry. 184:109097.* https://doi.org/10.1016/j.soilbio.2023.109097

Li H, Bölscher T, Winnick M, Tfaily MM, **Cardon ZG**, and Keiluweit M. (2021) Simple plant and microbial metabolites destabilize mineral-associated organic matter via multiple pathways. *Environmental Science and Technology* 55(5): 3389–3398 doi: 10.1021/acs.est.0c04592

Fu C, Wang G, Bible K, Goulden ML, Saleska SR, Scott RL, **Cardon ZG**. (2018) Hydraulic redistribution affects modeled carbon cycling via soil microbial activity and suppressed fire. *Global Change Biology.*24(8):3472-3485. doi: 10.1111/gcb.14164

Biteen JS, Blainey PC, **Cardon ZG**, Chun M, Church G, Dorrestein PC, Fraser SE, Gilbert J, Jansson JK, Knight R, Miller JF, Ozcan A, Prather KA, Taha S, Ven den Engh G, Quake S, Ruby EG, Silver P, Weiss PS, Wong GCL, Wright AT, Xie XS, Young TD (2016) Tools for the Microbiome: Nano and Beyond. *ACS Nano*, 10:6-37. DOI: 10.1021/acsnano.5b07826. (Most read *ACS Nano* paper of 2016.)

Blaser MJ, **Cardon ZG**, Cho MK, Dangl JL, Donohue TJ, Green JL, Knight R, Maxon ME, Northen TR, Pollard KS, Brodie EL. (2016) Towards a predictive understanding of Earth's microbiomes to address 21st Century challenges. *mBio*. 7:e00714-16. doi: 10.1128/mBio.00714-16

Espeleta JF, **Cardon ZG,** Mayer KU, Neumann RB. (2016) Diel plant water use and competitive soil cation exchange interact to enhance NH_4^+ and K^+ availability in the rhizosphere. *Plant and Soil* 414:33. doi: 10.1007/s11104-016-3089-5

Fu C, Wang G, Goulden ML, Scott RL, Bible K, and **Cardon ZG**. (2016) Modeling the hydrological impact of hydraulic redistribution using CLM4.5 at eight AmeriFlux Sites. *Hydrology and Earth System Sciences* 20:2001-2018. doi:10.5194/hess-20-2001-2016

Graves CJ, Makrides E, Schmidt V, Giblin A, **Cardon ZG**, Rand D. (2016) Functional responses of salt marsh microbial communities to long-term nutrient enrichment. *Applied and Environmental Microbiology* 82:2862-2871. doi: 10.1128/AEM.03990-15

Alivisatos AP et al. (2015) A unified initiative to harness Earth's microbiomes. ***Science*** 350:507-508. (45 authors in Unified Microbiome Initiative Consortium.)

Thomas F, Giblin AE, **Cardon ZG**, Sievert SM. (2014) Rhizosphere heterogeneity shapes abundance and activity of sulfur-oxidizing bacteria in vegetated salt marsh sediments. *Frontiers in Microbiology* 5:309 doi: 10.3389/fmicb.2014.00309.

Neumann R, **Cardon ZG**, Teshera-Levye J, Rockwell F, Zwieniecki M, Holbrook NM. (2014) Modeled hydraulic redistribution by sunflower (*Helianthus annuus* L.) matches observed data only after including nighttime transpiration. *Plant Cell and Environment* 37:899-910

Cardon ZG, Stark JM, Herron PM, Rasmussen JA. (2013) Sagebrush carrying out hydraulic lift enhances surface soil nitrogen cycling and nitrogen uptake into inflorescences. *Proceedings of the National Academy of Sciences, USA* 110(47):18988-18993. 10.1073/pnas.1311314110

Herron PM, Gage DJ, Arango Pinedo C, Haider ZK and **Cardon ZG** (2013) Better to light a candle than curse the darkness: illuminating spatial localization and temporal dynamics of rapid microbial growth in the rhizosphere. *Frontiers in Plant Science* 4:323. doi: 10.3389/fpls.2013.00323

Neumann, R.B. and **Z.G. Cardon** (2012). Tansley Review: The magnitude of hydraulic redistribution by plant roots: a review and synthesis of empirical and modeling studies. *New Phytologist* 194:337-352. doi: 10.1111/j.1469-8137.2012.04088.x

Skogen, K.A., Holsinger, K.E., and **Cardon, Z.G.** (2011) Nitrogen deposition and the decline of a regionally threatened legume, *Desmodium cuspidatum. Oecologia* 165:261–269.

Xia, LC, Steele, JA, Cram, JA, **Cardon, ZG**, Simmons, SL, Vallino, JJ, Fuhrman, JA, Sun, F (2011) Extended local similarity analysis (eLSA) of microbial community and other time series data with replicates. *BMC Syst. Biol.* 5, S15. doi: 10.1186/1752-0509-5-S2-S15

Herron, P.M., Gage, D.J., and **Cardon, Z.G**. (2010) Micro-scale water potential gradients visualized in soil around plant root tips using microbiosensors. *Plant, Cell, and Environment* 33:199-210. doi: 10.1111/j.1365-3040.2009.02070.x.

Herron, P.M., Stark, J.M., Holt, C., Hooker, T., and **Cardon, Z.G.** (2009) Microbial growth efficiencies across a soil moisture gradient assessed using ^{13}C-acetic acid vapor and ^{15}N-ammonia gas. *Soil Biology and Biochemistry* 41:1262-1269. doi: 10.1016/j.soilbio.2009.03.010

Gage, D.J., Herron, P.M., Arango Pinedo, C., and **Cardon, Z.G.** (2008) Live reports from the soil grain – the promise and challenge of microbiosensors. *Functional Ecology* 22: 983-989. doi: 10.1111/j.1365-2435.2008.01464.x

Cardon,Z.G. and Gage, D.J. (2006) Resource exchange in the rhizosphere – molecular tools and the microbial perspective. *Annual Review of Ecology, Evolution, and Systematics* 37: 459-88. doi: 10.1146/annurev.ecolsys.37.091305.110207

Gartner, T.L. and **Cardon, Z.G.** (2006) Site of leaf origin affects how mixed litter decomposes. *Soil Biology and Biochemistry* 38: 2307-2317. doi: 10.1016/j.soilbio.2006.02.014

Hooker, B.A., Morris, T. F., Peters, R., and **Cardon, Z.G.** (2005) Long-term effects of tillage and corn stalk return on soil carbon dynamics. *Soil Science Society of America Journal* 69 (1) : 188-196. doi: 10.2136/sssaj2005.0188

Venterea, R.T., Rolston, D.E., and **Cardon, Z.G**. (2005) Effects of soil moisture, physical, and chemical characteristics on abiotic nitric oxide production. *Nutrient Cycling in Agroecosystems* 72:27-40.

Gartner, T. B. and **Cardon, Z. G.** (2004) Decomposition dynamics in mixed-species leaf litter — a review. *Oikos* 104: 230-246. doi: 10.1111/j.0030-1299.2004.12738.x

Johnston, C. A., Groffman, P., Breshears, D. D., **Cardon, Z. G.**, Currie, W., Emanuel, W., Gaudinski, J., Jackson, R. B., Lajtha, K., Nadelhoffer, K., Nelson Jr., D., Post, W. M., Retalack, G., and Wielopski, L. (2004) Carbon cycling in soil. *Frontiers in Ecology and the Environment*, 2(10): 522-528.

Cardon, Z. G., Czaja, A. D., Funk, J. L., and Vitt, P. L. (2002) Periodic carbon flushing to roots of *Quercus rubra* saplings affects soil respiration and rhizosphere microbial biomass. *Oecologia* 133: 215-223. doi: 10.1007/s00442-002-1045-y

Bringhurst, R. M., **Cardon, Z. G.**, and Gage, D. J. (2001) Galactosides in the rhizosphere: utilization by *Sinorhizobium meliloti* and development of a biosensor. *Proceedings of the National Academy of Sciences*, *USA* 98(8): 4540-4545. doi: 10.1073/pnas.071375898

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Cardon, Z.G. (1995) Influence of rhizodeposition under elevated CO_2 on plant nutrition and soil organic matter. *Plant and Soil* 187(2):277-288.

<u>Publications focused on photosynthesis, transpiration, and desiccation tolerance:</u>

Peredo EL, Thomas S, Cardon ZG. (2025) Establishment and micropropagation of axenic in vitro cultures of salt marsh grasses within the genus *Sporobolus*. *Applications in Plant Sciences*. https://doi.org/10.1002/aps3.70033

Massoud EC, Hoffman F, Shi Z, Tang J, Alhajjar E, Barnes M, Braghiere RK, **Cardon ZG**, Collier N, Crompton O, Dennedy-Frank JK, Gautam S, Gonzalex-Meler MA, Green JK, Levine P, MacBean N, Mao J, Tran Mills R, Mishra U, Mudunuru M, Renchon AA, Scott S, Siirila-Woodburn ER, Sprenger M, Tague C, Wang Y, Xu C, Zarakasz C. (2023) Perspectives on Artificial Intelligence for Predictions in Ecohydrology. *Artificial Intelligence for the Earth Systems*. DOI: 10.1175/AIES-D-23-0005.1 e230005

Cardon ZG, Peredo EL, Enloe CM, Oakey JS, Wu S-Z, and Bezanilla M. (2022). Slip slidin' away: bristle-driven gliding by *Tetradesmus deserticola* (Chlorophyta) in microfluidic chambers. *Journal of Phycology*. https://doi.org/10.1111/jpy.13271

Peredo EL and **Cardon ZG** (2020) Shared up-regulation and contrasting down-regulation of gene expression distinguish desiccation-tolerant from intolerant green algae. *Proceedings of the National Academy of Sciences USA* 117 (29) 17438-17445. doi:10.1073/pnas.1906904117

Stark JR, **Cardon ZG**, Peredo EL (2019) Extraction of high-quality, high molecular-weight DNA depends heavily on cell homogenization methods in green microalgae. *Applications in Plant Sciences* 8(3):e11333. doi:10.1002/aps3.1133

Dohnalkova A and **Cardon Z** (2018) Addressing challenges in ultrastructural TEM imaging of Chlorophyceae (green algae). *Microscopy and Microanalysis* 24(Supp1) 1346. doi:10.1017/S1431927618007213

Cardon ZG, Peredo EL, Dohnalkova AC, Gershone HL, Bezanilla M. (2018) A model suite of green algae within the Scenedesmaceae for investigating contrasting desiccation tolerance and morphology. *Journal of Cell Science* 131: jcs212233 doi: 10.1242/jcs.212233 (Cover image, and paper included in the "Research Highlights" section of issue 131.)

Lunch, CK, LaFountain, AM, Thomas, S, Frank, HA, Lewis, LA, **Cardon, ZG.** (2013) The xanthophyll cycle and NPQ in diverse desert and aquatic green algae. *Photosynthesis Research* 115:139–151. doi: 10.1007/s11120-013-9846-x

Cardon, Z.G., Gray, D.W., and Lewis, L. A. (2008) The green algal underground – evolutionary secrets of desert cells. *Bioscience* 58(2): 114-122. doi: 10.1641/B580206

Gray, D.W., Lewis, L.A., and **Cardon, Z.G.** (2007) Photosynthetic recovery following desiccation of desert green algae (Chlorophyta) and their aquatic relatives. *Plant, Cell, and Environment* 30:1240-1255. (Cover image.) doi: 10.1111/j.1365-3040.2007.01704.x

Gray, D.W., **Cardon, Z.G**., and Lewis, L. A. (2006) Simultaneous collection of rapid chlorophyll fluorescence induction kinetics, fluorescence quenching parameters, and environmental data using an automated PAM-2000/CR10X data logging system. *Photosynthesis Research* 87:295-301. doi: 10.1007/s11120-005-9010-3

Zanne, A.E., Lower, S.S., **Cardon, Z.G.**, and Orians, C.M. (2006) ^{15}N fertilization of tomatoes: vascular constraints vs. tissue demand. *Functional Plant Biology* 33:457-64. doi: 10.1071/FP05299

Jones, C.S, **Cardon, Z.G**., and Czaja, A.D. (2003) A phylogenetic view of low level CAM in *Pelargonium* (Geraniaceae). *American Journal of Botany* 90:135-142.

Hooper, D. U., **Cardon, Z. G**., Chapin III, F. S., and Durant, M. (2002) Corrected calculations for whole ecosystem measurements of CO_2 flux using the LI-COR 6200 portable photosynthesis system. *Oecologia* 132: 1-11. doi: 10.1007/s00442-002-0870-3

Lodding, C. C., Behling, J., and **Cardon, Z. G.** (2000) Water relations of *Betula cordifolia* and *Betula allegheniensis* rooted together on landslides in Franconia Notch, NH. *American Midland Naturalist* 143:321-329.

Tsionsky, M., **Cardon, Z.G.,** Bard, A.J., and Jackson, R.B. (1997) Photosynthetic electron transport in single guard cells as measured by scanning electrochemical microscopy. *Plant Physiology* 113(3):895-901. doi: 10.1104/pp.113.3.895

Cardon, Z.G., Berry, J.A., and Woodrow, I.E. (1995). Fluctuating [CO_2] drives species-specific changes in water use efficiency. *Journal of Biogeography* 22:203-208.

Jackson, R.B., Luo, Y., **Cardon, Z.G**., Chiariello, N.R., Sala, O.E., Field, C.B., and Mooney, H. A. (1995). Photosynthesis, growth, and density for the dominant species in a CO_2-enriched grassland. *Journal of Biogeography* 22:221-225.

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Cardon, Z.G., Mott, K.A., and Berry, J.A. (1994) Dynamics of patchy stomatal movements, and their contribution to steady-state and oscillating stomatal conductance calculated with gas-exchange techniques. *Plant, Cell, and Environment* 17:995-1007. doi: 10.1111/j.1365-3040.1994.tb02033.x

Mott, K.A., **Cardon, Z.G**., and Berry, J.A. (1993). Asymmetric patchy stomatal closure for the two surfaces of *Xanthium strumarium* L. leaves at low humidity. *Plant, Cell, and Environment* 16:25-34. doi: 10.1111/j.1365-3040.1993.tb00841.x

Cardon, Z.G., and Berry, J.A. (1992). Effects of O_2 and CO_2 concentration on the steady-state fluorescence yield of single guard cell pairs in intact leaf discs of *Tradescantia albiflora*. Evidence for Rubisco-mediated CO_2 fixation and photorespiration in guard cells. *Plant Physiology* 99:1238-1244. doi: 10.1104/pp.99.3.1238

Cardon, Z.G., and Mott, K.A. (1989). Evidence that ribulose 1,5-bisphosphate (RuBP) binds to inactive sites of RuBP carboxylase *in vivo* and an estimate of the rate constant for dissociation. *Plant Physiology* 89:1253-1257. doi: 10.1104/pp.89.4.1253

Special Journal Issues, Volumes Edited, and Peer-Reviewed Contributions to Edited Volumes:

Evans-White MA, **Cardon ZG**, Schweitzer JA, Urabe J, Elser JJ. (2019) Editorial: Emerging Frontiers in Ecological Stoichiometry. *Frontiers in Ecology and Evolution*. *7:463.* doi: 10.3389/fevo.2019.00463

Cardon, Z.G. and Whitbeck, J.L. (eds) (2007) *The Rhizosphere: an Ecological Perspective*. Elsevier.San Diego,CA.

Whitbeck, J.L. and **Cardon, Z.G.** Introduction. (2007) IN: *The Rhizosphere: an Ecological Perspective*. Cardon, Z.G. and Whitbeck, J.L. (eds). Elsevier, San Diego. Pp. xv-xix.

Cardon, Z. G., and Herron, P. M. Sweeping water, oozing carbon: long distance transport and patterns of rhizosphere resource exchange. (2005) IN: *Vascular Transport in Plants*. Holbrook, N.M. and Zwieniecki, M.A. (eds). Academic Press, San Diego. Pp. 257-276.

Cottingham, K. L., **Cardon, Z. G**., D'Antonio, C. M., Dent, C. L., Findlay, S. E. G., Lauenroth, W. K., LoGiudice, K. M., Stelzer, R. S., Strayer, D. L. (2003) Increasing modeling savvy: strategies to advance quantitative modeling skills for professionals within ecology. In: *Models in Ecosystem Science.* 9th Cary Conference volume, Canham, C., Cole, J. and Lauenroth, W., eds. pp. 428-436.

FUNDING

Research grants:

Gordon and Betty Moore Foundation, Symbiosis in Aquatic Systems Initiative, "Underground Allies: Dynamic Interactions Among Cordgrass (*Spartina alterniflora*) and Sulfur-Cycling Microbes in the Rhizosphere". **Cardon (PI)**, co-Is Giblin A, Paul B, Peredo EL, Ruff SE. 2024-2026. ($299,995)

Simons Foundation, "Ecosystem on the Edge: How Coastal Marsh Plants and Microbes Thrive in an Oscillating Environment". **Cardon** (PI). 2024-2028. ($1,433,030), with supplements 2025 ($32,136 and $621,893). (Lead PI Cardon for 7-PI group, each PI with independent funding. Total project >$8.5 million.)

DOE Environmental System Science (ESS) Program. "Tidal Triggers and Hot-Spot Switches in Coastal Marshes" **Cardon** (PI), co-Is Bowen J, Giblin A, Forbrich I, Sulman B, and O'Meara T. 2023-2026. ($999,724, $878,314 to MBL)

DOE Environmental System Science (ESS) Program. "Hydraulic redistribution in forests: Spatial and temporal drivers of variation, and consequences for climate feedbacks" Jacobs E. (PI at Purdue), co-Is **Cardon**, Dukes J, Welp L, and Fang Y. 2022-2025. ($840,000, $60,000 to MBL)

DOE Environmental System Science (ESS) Program. "From tides to seasons: How cyclic tidal drivers and plant physiology interact to affect carbon cycling at the terrestrial-estuarine boundary" Forbrich I (PI at MBL), co-Is **Cardon**, Giblin A, Sulman B, and O'Meara T 2021-2024 ($974,905).

Bailey Wildlife Foundation, "Developing a novel, low-cost, flexible sensor platform for quantifying environmental conditions using imaging of immobilized dyes." **Cardon (PI)**. 2020. ($80,000)

DOE Environmental System Science (ESS) Program. "Sticky roots — implications of altered rhizodeposition for the fate of rhizosphere mineral–organic matter associations in natural ecosystems" **Cardon (PI)**, Co-Is Keiluweit M, Malmstrom C, and Riley WJ. . 2020-2023. ($899,931 + $100,000 to LBNL for associated modeling).

Gordon and Betty Moore Foundation, Symbiosis in Aquatic Systems Initiative, "Underground Allies: Dynamic Interactions Among Cordgrass (*Spartina alterniflora*) and Sulfur-Cycling Microbes in the Rhizosphere". **Cardon (PI)**, co-Is Giblin A, Paul B, Peredo EL, Ruff SE. 2020-2023. ($299,958)

University of Chicago-MBL-Argonne MicroBiome Center "Desiccation Tolerance in Green Algae from Desert Microbiotic Crust Microbiomes". **Cardon (PI),** Co-Is Austin II J and Peredo EL. 2020-2021. ($9,141 MBL, $10,838 UChicago)

Bailey Wildlife Foundation, "Developing a novel, low-cost, flexible sensor platform for quantifying environmental conditions using imaging of immobilized dyes." **Cardon (PI)**, Zhang X. and Guha S. (UChicago and ANL, co-Is). 2019. ($80,000)

NSF Sensors in the Soil (SitS) Program," EAGER SitS: Developing a Next Generation Modeling Approach for Predicting Microbial Processes in Soil", Joe Vallino (PI) and **Cardon (co-I)**. Jan 1 2019-Dec 31 2021. ($300,000)

DOE Terrestrial Ecosystem Science (TES) Program, "Sticky roots – implications of widespread, cryptic, viral infection of plants in natural and managed ecosystems for soil carbon processing in the rhizosphere." **Cardon (PI),** Keiluweit M and Malmstrom C (co-Is). Oct 1 2018 – Sept 30 2019. ($294,999).

DOE Subsurface Biogeochemical Reactions (SBR) Program, "Root Influences on Mobilization and Export of Mineral-Bound Soil Organic Matter." Keiluweit M (PI UMass Amherst), **Cardon (co-I)**, Oct 1 2018 – Sept 30 2019. ($200,000, $44,000 to MBL).

DOE Environmental Molecular Sciences Laboratory (EMSL) Science Theme Project 50268, "The Root of the Matter: Soil Carbon Mobilization in the Rhizosphere" Keiluweit, M (PI); **Cardon** and Malmstrom, C **(coPIs)**. EMSL : Lipton, Chu. Oct 1 2018 – Sept 30 2020.

Bailey Wildlife Foundation, "Developing a novel, low-cost, flexible sensor platform for quantifying environmental conditions using imaging of immobilized dyes." **Cardon (PI)**, Zhang X. and Guha S. (UChicago and ANL, co-Is). 2018. ($80,000.)

University of Wyoming, "Wyoming Algae for Unconventional Bioconversion Processes", J. Oakey (PI), **Cardon (co-I)**, P Stahl(co-I), M Bezanilla(co-I). 2017-2018. ($102,194 MBL.)

Anonymous donor, Quasi-Endowment (~$1,500,000) and Current Use Research Supplements (>$1 million) to "Women in Ecological Science" fund at MBL, 2009-2026. **Cardon (PI).**

DOE JGI Community Science Program, "Protecting photosynthesis during desiccation: do the genomes of desert-derived and aquatic *Scenedesmus* species hold the key to understanding extreme desiccation tolerance among green algae?", EL Peredo (PI) and **Cardon (co-I)**. 2016-18. Sequencing genomes of related green algae -- two desert and two aquatic.

DOE Environmental Molecular Sciences Laboratory (EMSL) Science Theme Project, "Does Chloroplast Thylakoid Membrane Organization Influence Desiccation Tolerance in Green Algae?" **Cardon (PI)**. EMSL Co-I: G Orr, EMSL and PNNL. 2015-2017.

DOE Joint Genome Institute – Environmental Molecular Sciences Laboratory (JGI-EMSL) Collaborative Science, "3D Reality Check: Developing Structural Support for Predicting

Microbial Function and Interpreting Microbial 'Omics' Data"**. Cardon (PI).** Co-Is: J Vallino and G Serres. EMSL collaborator: T Scheibe, EMSL,PNNL. 2015-. 2017.

Anonymous donor, "A novel low-waste, low-maintenance system for microbial generation of methane from algal biomass." **Cardon (PI)** Co-I J Vallino. 2014 – 2016. $302,393.

Environmental Molecular Sciences Laboratory (EMSL) science theme project, "Integration of Pore-Scale Simulations and Multi-Omics Data to Develop Insights into Functional Heterogeneity in Microbial Communities". **Cardon (PI)** Co-Is: J Vallino, G Serres, and computer scientist T Scheibe (EMSL). 2014-2015.

NSF, "Photoprotection in Diverse, Desiccation-Tolerant, Desert Green Algae and Their Close Aquatic Relatives"; **Cardon (PI).** 2014-2017. $629,975

DOE Terrestrial Ecosystems, "Hydraulic redistribution of water through plant roots – implications for carbon cycling and energy flux at multiple scales"; **Cardon (PI)**, D Gage and G Wang (UConn, Co-Is), R Neumann (Univ. WA, Co-I). 2012-2016. $1,048,327.

Brown-MBL Faculty Seed Grant, "Linking long- and short-term controls on terrestrial phosphorus cycling"; **Cardon (PI)**, S Porder and L Schreeg (Brown co-Is). 2011-2012. $49,949.

NSF, "Collaborative Research: MSB: The Role of Sulfur Oxidizing Bacteria in Salt Marsh C and N Cycling" ; **Cardon (PI),** A Giblin (co-I); S Sievert (PI) from WHOI. 8/2011 – 7/2016. $1,200,326 total ($510,333 to MBL, $689,993 to WHOI)

NASA Exobiology, "Leaping to Land – Physiology and Phylogenetics of Desert Green Algae", **Cardon (PI)**, L Lewis and H Frank (Co-Is), 2008-2012, $531,978.

Anonymous grant, "Hydraulic Redistribution of Water in Western Landscapes: Effects on Plant Fitness and Rhizosphere Function", **Cardon (PI)**. 3/08. $300,000.

DOI USGS Office of Groundwater Research, Branch of Geophysics, "USGS OGW BG-UCONN Cooperative Agreement", **Cardon (co-I)**. 8/2007-8/2012. $220,632.

Connecticut Institute of Water Resources Grant, "Development of a New Generation of Sensitive, Fluorescence-based Nitrate Sensors for Use in Soil and Water", **Cardon (co-I)** with PI S Burdette. 9/1/07-8/31/09. $36,994.

UConn Research Foundation Large Faculty Grant, "Desiccation Tolerance in Desert Green Algae", **Cardon (PI).** 1/06 – 1/07. $16,677.

NSF DDIG, Population Dynamics Program, "Nitrogen Deposition and Population Dynamics of a Declining Nitrogen-fixing Plant Species", **Cardon (co-PI)**, co-PI K Skogen (student written proposal) and PI K Holsinger, 6/1/06-7/31/08, $11,993.

NSF Ecosystems Program, "Desert Microbial Activity in the Rhizosphere Oasis", **Cardon (PI)**, co-PIs D Gage and J Stark. 2004 – 2007. $529,625.
NSF REU supplements, summers of 2005, 2006, 2007, $6000 each summer.
NSF International Supplement, with Dr. Vit Gloser, Czech Republic, 2004-2007, $25,472.

NSF DDIG, Ecosystems Program, "Dissertation Research: Does Hydraulic Redistribution Increase Microbial Activity in the Rhizosphere?", **Cardon (PI)**, co-PI P Herron (student written proposal), 2004-2006, $12,000.

NASA Exobiology, "Phylogenetic diversity and comparative physiology of independently-evolved lineages of desert green algae (Chlorophyta)", L.A. Lewis, PI, **Cardon (co-PI)**, 2003-06 $380,876.

NSF Ecosystems Program, SGER, "Developing a New Miniaturized Sensor for Detecting Glucose in Soil", **Cardon (PI)**, F. Moussy (co-PI), 5/02-5/03, $25,053

UConn Research Foundation Large Faculty Grant, "Effect of tillage and carbon input levels on soil organic carbon distribution" **Cardon (PI)**, T. Morris (co-I). 1/01-1/02, $7881

Andrew W. Mellon Foundation Grant, "Carbon fluxes from plant roots to soils -- how timing, quality, and quantity of fluxes affect rhizosphere microbial activity." **Cardon (PI)** 3/00-12/04, $350,000

UConn Research Foundation Large Faculty Grant, "Does Plant Phenology Influence Microbial Activity in the Rhizosphere? " **Cardon (PI)**, 6/98-5/99, $17,609

Andrew W. Mellon Foundation Grant, "Influence of Root Exudation and Rhizodeposition on Rhizosphere Processes in Natural Soils." **Cardon (PI)**, 4/96-12/99, $180,000

Teaching and Graduate Training Grants:

NSF IGERT, "Reverse Ecology: Computational Integration of Genomes, Organisms and Environments", D Rand (PI), ZG **Cardon**, M Sogin, A Schmitt, & S Istrail (**co-Is)**, $2,920,540, 8/2010-8/2015 (extended to 2016, MBL-Brown Univ. graduate program)

NSF Instrumentation and Laboratory Improvement, "Analytical and Quantitative Understanding of Integrative Plant Biology through Coursework and Independent Student Research" **Cardon (PI)** 6/97-6/00, $17,520

UConn Institute for Teaching and Learning Grant, "Biology as a quantitative science--easing the path to computational ability and conceptual thinking." **Cardon (PI)** 6/99, $6000

SERVICE – GRANT AND JOURNAL REVIEWS

Grant review panels and ad hoc reviews

National Science Foundation, grant review panel member (over multiple years):
Doctoral Dissertation Improvement Grants(DDIG); Integrative Organismal Systems (IOS); Ecology; Ecology and Evolutionary Physiology; Ecosystem Studies; IGERT (Integrative Graduate Education and Research Traineeship); SitS (Signals in the Soil); TECO (Terrestrial Ecology and Global Change)

DOE Environmental Molecular Sciences Lab, Terrestrial & Subsurface Ecosystems panel.

DOE Joint Genome Institute Small-scale microbial/metagenome program panel.

U.S. Department of Energy (DOE) Alexander Hollaender Postdoctoral Fellowships panel.

Ad hoc reviewer for multiple grant proposals from European Research Council (Frontier Research Grants), NSF, NASA, NERC, DOE, University of Connecticut, USDA, Utah State University, San Jose State University

Journal reviews

Reviewer for *American Naturalist*, *Biogeochemistry*, *Biology Letters, Ecological Applications*, *Ecology*, *Ecosystems, Global Change Biology*, *Journal of Ecology*, *Journal of Environmental Quality*, *Journal of Geophysical Research Biogeosciences, Journal of Theoretical Biology, mSystems*, *Microbial Ecology, Nature Microbiology*, *New Phytologist*, *Oecologia*, *Physiologia Plantarum*, *Plant and Soil*, *Plant Cell and Environment*, *PNAS, Science, Soil Biology and Biochemistry, Wetlands*

Editorial Board, *Oecologia* (2004-2012)

SELECTED SERVICE ON MBL COMMITTEES

MBL strategic planning:

Search committee, Ecosystem Center, coastal ecosystems faculty cluster search (2020-2021)
Science Council (elected, 2010 – 2013, 2014 - 2021) Advisory committee to the MBL Director on research and education strategy at the MBL.
Steering Committee, Imaging Innovation Initiative (2018)
Search committees, Bay Paul Center faculty search (2008, 2009, 2019)
Search committees, Bell Center faculty searches (2011, 2018)
Co-Leader (appointed), "PRO-Microbes" vision meeting (23 invited attendees, 9 from MBL). New research and education linking dynamic microbial response with shifting ecosystem function over ecological and evolutionary time scales. (2015)
Co-Leader (appointed), MBL "Vision Team IV: Microbial diversity, ecology, evolution and microbiomes" (12 invited attendees, 5 from MBL, 5 from University of Chicago). Development of new strategic MBL theme in research and education focused on microbiomes. (2015)
Institutional Committee (appointed 2009 – 2010) (Advisory committee to the MBL Director on resident research at the MBL)

Implementation -University of Chicago affiliation:

MBL Affiliation Committee (appointed 2014) (guidance for new MBL-UChicago affiliation)
Head (appointed), Organizing Committee, first UChicago-MBL faculty retreat (2014)

Day-to-day operations committees:

MBL Biosafety (2009 - ongoing)
Multiple MBL promotion committees (2008-ongoing)
Head and Greenhouse Manager, MBL Research Greenhouse (2009 - ongoing)
MBL Research Services (2013 -2019)
Head, Ecosystems Center Facilities (2009 - 2019)
Stable Isotope Laboratory (2008 - 2023)
Friday Evening Seminar series (2017 - 2019)
Weekly seminars, Ecosystems Center (2008-2010)

TRAINING

Postdoctoral Advisor:

Biagio DiSalvo (MBL 2025-current) PhD from University of California, Riverside.
Ilana Stein (MBL 2024-current) PhD from UC Berkeley.
Joseph Vineis (MBL 2024-) PhD from Northeastern University. Now Scientific Informatics Project Leader at MBL.
Sherlynette Pérez Castro (MBL 2020 - 2023). PhD 2018 San Diego State University-University of California, Davis. Now postdoc at University of North Carolina.
Elena Lopez Peredo (MBL 2014 - 2018). PhD 2008 from University of Oveido. Fulbright Scholar 2010-2012, University of Connecticut. Research Associate, MBL, 2018-2023. Now Rochester Institute of Technology Assistant Professor (2023-).
Or Shapira (MBL 2014-2016). Visiting postdoc from Robert H. Smith Institute of Plant Science and Genetics in Agriculture, The Hebrew University of Jerusalem, Israel. PhD 2013 from The Hebrew University of Jerusalem.

Laura Schreeg (Brown-MBL 2011 – 2013, co-advisor with Stephen Porder). PhD 2011 from University of Florida. AAAS Science and Technology Postdoctoral Fellow 2013-2015. Now Agricultural Resource Specialist at U.S. Department of Agriculture (USDA) and U.S. Agency for International Development (US AID), Washington, DC.

Claire Lunch (MBL 2009-2012). PhD 2009 Stanford University. Now Staff Scientist, Plant Physiology, Neon, Inc. Boulder, CO.

Dennis Gray (UConn 2004-2007) PhD 2003 from SUNY Stonybrook. Associate Professor of Biology, Saginaw Valley State University, University Center, MI. Deceased.

Catalina Arango Pinedo (UConn 2007). PhD 2000 from UMass Amherst. Now Associate Professor, Department of Biology, Saint Joseph's University, Philadelphia, PA.

Pati Vitt (UConn 1998-1999). PhD UConn 1998. Now Susan and Roger Stone Curator, Dixon National Tallgrass Prairie Seed Bank Conservation Scientist, Chicago Botanic Garden; and Adjunct Assistant Professor, Northwestern University.

Jon Behling (Bowdoin College 1996-1997). Now organic farmer in Wisconsin.

<u>Graduate Major Advisor, Department of Ecology and Evolutionary Biology, UConn:</u>

Patrick Herron, PhD 2007. NSF DDIG recipient and EPA STAR Fellow. Now Executive Director, Mystic River Watershed Association. Arlington, MA.

Bethanie Hooker, PhD 2006. EPA STAR Fellow and PEO Scholar. Now Senior Director of Sustainability, Smith College, Northhampton, MA.

Tracy Gartner, PhD 2004. NSF Graduate Research Fellow. Now Director, Environmental Science Program; Professor of Environmental Science and Biology. Carthage College, Kenosha, WI.

<u>Graduate Major Co-Advisor, Center for Integrative Geosciences, Univ. of Connecticut:</u>

David Hoover. MS 2008. Now Research Ecologist/Ecohydrologist, USDA-ARS Rangeland Resources & Systems Research: Fort Collins, CO

<u>Graduate Committee Member, Various Institutions</u>

Philip Gwyther (University of Lausanne, Lausanne, Switzerland, PhD expected 2028)

Isabella Hrabe de Angelis (Max Planck Institute for Chemistry, PhD 2024)

Joseph Vineis (Northeastern University, PhD 2022) Now Scientific Informatics Project Leader, Marine Biological Laboratory, Woods Hole MA.

Brooke Osborne (Brown University, PhD 2019) Now Assistant Professor, Utah State Univ.

Bo Pietraszkiewicz (University of Connecticut, PhD 2010)

Kristina Catanese (University of Connecticut, MS 2009)

Shirley Micallef (University of Massachusetts, Boston, PhD 2008) Now Professor, Plant Science and Landscape Architecture, University of Maryland.

Krissa Skogen (University of Connecticut, PhD 2008), now Senior Scientist and the Director of the Botanical Garden at the University of Vienna.

Lindsay Bowerman (University of Connecticut, MS 2007)

Krista Fisk (University of Connecticut, MS 2007)

Courtney Hamler Zabadka (University of Connecticut, MS 2007) Now Visiting Lecturer, Westfield State University, MA, and Lecturer, Eastern Connecticut State University, CT.

Robin Kodner (Harvard University, PhD 2007) Now full Professor at Western Washington University, Biology Department.

Sarina Lambert (University of Connecticut, MS 2007)

Corie Cann (University of Connecticut, MS 2006)

Stacey Leicht (University of Connecticut, PhD 2006)
Nava Tabak (University of Connecticut, MS 2005) Now Natural Resource Director at Baxter State Park, Maine.
Robert Dunn (University of Connecticut, PhD 2003) Now William Neal Reynolds Distinguished Professor, Applied Ecology, NC State University.
Michael Gavin (University of Connecticut, PhD 2003) Now Professor, Warner College of Natural Resources, Colorado State University.
Nancy Ryan (University of Connecticut, MS 2003)
David Bryant (University of New Hampshire, PhD 2002).

Graduate Qualifying Exam Committee Member at Brown:
Susanna Theroux (PhD 2012) Now Senior Scientist, Southern California Coastal Water Research Project

Post-undergraduate trainees:
Quincy Dowling (MBL research assistant, 2024-2026). Now MSc Program, Univ. of Lausanne.
Jordan Stark (MBL research assistant 2017-2019.) Research produced Stark et al. (2019). Master's degree, Syracuse University. Biology Dept.
Elizabeth Forbes (MBL research assistant 2012-2014. PhD, University of California, Santa Barbara, CA. Now postdoctoral scholar, Yale University.
Jennifer Funk (UConn RA 1997-1999). Research contributed to *Oecologia* publication Cardon et al (2002). Now Associate Professor, Dept. of Plant Sciences, UC Davis, CA.

Undergraduate lab trainees:

At MBL:
Leana Amezquita (University of Chicago) SES independent project advisor (2026)
Barlow Herbst (Colby College) SES independent project advisor (2025)
Jenna Moor (University of Chicago) SES independent project advisor (2024). Now MSc Program in Biology at Aarhus University.
Aaron MacDonald (University of Toronto) SES independent project advisor (2023). MacDonald et al. (2025) *Oecologia* resulted. Now PhD student, Univ. of Illinois, Chicago.
Nyah Lues (University of Chicago) SES independent project advisor (2023). Now Peace Corps.
Danya Hammoudeh (Xavier University) SES independent project advisor (2022)
Grady Welsh (Middlebury College) SES independent project advisor (2022). Goldwater Scholarship 2023. Now PhD student, Cornel University.
Ross Brown (University of Virginia) Maxwell-Hanrahan Foundation summer research fellow (2022). Fullbright Fellowship (Germany) 2023.
Ella Lemley-Fry (Lawrence University) SES independent project advisor (2021)
Kathryn Hulleman (Earlham College) SES independent project advisor (2019)
Anthony DiGiovanni (Clarkson Univ.) SES independent project advisor (2018)
Hannah Gershone (Mt. Holyoke) SES independent project advisor (2016); research contributed to *Journal of Cell Science* publication Cardon et al. (2018) .
Emily Geoghegan (Bryn Mawr) SES independent project co-advisor with Joe Vallino (2015)

Caroline Kanaskie (Dickinson College) SES independent project advisor (2015)
Tinsley Galyean (Hampshire College) SES independent project advisor (2015)
Ruby An (Univ. of Chicago Metcalf program), co-advisor with Joe Vallino (2015). Now PhD student, Princeton University.
Hansen Johnson (Bates College), co-advised SES project with Ed Rastetter (2011) Now graduate student, Dalhousie University, Department of Oceanography.
Adrien Hansen (Bowdoin College), co-advised with Anton Post (2011)
Jed Rasmussen (REU through UConn, graduate of Utah State University, 2008) Now Associate Professor, Biology, Snow College, Ephraim,Utah.
Kristina Catanese, UConn honors thesis (2008)

At UConn:
David Hoover, undergraduate and master's degrees, now Research Ecologist at USDA-ARS, Fort Collins, CO)
Naomi Avery
Corie Cann, UConn BS/MS program in Conservation Biology
Andrew Czaja, honors (NSF and NDSEG graduate fellow). Now full Professor, University of Cincinnati, Dept. of Geosciences.
Jeremy Draghi (NSF graduate fellowship honorable mention) Now Associate Professor, Virginia Polytechnic Institute and State University, Dept. of Biological Sciences.
Matthew Dunn, honors thesis
Laura Pustell
Kristen Riley

Bowdoin College:
Cynthia Lodding, honors thesis published in *American Midland Naturalist*. Now physician.
Erika Kiers, now University Research Chair and Professor at Vrije Universiteit, Amsterdam, and MacArthur Fellow.

Multiple other undergraduates for shorter-term projects, at Bowdoin, UConn, and MBL.

TEACHING

Marine Biological Laboratory, Woods Hole, MA
Semester in Environmental Science
Fall 2026- Two weeks intensive teaching lectures, discussions, labs; mentoring 5-wk independent project.
Fall 2011-2025,3-4 lectures each fall, two laboratory weeks, and supervision of 1-3 independent student research projects over 5 weeks each year (2011-2025). Rewrite 2026 to 9 lectures, 8 discussions, two labs, two data sessions, and supervision of 1-2 independent research projects. The SES program (http://www.mbl.edu/ses/) is a hands-on field- and lab-intensive semester course, drawing up to 24 juniors and seniors from over 60 colleges & universities.
Co-Organizer and webmaster, MBL "MicroEco" discussion group, exploring links between microbial activity, diversity and ecosystem function (2008 – 2025)
Organizer, weekly "Chlorophyll Fluorescence" discussion group at MBL & WHOI, examining information chlorophyll fluorescence can give about photosynthetic activity (2009 – 2010)

UChicago

Mentored University of Chicago undergraduate Leana Amezquita (2026) and Jenna Moor (2024) during their intensive independent projects, as part of the Semester in Environmental Science program.

BIOS 27720: Microbiomes Across Environments. Invited one-hour lecture, Sept. 2018.

BIOS 27720: Microbiomes Across Environments. Invited one-hour lecture, Sept. 2017.

Invited contributor , third annual Quantitative Methods in Biology Bootcamp at MBL, for incoming biological sciences graduate students at the University of Chicago. Sept. 2017.

BIOS 15123 – The Microbiome in Human and Environmental Health. Invited one-hour lecture, UChicago, May, 2016.

Invited contributor, first annual Quantitative Methods in Biology Bootcamp at MBL, for all incoming biological sciences graduate students at the University of Chicago. Sept. 2015.

Brown-MBL Graduate Program

Co-taught (with Dr. David Rand, Brown Univ.) the IGERT "Core Course" for the Brown-MBL graduate training grant: "Reverse Ecology – Computational Integration of Genomes, Organisms, and Environments". (2011-2017). Intensive, year-long core course required of all incoming graduate students. Ecology, history of salt marsh, and genomic techniques.

University of Connecticut, regularly taught (1996-2007):

Introductory Biology (~300 first year students);

General Ecology "W" (~70-100 sophomores/juniors, writing intensive);

Organisms and Ecosystems (~10-20 seniors and graduate students);

Soil Degradation and Conservation (~10-15 seniors and graduate students)

Integrative Earth System Science (~6-10 graduate students, developed and taught this writing intensive core course for first-year students in the new interdisciplinary Center for Integrative Geosciences that Cardon helped to found in 2004.)

University of Connecticut, irregularly taught (1996-2007):

Introduction to Undergraduate Research (~25-60 students)

Professional Development Seminar (~15 graduate students)

Seminar on The Rhizosphere; Seminar on Plant Evolution; Seminar on Plant Ecology; Seminar on Plant Water Relations (~10-15 graduate students each)

Multiple independent study courses one-on-one with undergraduate and graduate students

Harvard University (fall, 2002):

Soil Degradation and Conservation (as Hrdy Fellow in Conservation Biology, OEB Dept.)