2022

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https://czo-archive.criticalzone.org/calhoun/
https://iscn.fluxdata.org/network/partner-networks/ltse/

Contents

Education

Ph.D. Soil Science & Ecology, Minor Statistics, Duke University, Durham, "Prescribed fire: effects on water quality and forest nutrient cycling," 1980; Published as a *Science* Report with cover photograph, 1982

Graduate coursework: Soil Science, Statistics, Ecology, and Forestry at Mississippi State and North Carolina State Universities, 1976-77

B.A., Philosophy, Lehigh University, Bethlehem, PA, 1973

Employment

Full and Associate Professor of Soils and Ecology, Nicholas School of the Environment, 1987-present

Visiting Associate Professor of Soils, Instituto Tecnológico de Costa Rica, Cartago, 1993-94

Assistant Professor of Soils and Watershed Management, School of Natural Resources, University of Michigan, Ann Arbor, 1984-87

Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory, 1980-84

Leadership

Lead-PI (Lead-Principal Investigator), NSF's Calhoun Critical Zone Observatory with 15 Co-PIs from five universities, with > 150 students and participants, https://czo-archive.criticalzone.org/calhoun/, 2013-21

Lead-PI, since 1990 of Long-Term Calhoun Soil-Ecosystem Experiment, Sumter National Forest, 1957-present

Lead-PI, International Network of ~200 Long-Term Soil-Ecosystem Experiments, https://iscn.fluxdata.org/network/partner-networks/ltse/, 2005-present,

Member, Anthropocene Working Group of the International Commission of Stratigraphy, proposing to change the geologic epoch from Holocene to Anthropocene, http://quaternary.stratigraphy.org/wp-content/uploads/2021/03/AWG-Newsletter-2020-Vol-10.pdf, 2012-present

Convenor, Monthly Soil Lead Presentations on Zoom, 2020-present

Lead-PI, "Forever Humboldt!", Duke University's Scholarly Celebration of Alexander von Humboldt's 250th Birthday that featured a public lecture by biographer Andrea Wulf, a Duke workshop with leading Humboldt scholars, a Bass Connections student project, and a Duke-UNC-NCSU Monthly Humboldt Reading Club, 2019-21

Chair, PIs Committee of NSF's Nine Critical Zone Observatories, 2015

Co-Founder and Chair, Working Groups on Soil Change in the International Union of Soil Sciences and Soil Science Society of America, 2009-2015

Co-Director and Co-Founder, Southern Center for Sustainable Forests, NCSU-Duke-NCDENR, which directly led to Duke Forest's FSC Certification and the major ecologic-economic review of Southern chip mills, 1997-2010

Member, Critical Zone science team that over many meetings successfully lobbied NSF to create NSF's Geosciences Directorate's Critical Zone science research and education program, 2003-2009

Director, Graduate Studies for Duke's Interdepartmental University Program in Ecology, 2004-2011

Chair, NSOE's Forest Resource Management, Resource Ecology, and Ecosystem and Conservation Sciences Programs, Duke University, 1988-2000

Chair, Society of American Foresters Reaccreditation Review Committees, NSOE, 1997-1998 and 2010-2012

Member and Chair, Academic Review Committees, for Lafayette College's Department of Geology and Environmental Geosciences and the University of Pennsylvania's Department of Earth and Environmental Science

Board of Directors Member, Forest History Society, Durham, NC, 2011-2018

Board of Directors Member, North Carolina Governor's Forestry Council, 1998-2014

Board of Directors Member, Biomass Energy Resource Center, Montpelier, VT, 2007-2012

Board of Directors Member, Organization for Tropical Studies, Durham, NC, 1990-2000

Honors

Fellow, Soil Science Society of America, 2015

Lectureships, keynotes, and awards:

Invited author of "Ansichten der Calzone," a chapter in *Critical Zones*, edited by Bruno Latour and Peter Weibel, which was named to the *New York Times* Best Art Books of 2020.

Nyle C. Brady Lecture, opening the International Soils Meeting of the Soil Science Society of America, San Diego, CA, "How Deep is Soil?", 2019

Opening lecture for the National Humanities Center's Environmental Humanities Conference at the Duke Campus Farm and Duke Forest, "Reading the Landscape," 2019

Keynote Lecture for the International Long-Term Ecological Research Network Meetings, "Darwin, Lyell, Ecosystems, & Earth's Critical Zone," Nantes, France, 2017

The Year of the Soil Lecture, National Autonomous University of Mexico, Mexico City, "Global Soil Change," 2015

Keynote Lecture for Euro-Clay Conference, Edinburgh, Scotland, "Critical Zone Science as the Earth Science in the Anthropocene," 2015

E.W. Russell Memorial Lecture opening the British Soil Science Society Annual Meeting, Lancaster University, 2013; BSSS interview by John Quinton at: https://www.youtube.com/watch?v=CG5IMW2ybDI

United States National Forests' Experimental Forests, Ranges, and Grasslands "Award of Recognition," for decades-long work at the Calhoun Experimental Forest, 2009

Keynote Lecture for Smithsonian Museum's opening of the soil exhibit, "Dig It!", National Academy of Sciences, Washington DC, 2008

L.E. Nelson Lecture, Mississippi State University, State College, 2005

Invited speaker and participant at:

Nasher Museum's 2005 opening "The Forest: Politics, Poetics and Practice," and Nasher's exhibit "Second Nature: Photography in the Age of the Anthropocene", 2021

Rachel Carson's Center-Munich's "Whose Anthropocene?" Workshop, 2016

Anthropocene Working Group meetings in Berlin 2014 and Oslo 2016

International Conference on Hydropedology, Beijing Normal University, China, 2016

National US Critical Zone Science Meetings in Champaign, Illinois, 2016, Boise, Idaho 2015, and Tenaya, California 2014

Frontiers in International Critical Zone Science, Beijing, China, 2014

Goldschmidt Conference in Geochemistry, Florence, "Soil rhizogenic C-Fe redox cycling: A sleeping couple no longer", 2013

Soil Systems and Critical Zone Processes Workshop, Monte Verita, Ascona, Switzerland, 2013

Soil Organic Matters Workshop, Rothamsted, UK, 2009

Soil Carbon Meetings with EU organizations at Rothamsted UK and Rome Italy, and at the Chinese Academy of Agricultural Sciences, Beijing

Annual meeting sessions of the Ecological Society of America, the American Geophysical Union, and the Soil Science Society of America

Invited lectures and seminars on soils, ecosystem science, biogeochemistry, the Anthropocene, and critical zone science at:

Stanford University, Wageningen University, Yale University, University of California-Berkeley, University of Wisconsin, University of Georgia, North Carolina State University, University of North Carolina, University of South Carolina, University of Delaware, Virginia Tech University, Utah State University, Penn State University, James Madison University, University of Montana, University Koblenz-Ladau, Beijing Normal University.

Research

My research investigates both how soils are formed as natural bodies and how soils are changing in human-altered ecosystems, now internationally defined as Earth's critical zone (Richter and Billings 2015). Our soils research is practiced with ecologists, Earth

scientists, and environmental economists, anthropologists, and historians, i.e., across the wide new field of environmental humanities. We work at long-term ecological research sites, critical zone observatories, and most recently in urban environments.

I am broadly interested in how humanity transforms Earth's soils, and specifically in how land-uses alter soil biogeochemistry on time scales from moments, seasons, years, decades, centuries, to multi-millennia. These interests have led to 1) a decade of work with the Anthropocene Working Group (via the International Commission on Stratigraphy) that is conceiving and proposing a renaming of our geologic epoch from the Holocene to the Anthropocene; 2) the creation of the International Long-Term Soil-Experiment Network (LTSEs network) that I founded as an NSF-supported Research Coordination Network (RCN) and that was recently described by the International Soil Carbon Network, as "the premier global data base of long-term soils research"; and 3) the international critical zone science movement that today includes many dozens of critical zone observatories that bring together thousands of scholars from many disciplines to study the diversity and the human forcings of the Earth's landscapes, "from tree top to bedrock." My scientific interests have also led to a decade of scholarship and teaching with humanities scholars, both on Duke's campus where I recently did a sabbatical at the Franklin Humanities Institute and internationally with "my co-production" with Eric Barstow of the FHI-supported 60-min documentary entitled, "The Education of Bruno Latour: From the Critical Zone to the Anthropocene."

I am lead author of *Understanding Soil Change* with my former PhD student Daniel Markewitz (now Professor of Forest Soils at University of Georgia), a Cambridge University book reviewed widely including in *Nature*. The book is a testament to the importance of long-term ecological studies, specifically those that include regular observations of soil made and archived over many decades.

Throughout my 30-plus years at Duke, I have led research at the Calhoun Experimental Forest (CEF) in South Carolina's Sumter National Forest, in a long-term field study of soils and ecosystems that originated in 1957, what we call the Long-Term Calhoun Soil-Ecosystem Experiment (LTSE). The study quantifies how soils have formed as natural bodies, how soils have been transformed by historic cotton cultivation from about 1800 to 1950, and since 1957, how the infertile, played out soils have supported and been dynamically altered by reforestation. My students and I have produced nearly 40 peer-reviewed papers on the decadal to millennial changes in the chemistry and cycling of soil C, N, P, Ca, K, Mg, and the trace elements B, Fe, Mn, Cu, Be, Zr, and Zn across full soil profiles to as deep at 40-m. The Calhoun LTSE is a rarity, a well-replicated field experiment that directly observes the interplay of soils and vegetation with periodic sampling including a sample archive that began in 1962. We have managed this long-term project over three decades with over $7 million of short-term grants from several directorates of NSF, the USDA, the USFS, and the Andrew Mellon Foundation.

In 2004, inspired by the Calhoun LTSE, my students and I initiated the first international inventory and networking of LTSEs, using advanced-format websites and organizing metadata from about 200 LTSEs worldwide. Supported by NSF's Research Coordination

Network Program, we held three international workshops at Duke University, NCSU's Center for Environmental Farming Systems, the Calhoun Experimental Forest, and Coweeta Hydrologic Laboratory, hosting LTSE representatives from Africa, Asia, Australia, Europe, and North and South America. I helped convene and lead Working Groups in the International Union of Soil Sciences and the Soil Science Society of America to promote LTSEs and promote more robust study of human transformations of soils. I have written widely for the peer-review scientific and environmental history literature, and in November 2014 my soils research and teaching were featured in *Science* magazine (Tennesen 2014). Our soils lab is now the home to two of the world's finest soil archives, that of the Calhoun LTSE (1962-present) and for the soils of the city of New Orleans (the Mielke collection from the 1990s-present).

Since our paper in *BioScience* in 1995, "How Deep is Soil?", I have worked to deepen the lower boundary of soil science, given the long-standing bias to limit soil science to the farmer's plow zone. This has led to work to not only expand the concept of soil *but that of the ecosystem concept* itself, to embrace the full belowground weathering zone of the Earth's crust, that is, the Earth's belowground critical zone. In 2019, I was invited to open the International Soils Meeting of the Soil Science Society of America with the Brady Lecture, a lecture I entitled "How Deep is Soil?" In 2021, *Science* magazine interviewed me in an article entitled, "New Observatory to Bring Soil Up from the Deep."

Most recently, I have opened a new research front with urban soils and specifically on city soil-lead contamination. Since 2017, we have been actively mapping legacy metals, especially lead, in city soils. Objectives of this work are to contribute to the understanding of lead poisoning in cities and towns, and to initiate a new urban soil science to better understand the relation of city soils with the environmental health and justice of cities. Medical and public health experts have widely documented that hundreds of millions of children worldwide are impaired by exposures to metal contaminants, specifically to lead, a large but unknown fraction of exposures are via soil-borne lead. This work has pulled me into NSOEs Ecotoxicology and Environmental Health faculty and to the 2022 renewal of NSOE's Superfund project. I am hosting a very successful monthly Soil Lead Presentation on Zoom.

Selected External Research Funding:

NSF Geosciences Directorate, 2013-2021. PI: Evolution and regeneration dynamics of Earth's Critical Zones subsequent to agriculturally forced land degradation: Calhoun Critical Zone Observatory, 15 investigators, 6 universities, $5.7 million

Nicholas Institute Catalyst Grant. 2020-2021. PI: Reconsiderations of urban soil-lead toxicity, about ten colleagues from across the Duke campus, $15,000

Bass Connections, 2019-2020. PI: Mapping urban soil lead for improving human health in Durham, North Carolina. $25,000

CarboSylva, USAID, USDA Forest Service, 2012-2013. PI: Inventory of soil carbon in the forests of Gabon. $125,000

USDA Forest Service, 2012-2013. PI: Resampling of long-term forest plots in the Black Mountains, NC. $10,000

Wallace Genetic Foundation, 2012-2013. PI: Research planning for coordinated sampling of the world's long-term soil experiments. $35,000

USDA Forest Service, 2009-2010. Co-PI: Wood Education and Resource Center. $50,000

NSF-EAR, 2008-2010. PI: New insights into soil-regolith genesis and structure. $20,000

NSF-Bio, 2007-2012. PI: Collaborative Research: New Analyses of 50-Year Net Ecosystem Productivity Including Long Lag Time Carbon Accretions in Ageing Secondary Forests. $275,000

NSF-RCN, 2006-2012. PI: Research Coordination Network: Global Soil Change Community Networking Chronosequence Studies and Long-term Soil Experiments. $425,000

Andrew W. Mellon Foundation, 2002-2008. PI: Temporal and spatial reassembly of soil microbial communities and organic matter in post-disturbance forests; an interdisciplinary soil ecology research and training project. $500,000

NSF-EAR, 2006-2008. Co-PI: Development of a cyberinfrastructure system for studies of the Critical Zone. $50,000

USDA-NRI, 2005-2008. PI: Improving the science of soil change: Conference to evaluate research at the world's long-term soil experiments (LTSEs), $10,000

Duke Center for Global Change, 2004-2006. PI: Soils Working Group to Initiate First Global Inventory of Long-Term Soil-Ecosystem Experiments, $30,000.

NSF-Ecology-LTREB Program. 2001-2006. PI: Long-term soil-ecosystem studies at the Calhoun Experimental Forest. $280,000

NSF-Biocomplexity Program. 2001-2003. PI: Simplification and recovery of biocomplexity of soils long used for agriculture and forestry. $83,000

USDA-Forest Service, PI: Effects of ice damage on coniferous and deciduous temperate forests. $9,000

USDA-Forest Service, PI: Forty years of Fraser fir (*Abies fraseri*) regeneration following balsam woolly adelgid (*Adelges piceae*) depredation in the Black Mountains of North Carolina. $9,000

Pinchot Institute, Co-PI: Forest certification on the Duke Forest (with NC State University and the State of North Carolina). $50,000

US-EPA & NC-DENR. 1998-2000. Co-PI with Dr. F. Cubbage: Ecological evaluation of chip mills in North Carolina. $125,000

USDA FS Cooperative Research Program. 1999-2002. PI: Establishment of three long-term soil-ecosystem studies in the southeastern forest: the Calhoun, SETRES, and Butler Forests. $230,000

USDOE. 1996-2002. PI: Effects of elevated CO_2 on belowground processes: interactions on throughfall and soil-water chemistry. About $300,000

USDA-Forest Service Cooperative Research Program. 1997-1998. PI: Project initiation to evaluate fertilizer leaching at the SETRES Experimental Forest. $15,000

USDA-NRI. 1996-1999. PI: Thirty-four year N and P budgets at the Calhoun Experimental Forest. ~$80,000

NSF. 1993-1998. Co-PI: Carbon sequestration in soils and ecosystems at the Calhoun Experimental Forest. ~$250,000

US AID. 1992-1996. Co-PI: Indigenous tree reforestation in degraded pastures in southern Costa Rica. ~$800,000

USDA. 1992-1995. PI: Long-term acidification at the Calhoun Experimental Forest. ~$100,000

Teaching and Student Advising

My teaching and advising contributes to Duke's University Program in Ecology, NSOE's Master of Forestry program, the program in Ecotoxicology and Environmental Health, the Earth and Climate Science Division, the Environmental Science and Policy Division, and an emerging environmental humanities program. Topics of teaching include soil science, pedology, and management; soil linkages ("overlap") with ecosystem ecology, Earth sciences, hydrology, geomorphology, forest ecosystems and management, wildland fire, environmental history, and the urban environment. The teaching contributes to graduate, professional, and undergraduate degree programs (First Year Undergraduate to PhD).

My pedagogy actively uses indoor and outdoor classrooms for lectures, discussions, laboratory exercises, writing and quantitative analyses, and "the traveling seminar," a series of forestry-field trips offered more than 30 times with each series exploring a theme of interest with environmental managers as "seminar speakers" who engage with students on the managers' home landscape. I have given many hundreds of field trips, with the majority of these across the USA's South. Two high points to date were a multiple-day 2018 Friends of the Pleistocene Field Trip at the Calhoun Critical Zone Observatory that attracted nearly 100, and a 2.5-week-long Geophysics-Geomorphology field school that I facilitated and co-led at the Calhoun Critical Zone Observatory in the summer of 2021.

I have taught and advised 100s of MEM and MF advisees, and my PhD advisees total 19 and include eight women and seven internationals.

Ph.D. Advisees (19, with 18 graduates):

Spiguel, Maria C. 1988. Nitrogen cycling in three contrasting *Quercus* (oak) ecosystems

Reynolds-Vargas, Jenny S. 1988. Nitrogen cycling in intensively managed coffee plantation ecosystems in the Valle Central, Costs Rica

Babbar, Liana. 1990. Nitrogen cycling in coffee plantations with shade trees in Costa Rica

Ye, Henri. Fuelwood plantation growth in Burkina Faso (non-graduate)

Dai Ko-Hsu. 1994. Soil cation exchange reactions and effects of acid deposition on soil solution chemistry: the role of aluminum

Markewitz, Daniel. 1995. Soil acidification, soil potassium availability, and biogeochemistry of aluminum and silicon in a 34-year-old loblolly pine (*Pinus taeda* L.) ecosystem in the Calhoun Experimental Forest, South Carolina

Korfmacher, Karl. 1996. Changes in land use and water quality in the Yadkin River basin, NC, 1951-90: A time-series and GIS analysis

Billings, Sharon. 1998. Effects of rainfall exclusion on soil carbon gases and water relations in two boreal forest ecosystems

Krishnaswamy, Jagdish. 1999. Effects of forest conversion on soils and hydrology in the Terraba River Basin, Costa Rica

O'Neill, Katharine P. 2000. Changes in carbon dynamics following wildfires from forest soils in the interior of Alaska

Oh, Neung Hwan. 2002. Chemical weathering of three Piedmont soils in North Carolina

Fimmen, Ryan 2004. Organic geochemistry of the South Carolina Piedmont: Decomposition, mineral associations, and ferrolysis. (with Richter and Prof. D. Vasudevan)

DeMeester, Julie. 2009. Effects of invasive grasses on restored-riparian N cycling

Li Jianwei. 2009. Effects of land-use history on soil macro- and trace elements in the Southern Piedmont of North America

Jackson, Jason A. 2010. Molecular approaches to estimating soil fungal diversity and community shifts in response to land-use change. (with Richter and Prof. R. Vilgalys)

Mobley, Megan A. 2012. An ecosystem approach to dead plant carbon over 50 years of old-field forest development.

Bacon, Allan R. 2014. Pedological and anthro-pedological change in soils at the Calhoun Experimental Forest

Brecheiser, Zachary. 2017. Earth's critical zone structure and dynamics of the Calhoun Experimental Forest.

Wade, Anna. 2020. Land-use legacy dynamics in decades- and centuries-old soils.

Coursework:

ENV 340 & six departmental co-listings. *Environment in Literature, Law, and Science*, 40 to 55 students, 2015, 2017, 2020

ENV 593.23 *Independent Readings and Discussion in Urban Soil Lead Toxicity*, 5 students, 2019, 2020

ENV 721 *Soil Resources*, 3 unit lecture with weekly laboratories; 5-40 students, 1987-present

ENV 762 *Forest Management Traveling Seminar*, 1 unit field trips and speaker stimulated discussions. Alternating themes: 6-20 students, 1997-present

ENV 766 *Forest Ecology of Southern Appalachian Mountains*, 1 unit Environmental science & history readings and field trip, 12-25 students, 1987-present

ENV 799.19 *Independent Studies*, 1-3 units, various topics, to undergraduate, professional, and graduate students, 1988 - present

UPE 301/701 *Advanced Readings & Discussions in Ecology*, 4 units, historial and contemporary ecosystem ecology readings, 8-12 PhD students, 2006-2014, 2020

UPE 303S/BIO311S,UPE 704 UPE Ecology Seminar, 1 unit, 24-35 students, 2001-2003, 2019-2020

Previous Duke Coursework:

ENV 049 *Into the Woods*, First Year Undergraduate Seminar, 14-16 students, 2008-2014
Top 5% of undergraduate classes in post-class student assessment, 2012.

ENV 201/701 Forest Resources Field Skills, 2 unit field laboratory, 12-24 students, 1989-2014

ENV 213 Forest Ecosystems, 3 unit lecture with weekly laboratory; 15-30 students, 1988-2004, 2012

ENV 278 Conservation and Sustainable Development, 3 unit lecture and case-study field problems course, jointly taught with NCSU and UNC; Richter co-led course with Prof. Jan Laarman, NCSU, and J. Terborgh, Duke for about five years, 30 to >60 students, 1988-1995

ENV 298.13 Ecological Applications, 3 unit lecture and discussion, coordinated and led by Richter and co-taught with five NSOE ecology faculty, 1996 only, 40 students

ENV 298.14 Forest Sustainability and Certification, with NCSU on video with live link throughout the state of NC, 2002

ENV 299.19 Tropical Watershed Management, 1 unit lecture and seminar, 12 students, 1993

ENV 299.19 Tropical Soil Resources, 2 unit lecture and laboratory, 12 students, 1993

ENV 321 Advanced Readings in Soil Science, 1 unit, readings and discussion, 5-12 students, 1995-present

ENV 870 *Fire Ecology and Management Seminar*, 2005-2014, alternate years

Other Teaching:

OTS facilitated course "Fertility of Acid Soils in the Tropics", co-taught with D. Zeaser in Spanish
for foresters and ecologists in Costa Rica, 1994

OTS teacher in Tropical Biology with Dr. Luis Diego Gómez; Soils and Ecosystems of Cerro de la Muerte, Costa Rica, 1994

OTS teacher in Tropical Managed Ecosystems with Dr. Jenny Reynolds-Vargas; Soil Infiltration in Andisols Managed for Coffee, 1992

Miscellaneous lectures and discussions in courses at Duke, UNC, and NCSU

Publications & Other Products

Books:

Richter, D.D. and D. Markewitz. 2001. *Understanding Soil Change: Soil Sustainability over Millennia, Centuries, and Decades*. Cambridge University Press, UK, 255 pp. (paperback summer 2007; 2nd edition pending).

Intergovernmental Technical Panel on Soils led by Montanarella, L. and eight editors with about 200 contributing authors including D.D. Richter. 2015. Status of the

World's Soil Resources Report. Food and Agriculture Organization of the United Nations, Rome.

Op-Eds, documentaries, book reviews, curated exhibits, obituaries, and various pieces about Richter's soils research:

Richter, D.D. 2021. Book review, *A World Without Soil* by Jo Handelsman, *Science* http://doi.org/ 10.1126/science.abm4765

Richter, D.D., D. Evans. 2021. Double book review, *Back of Beyond: A Horace Kephart Biography* and *Horace Kephart: Writings*. *Environmental History* 26: 793-796. https://doi.org/10.1093/envhis/emab064

Richter, D.D. 2020. Book review, *A Delicious Country: Rediscovering the Carolinas along the Route of John Lawson's 1700 Expedition* by Scott Huler. *Environmental History*, 25, 150-153.

Barstow, E., director and D.D. Richter, co-producer. 2019. *The Education of Bruno Latour: From Critical Zone to Anthropocene. A* 60-min documentary of the Franklin Humanities Institute. https://humanitiesfutures.org/media/the-education-of-bruno-latour-from-the-critical-zone-to-the-anthropocene-unlisted/

Richter, D.D., A. Davis, J. Llano Caldas, C. Sloggy, M. Brown. 2019. "Forever Humboldt!" A cureated exhibit of books and materials in Rubinstein Library as a part of a Duke and Bass Connections' scholarly celebration project of Alexander von Humboldt's 250th Birthday <exhibits.library.duke.edu/exhibits/show/forever-humboldt/introduction>.

Richter, D.D., A. Wade. 2018. Lead may be out of paint and gasoline, but it's still in the soil. *Raleigh News and Observer*, Aug 25.

Huler, S. 2018. "How critical zone science unearths secrets." *Duke Magazine*, Fall 2018 (a large illustrated piece on Richter's soil and critical zone research).

Richter, D.D. 2016. With drivers distracted by their phones, I'm off my bike. OpEd, *Raleigh News and Observer*, Nov 26.

Smith, R.A. 2016. Jars of dirt at Duke show how damaged soil can recover. Photo and text on Richter's soil science. *Raleigh News and Observer*, May 9.

Richardson, J.B., D.D. Richter. 2016. A comic book entitled "Adventures in the Critical Zone" (https://czo-archive.criticalzone.org/national/blogs/post/what-is-the-calhoun-critical-zone-observatory/).

Richter, D.D., C. Monger, E. Brevik. 2015. Meeting commemorates Dan Yaalon. *Crop, Soils, and Agronomy News* 60 (9): 38-39, doi:10.2134/csa2015-60-9-14

Richter, D.D. 2014. In memorium: Dan Yaalon, 1924-2014. *International Union of Soil Sciences Bulletin* 124: https://www.iuss.org/about-the-iuss/iuss-history/obituaries-to-great-soil-scientists/dan-hardy-yaalon-1924-2014/.

Richter, D.D. 2014. Favorite soil books of Daniel D. Richter, Duke University. *International Union of Soil Sciences Bulletin* 124: 43.

Tennesen, M. 2014. "Rare Earth." Photos and text on Richter's soil science. *Science* 346: doi: 10.1126/science.346.6210.692

Richter, D.D., P. Wald, C. Chia, M. Brown. 2013. "Recording the Anthropocene." A curated exhibit at the entrance to Perkins Library.

Richter, D.D. 2013. Sustaining a university forest is difficult due to rising land values but necessary. OpEd, *Raleigh News & Observer.* Dec. 4.

Richter, D.D. 2012. NC wind project could kill eagles. OpEd, *Charlotte Oberver*. June 28

Richter, D.D. 2011. Bound to tangle with a turbine. OpEd, *Raleigh News & Observer.* Nov 16.

Richter, D.D. 2010. Good wood energy. OpEd, *Raleigh News & Observer*, April 26.

Richter, D.D. 2010. Will Duke twice become a leader in renewable energy? OpEd, *Duke Chronicle*, Sept.

Richter, D. D. 2009. Rekindling wood energy in America. *RenewableEnergyWorld.com*,

Richter, D.D. 2021. Book review, *A World Without Soil* by Jo Handelsman, *Science* http://doi.org/ 10.1126/science.abm4765

Richter, D.D., D. Evans. 2021. Double book review, *Back of Beyond: A Horace Kephart Biography* and *Horace Kephart: Writings*. *Environmental History* 26: 793-796. https://doi.org/10.1093/envhis/emab064

the on-line journal. http://www.renewableenergyworld.com/rea/news/article/2009/06/rekindling-wood-energy-in-america

Richter, D.D. 2009. High school in Duke Forest would harm natural area. OpEd, *Durham Herald-Sun*, June 24.

Richter, D.D., J.T. Karakash. 2008. Time to stop wasting Durham's yardwaste**.** OpEd, *Durham Herald-Sun*, July.

Richter, D.D., J.T. Karakash. 2008. Turn yard "waste" into opportunity. OpEd, *Durham Herald-Sun*, Feb.

Richter, D.D. 2007. Navy fails to use common sense about birds and jets. OpEd, *Charlotte Observer.* April 1.

Richter, D.D. 2007. Warming up to a market in carbon. OpEd, *Raleigh News & Observer*. Jan. 2

Richter, D.D. 2007. Book review of J. Hellin's *Better Land Husbandry – from Soil Conservation to Holistic Land Management*. *Soil Science Society America Journal* 71: 635.

Richter, D.D. 2006. Why the modest coverage of the world's most spectacular sporting event? OpEd, *Durham Herald-Sun.* July.

Richter, D.D. 2006. The road to ruination of a National Park. OpEd, *Raleigh News and Observer*. Mar. 3.

Richter, D.D. 2005. The OLF vs. North Carolina's Serengeti. OpEd, *Raleigh News & Observer*. Dec.

Peer-review scientific journal papers & book chapters:

1) Richter, D.D., E. Bihari, A. Wade. 2022. Soil. In: *Handbook of the Anthropocene*. N. Wallenhorst, C. Wulf (eds). Springer-Verlag (in press).

2) Schroeder, P.A., J.C. Austin, A. Thompson, D.D. Richter. 2022. Mineralogical and elemental trends in regolith on historically managed sites in the southeastern United States Piedmont. *Clays and Clay Mineralogy* (in press).

3) Billings, S.A., P. Sullivan, D. Hirmas, J.B. Nippert, D.D. Richter. 2022. The critical zone as an ecological problem: How the interplay of biotic and abiotic actors determines fundamental functioning of Earth's living skin. In: T. White (ed.) *The Critical Zone*. Springer (in press).

4) Moorberg, C.J., M.J. Vepraskas, C.P. Niewoehner, J.G. White, D.D. Richter. 2022. Phosphorus fluxes in a restored Carolina Bay wetlands following eight years of restoration. *Wetlands* (in press).

5) Wade, A.M., D.D. Richter, C.B. Craft, N.Y. Bao, P.R. Heine, M.C. Osteen, K.G. Tan. 2021. Urban-soil pedogenesis drives contrasting legacies of lead from paint and gasoline in city soil. *Environmental Science and Technology* 55: 7981-7989.

6) Brecheisen, Z., D.D. Richter, S. Moon, P.N. Halpin. 2021. Quantitative analysis of hillshed geomorphology and critical zone function: Raising the hillshed to watershed status. *Geological Society America Bulletin,* https://doi.org/10.1130/B35724.1

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