

Mary Jane Carmichael

Departments of Biology and Environmental Studies
Hollins University
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EDUCATION:

- 2017 Ph.D. in Biology, Wake Forest University, Winston-Salem, NC
Biogeochemical Controls on Carbon Fluxes in a Restored Coastal Freshwater Forested Wetland
Advisor: William K. (Bill) Smith
- 2012 M.S. in Biology, Appalachian State University, Boone, NC
Geomicrobiology of Ferromanganese Deposits in Caves of the upper Tennessee River Basin
Advisor: Suzanna L. Bräuer
- 2005 NC Licensure in Biology and General Science, Salem College, Winston-Salem, NC
- 2003 B.S. in Biology, Wake Forest University, Winston-Salem, NC

FACULTY POSITIONS:

- 2019-present Assistant Professor of Biology and Environmental Studies, Hollins University, Roanoke, VA
Courses Taught: Biogeochemistry, Environmental Science, Microbiology, Microbial Ecology, Molecular and Cell Biology Lab, Human Physiology, Immunology, Introduction to the Earth Sciences, Junior Biology Seminar, Senior Biology Seminar, Sophomore Biology Seminar, Sustainability and Social Innovation
- 2017-2019 Visiting Assistant Professor of Biology and Environmental Studies, Hollins University, Roanoke, VA
Courses Taught: Biogeochemistry, Microbiology, Microbial Ecology, Introduction to Environmental Science, Human Physiology, Senior Biology Seminar

RESEARCH INTERESTS:

Anthropogenic Disturbance of Ecosystems and Ecosystem Recovery, Astrobiology, Biogeochemistry, Cave Ecology, Environmental Microbiology, Geomicrobiology, Global Climate Change, Life in Extreme Environments, Microbiology, Microbial Ecology, Physiological Plant Ecology, Restoration Ecology, Wetland Ecology.

TEACHING EXPERIENCE:

- 2019-present Assistant Professor of Biology and Environmental Studies, Hollins University, Roanoke, VA
- 2017-2019 Visiting Assistant Professor of Biology and Environmental Studies, Hollins University, Roanoke, VA
- 2012-2017 Teaching Assistant, Comparative Physiology, Data Visualization and Statistics, Ecology and Evolutionary Biology, Plants and People, and Physiological Plant Ecology, Wake Forest University, Winston-Salem, NC
- 2009-2010 Earth and Physical Science Teacher, Mount Tabor High School, Winston-Salem, NC
- 2006-2009 Physical Science Teacher, Forsyth Country Day School, Lewisville, NC
- 2005-2006 Biology and Environmental Science Teacher, Parkland High School, Winston-Salem, NC

PUBLICATIONS AND PRESENTATIONS:

Undergraduate student co-authors are indicated by an asterisk (*).

Waynick GB* and Carmichael MJ. (*in press*) The influence of infant formulae on the growth of commensal and pathogenic *Streptococcus* species in the infant oral cavity. *Fine Focus*.

- Martinez M, Ardón M, and **Carmichael MJ**. (2021) Identifying sources and oxidation of methane in standing dead trees in freshwater forested wetlands. *Frontiers in Environmental Science* 9:737379. DOI: 10.3389/fenvs.2021.737379.
- Domec, JC, King JS, **Carmichael MJ**, Overby AT, Wortemann R, Smith WK, Miao G, Normeets A, and Johnson DM. (2021) Aquaporins, and not changes in root structure, provide new insights into physiological responses to drought, flooding, and salinity. *Journal of Experimental Botany* 72: 4489-4501. DOI: 10.1093/jxb/erab100.
- Carmichael MJ**, White JC, Cory ST, Berry ZC, and Smith WK. (2020) Foliar water uptake of fog confers ecophysiological benefits to four common tree species of southeastern freshwater forested wetlands. *Ecohydrology* 13: e2240. DOI: 10.1002/eco.2240.
- Schleupner HV*, Juarez KL*, and **Carmichael MJ**. (2019) Carbon dioxide (CO₂) and methane (CH₄) fluxes from agricultural drainage ditches at the Timberlake Observatory for Wetland Restoration in North Carolina's coastal plain. *RURALS: Review of Undergraduate Research in Agricultural and Life Sciences* 12: article 1. Available at: <http://digitalcommons.unl.edu/rurals/vol12/iss1/1>.
- Carmichael MJ**, White JC, and Smith WK. (2018) Water source utilization in *Taxodium distichum* (L.) Rich (bald cypress) over the course of a growing season in a restored coastal freshwater wetland vulnerable to saltwater incursion. *Castanea* 83: 272-287. DOI: 10.2179/18-158.
- Carmichael MJ**, Helton AM, White JC, and Smith WK. (2018) Standing dead trees are a conduit for the atmospheric flux of CH₄ and CO₂ from wetlands. *Wetlands* 38: 133-143. DOI: 10.1007/s13157-017-0963-8.
- Carmichael MJ**. (2017) Biogeochemical controls on carbon fluxes in a restored coastal freshwater forested wetland. Ph.D. Dissertation.
- Carmichael MJ** and Smith WK. (2016) Standing dead trees: a conduit for the atmospheric flux of greenhouse gases from wetlands? *Wetlands* 36: 1183-1188. DOI: 10.1007/s13157-016-0845-5.
- Carmichael MJ** and Smith WK. (2016) Growing season ecophysiology of *Taxodium distichum* (L.) Rich. (bald cypress) saplings in a restored wetland: a baseline for restoration practice. *Botany* 94: 1115-1125. DOI: 10.1139/cjb-2016-0147.
- Carmichael SK, Zorn BT, Santelli CM, Roble LA*, **Carmichael MJ**, and Bräuer SL. (2015) Nutrient input influences fungal community composition and size and can stimulate Mn(II) oxidation in caves. *Environmental Microbiology Reports* 7: 592-605. DOI: 10.1111/1758-2229.12291.
- Bräuer SL, Vuono D, **Carmichael MJ**, Pepe-Ranney C, Strom A*, Rabinowitz E, Buckley DH, and Zinder SH. (2014) Microbial sequencing analyses suggest the presence of a fecal veneer on indoor climbing wall holds. *Current Microbiology* 69: 681-689. DOI: 10.1007/s00284-014-0643-3.
- Carmichael MJ**, Bernhardt ES, Bräuer SL, and Smith WK. (2014) The role of vegetation in methane flux to the atmosphere: should vegetation be included as a distinct category in the global methane budget? *Biogeochemistry* 119: 1-24. DOI: 10.1007/s10533-014-9974-1.

Carmichael SK, **Carmichael MJ**, Strom AC*, Johnson KW, Roble LA*, Gao Y, and Bräuer SL. (2013) Sustained anthropogenic impact in Carter Saltpeter Cave, Carter County, Tennessee and the potential effects on manganese cycling. *Journal of Cave and Karst Studies* 75: 189-204. DOI: 0.4311/2012MB0267.

Carmichael MJ, Carmichael SK, Santelli CM, Strom A*, and Bräuer SL. (2013) Mn(II)-oxidizing bacteria are abundant and environmentally relevant members of ferromanganese deposits in caves of the upper Tennessee River Basin. *Geomicrobiology Journal* 30: 779-800. DOI: 10.1080/01490451.2013.769651.

Carmichael MJ. (2012) Geomicrobiology of ferromanganese deposits in caves of the upper Tennessee River Basin. M.S. Thesis.

Johnson KW, **Carmichael MJ**, McDonald W*, Rose N*, Pitchford J, Windelspecht M, Karatan E, and Bräuer SL. (2012). Increased abundance of *Gallionella* sp., *Leptothrix* sp. and total bacteria in response to enhanced Mn and Fe concentrations in a disturbed southern Appalachian high elevation wetland. *Geomicrobiology Journal* 29: 124-138. DOI: 10.1080/01490451.2011.558557.

Manuscripts in Review:

Schleupner HV* and **Carmichael MJ**. *in review at Women's Health*. Attention-Deficit/Hyperactivity Disorder Etiology and Symptomology: The Potential Role of the Gut Microbiota-Gut-Brain Axis.

Manuscripts in Preparation:

Carmichael MJ, Martinez M, and M Ardón. *in preparation*. Standing dead trees as bioreactors: caulosphere microbial communities modulate carbon fluxes across the tree-atmosphere interface.

Carmichael MJ and Smith WK. *in preparation*. The impact of experimental saltwater incursion on the growing season ecophysiology of a foundational coastal freshwater forested wetland species, *Taxodium distichum* (L.) Rich (bald cypress).

Conference Presentations:

2018 Standing dead trees are a conduit for the atmospheric flux of CH₄ and CO₂ from wetlands. *Association of Southeastern Biologists*. General Meeting, Myrtle Beach, SC.

2016 The ecophysiology of *Taxodium distichum* (bald cypress) saplings in a restored wetland over the course of a growing season. *Association of Southeastern Biologists*. General Meeting, Concord, NC.

2015 Snags as straws? The role of standing dead vegetation in the atmospheric flux of methane from wetlands. *15th Annual Graduate Student and Postdoc Research Day*. Wake Forest University, Winston-Salem, NC.

2014 The role of vegetation in methane flux to the atmosphere: should vegetation be included as a distinct category in the global methane budget? *1st Annual Southeastern Biogeochemistry Symposium*. Georgia Institute of Technology, Atlanta, GA.

2011 Mn-oxide deposits in Tennessee cave systems harbor diverse and unique microbial communities. *American Society for Microbiology*. General Meeting, New Orleans, LA.

2010 Geomicrobiology of Mn-oxide deposits in Eastern Tennessee cave systems. *Association of Southeastern Biologists*. General Meeting, Asheville, NC.

2009 Peptide-based probe capture of Mn oxides and associated bacteria in various environments including deep-sea samples near Loihi Seamount, Hawaii, and Carter Saltpeter Cave, Tennessee. *American Society for Microbiology*. Regional Meeting, Durham, NC.

Invited Lectures and Panel Discussions:

- 2019 Microbes & methane: the discovery of a new pathway in the global methane budget. *Presentation to the Hollins University Board of Trustees*. Hollins University, Roanoke, VA.
- 2018 Biogeochemistry from the mountains to the sea. *Spring meeting of the Virginia Blue Ridge Section of the American Chemical Society*. Hollins University, Roanoke, VA.
- 2017 Untangling the role of wetland vegetation in the annual flux of methane to the atmosphere. *Departmental Seminar Series*. Appalachian State University Department of Biology, Boone, NC, and Wake Forest University Department of Biology, Winston-Salem, NC.
- 2017 Restoration ecophysiology: a new sub-discipline in restoration ecology. *EEB Lunch Series*. Wake Forest University Department of Biology, Winston-Salem, NC.
- 2015 Species Interactions and Trophic Cascades. *Ecology and Evolutionary Biology (BIO113) Lecture*. Wake Forest University Department of Biology, Winston-Salem, NC.
- 2014 Snags as straws? Dead vegetation and methane flux to the atmosphere. *EcoLunch Series*. Wake Forest University Department of Biology, Winston-Salem, NC.
- 2013 The biogeochemical consequences of saltwater incursion on a coastal freshwater wetland under active restoration. *EcoLunch Series*. Wake Forest University Department of Biology, Winston-Salem, NC.
- 2013 Senior Summit: Navigating What's Next. *Alumni panel discussion*. Wake Forest University, Winston-Salem, NC.
- 2010 Geomicrobiology of Mn-oxide deposits in Eastern Tennessee caves. *Monthly Meeting*. Mountain Empire Grotto, Johnson City, TN.

FELLOWSHIPS AND GRANTS:

- 2021 Partners in Purpose Fellowship, Hollins University, *Partners in Purpose (Sponsored by LeeRay Costa and Catina Martin and funded through the Network for Vocation in Undergraduate Education and the Council of Independent Colleges)*, \$800
- 2021 Faculty Research Grant, Hollins University, *The influence of infant formulas on the growth of commensals and opportunistic pathogens in the oral cavity of humans*, \$850, & *Investigating the antimicrobial properties of multifloral honey*, \$1,700
- 2020 Faculty Research Grant, Hollins University, *Could shifts in the composition of the oral microflora act as an early indicator for susceptibility to obesity in humans?*, \$850
- 2020 Summer Collaborative Research Fellowship, Hollins University, *Could shifts in the composition of the oral microflora act as an early indicator for susceptibility to obesity in humans?*, \$7,000
- 2019 Faculty Research Grant, Hollins University, *Standing dead trees as bioreactors: understanding the role of caulosphere microbial communities in modulating methane fluxes across the tree-atmosphere interface*, \$850
- 2019 IMPACT Research Fellowship, Hollins University, *Standing dead trees as bioreactors: understanding the role of caulosphere microbial communities in modulating methane fluxes across the tree-atmosphere interface*, \$10,000
- 2018 Faculty Travel Grant, Hollins University, *Attendance and Participation at the 2018 Annual Meeting of the Association of Southeastern Biologists*, \$1,000
- 2017 Mellon Fellowship, Hollins University, *Writing for Understanding/Thinking through Writing (Sponsored by The Andrew W. Mellon Foundation via Hollins University)*, \$1,500
- 2016 American Fellowship, American Association of University Women, *American Dissertation Fellowship for the 2016-2017 academic year*, \$20,000
- 2016 Vecellio Award for Graduate Research, Wake Forest University, *Investigating the capacity for foliar and bark water uptake in freshwater forested wetland canopy dominants*, \$1,000
- 2015 Garden Club of America Wetlands Scholarship, *Snags as straws? Dead vegetation and methane flux to the atmosphere*, \$5,000

- 2015 Vecellio Award for Graduate Research, Wake Forest University, *Snags as straws? Quantifying the role of standing dead vegetation in the atmospheric flux of methane from wetlands*, \$1,224
- 2015 Field Travel Grant, The Wetland Foundation, *Snags as straws? Dead vegetation and methane flux to the atmosphere*, \$800
- 2014 Vecellio Award for Graduate Research, Wake Forest University, *Delineating the Dominant Water Source for Taxodium distichum (bald cypress): the Role of Groundwater and Surface Water in Plant Water Relations*, \$1,275
- 2014 Elton C. Cocke Travel Award, Wake Forest University Department of Biology, Attendance at the 1st Annual Southeastern Biogeochemistry Symposium in Atlanta, GA, \$500
- 2013 North Carolina Sea Grant Mini Grant, NOAA, *The impact of saltwater incursion on Bald Cypress (Taxodium distichum) in a coastal freshwater wetland*, \$5,000
- 2013 Vecellio Award for Graduate Research, Wake Forest University, *The Woody Plant Pathway: Vegetation as a conduit for methane and nitrous oxide emissions from freshwater wetlands*, \$1,000
- 2011 Graduate Research Associate Mentor (GRAM) Fellowship Recipient, Appalachian State University, \$12,000
- 2011 NC Space Grant Graduate Research Fellowship, NASA, *Microbial Biosignatures in Eastern Tennessee Caves*, \$6,000
- 2011 Office of Student Research Travel Grant, Appalachian State University, Attendance at the ASM National Meeting in New Orleans, LA
- 2011 Office of Student Research Grant, Appalachian State University, *Isolation of novel Mn-oxidizing organisms from Eastern Tennessee caves*
- 2010 Graduate Research Associate Mentor (GRAM) Fellowship Recipient, Appalachian State University, \$12,000
- 2010 Cratis D. Williams Graduate Student Research Grant, Appalachian State University, *An investigation of the effect of anthropogenic carbon inputs on the growth of cave microbial communities*
- 2010 Office of Student Research Travel Grant, Appalachian State University, Attendance at the Association of Southeastern Biologists Meeting in Asheville, NC

AWARDS:

- 2021 With Your Help Award, Hollins University Cultural and Community Engagement Office
- 2017 Gordon A. Melson Outstanding Doctoral Student Award, Wake Forest University Graduate School of Arts & Sciences
- 2012 Outstanding Thesis Award in Science, Technology, and Mathematics, Appalachian State University Cratis D. Williams Graduate School
- 2012 Cratis D. Williams Society Member, Appalachian State University

DEPARTMENTAL AND UNIVERSITY SERVICE:

- 2021-Present Co-PI on Hollins' NSF Robert Noyce Teacher Scholarship Capacity Building Grant proposal, *Reimagining Innovative STEM Education (RISE) at Hollins*. Proposal in progress, anticipated submission in August 2021 with anticipated decision in early spring 2022.
- 2021-Present PI on Hollins' NSF S-STEM proposal, *Artemis Scholarship Program for Women in STEM*. Funding pending, with anticipated decision in late fall or early winter, 2022.
- 2020-Present Division III representative to the Faculty Development and Student Research Funds Committee
- 2019-2021 Member of the Advisory Board for the Entrepreneurial Learning Institute at Hollins University.
- 2019-2020 Member of the Judging Panel for the Hollins University Undergraduate Research Awards.

- 2017-2019 Division III science representative to the Hollins University Public Health Work Group, a group tasked with developing a proposal for a new curriculum in public health at Hollins University.
- 2016-2017 Graduate student representative to the Wake Forest University Department of Biology Faculty.
- 2014-2017 Coordinator. EEB (Ecology & Evolutionary Biology) Lunch series, a weekly seminar for Ecology and Evolutionary Biology graduate students at Wake Forest University.
- 2013-2017 Biology department representative to the Wake Forest University Graduate School Honor and Ethics Council.
- 2015-2016 Biology department representative to the Wake Forest University Graduate Student Association.
- 2014-2015 Graduate student representative to the Wake Forest University Department of Biology Graduate Committee.

ADVISING:

Honors Theses Advised at Hollins University

- 2020-present Isabella Jessee, *Antimicrobial properties of honey against known pathogens*
- 2020-2021 Hannah Schlepner, *Attention-Deficit/Hyperactivity Disorder Etiology and Symptomology: The Potential Role of the Gut Microbiota-Gut-Brain Axis*, Honors in Biology, Recipient of a VFIC/Carilion Clinic Undergraduate Science Research Fellowship and the Judith Gregory Smith Award and the Alice Bull Award at Hollins University
- 2019-2021 Geneva Waynick, *The influence of infant formulae on the growth of commensal and pathogenic Streptococcus species in the infant oral cavity*, Honors in Biology, Recipient of the Harriett Gray Award at Hollins University
- 2017-2019 Maya Sproelich, *Bioprospecting for novel antibiotic compounds in southwest Virginia caves and the isolation of 2,4-diacetylphloroglucinol (DAPG)*, Honors in Biology and Chemistry, Recipient of the Alice Bull Award for student research in biology.

Undergraduates at Hollins University:

- 2021-present Ellie Song, *Volatile chemical compounds produced by the avian microflora may influence mating success in the eastern bluebird (Sialia sialis)*, Co-advised with Morgan Wilson
- 2020-present Isabella Jessee, *Antimicrobial properties of honey against known pathogens*
- 2020-2021 Hannah Schlepner, *Attention-Deficit/Hyperactivity Disorder Etiology and Symptomology: The Potential Role of the Gut Microbiota-Gut-Brain Axis*
- 2019-2021 Geneva Waynick, *The influence of infant formulae on the growth of commensal and pathogenic Streptococcus species in the infant oral cavity*
- 2019-2020 Simran Shrestha, *You and your period: workshop and collaborative art exhibition in Mumbai, India*
- 2019-2020 Meredith Keppel, *The impact of the mycobiome on tree-associated methane emissions in coastal wetlands*, Recipient of the Harriet Gray Award at Hollins University
- 2018-2019 Hannah Schlepner, *Phyllosphere microbial diversity along an elevational gradient in Roan Mountain, TN*
- 2018-2019 Shannen Kelly, *Linking phyllosphere microbial communities to physiological plant ecology*
- 2017-2019 Maya Sproelich, *Bioprospecting in cave microbial communities*
- 2017-2018 Madison Correiro, Maddy Evans, and Gabby Turner, *The role of roadside ditches and ephemeral wetlands in the atmospheric flux of methane and carbon dioxide*
- 2017-2018 Xochitl Ayala-Gonzalez, Shannen Kelly, and Sarah Rubin, *Linking phyllosphere microbial communities to physiological plant ecology*

Undergraduates at Wake Forest University:

- 2015-2017 Katherine Juarez, *The role of roadside ditches and ephemeral wetlands in the atmospheric flux of methane*
- 2015 Ted Primka, *Patterns of chlorophyll reabsorption during fall leaf senescence in four deciduous tree species*
- 2013-2015 Sean Taylor, *The impact of saltwater inundation on carbon and water relations in Taxodium distichum*

2013-2015 Parastou Ranjbar, *The impact of saltwater incursion on leaf and root phosphatase activity in Taxodium distichum*

Undergraduates at Appalachian State University:

2010-2012 Bryan Zorn, *Fungal diversity in Eastern Tennessee caves*

2009-2012 Zach Anderson, *Using qPCR to quantify the abundance of fungi in Eastern Tennessee cave systems*

2009-2012 Amanda Strom, *Investigating the potential for microbial (bacterial and fungal) antibiotic production in Eastern Tennessee cave systems*

2009-2010 Noah Goodson, *Microbial Mn-oxide production in Eastern Tennessee caves*

2009 Jared Butler, *Designing media for the isolation of novel Mn(II)-oxidizing bacteria*

2009 Whitney MacDonald, *Quantifying the seasonal abundance of Leptothrix spp. and Gallionella spp. in a disturbed high elevation wetland*

2009 Natalie Rose, *Culturable heterotrophic diversity in Tennessee caves*

High School Students at Watauga High School, Boone, NC:

2010-2012 Marlie Shelton, *Isolation of novel Mn(II)-oxidizing bacteria from Tennessee caves*

OUTREACH AND VOLUNTEER WORK:

2020-Present Virginia Junior Academy of Science, *Reader and Judge for Annual Research Symposia.*

2019-Present Roanoke Valley Governor's School. *Project Forum Judge and Research Mentor.*

2015-2017 Paisley IB Magnet School. *PTSA member and volunteer for the Panther Rewards Store.*

2014-2015 Meadowlark Elementary School. *Parent representative on the School Improvement Team.*

2013-2015 Wake Forest University Graduate School-Winston-Salem/Forsyth County Schools Partnership. *Founder of partnership and coordinator for graduate student outreach activities in K-12 schools.*

2012-2017 North Carolina Science Olympiad. *Event writer and coordinator.*

2009-2017 Winston-Salem/Forsyth County Public Schools. *Volunteer at Meadowlark Elementary School, Brunson Elementary School, and Paisley IB Magnet School.*

PROFESSIONAL MEMBERSHIPS:

American Association of University Women (AAUW)

American Geophysical Union (AGU)

American Society for Microbiology (ASM)

Association of Southeastern Biologists (ASB)

North Carolina Academy of Science (NCAS)

Ecological Society of America (ESA)

Geological Society of America (GSA)

REVIEWER FOR:

New Phytologist

Wetlands

TECHNICAL EXPERTISE:

Analytical Chemistry

Gas chromatography, ICP-OES

Biogeochemistry

ICP-OES, gas chromatography, ion chromatography, soil porewater sampling (lysimeter and piezometer), TOC and TDN analysis, greenhouse gas flux measurements using static flux chambers, stable isotopic analysis

Microbiology

Design of culture media (archaea, bacteria, fungi), sterile techniques, isolation of novel microbes, prokaryotic cell culture (archaea and bacteria), microaerophilic techniques, anaerobic techniques

Microscopy

Light microscopy, Confocal microscopy, SEM-EDS, TEM-EDS

Molecular Ecology

DNA extraction and purification, PCR, qPCR, cloning, DNA sequencing, phylogenetic analysis, and FISH

Physiological Plant Ecology

Gas exchange measurements (LI-COR 6400), water potential measurements (pressure chamber), fluorometry, photosynthetic pigment analysis and quantification

CERTIFICATIONS:

All Kinds of Minds Subject Specialist

CERTL Problem Based Learning

CPR/AED

PADI Open Water Scuba Diver

Wilderness First Aid