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Engineering & Scientific Consulting

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Professional Profile

Dr. James is a soil scientist specializing in biogeochemistry, hydrology modeling, chemical fate and transport, and data analysis. His work explores the impacts of anthropogenic activities such as mining, oil spills, forest harvesting, and prescribed fire on ecological and groundwater resources. He is also a published expert on soil health and ecosystem carbon sequestration related to forest management, land-use change, and horticulture.

Dr. James' expertise is analyzing complex physical, chemical, biological, and hydrological phenomena, which intersect and interact in soils at global, individual watershed, and soil pore scales. His data analysis expertise includes multivariate statistics and machine learning techniques, as well as using US EPA-approved methods for establishing background threshold values and confidence limits for exposure point concentrations. Dr. James has consulted for government, utility, and industrial clients, focusing on remediating metals and hydrocarbon contamination from mines, smelters, and oil spills to minimize ecological and human health effects. His project and research experience includes:

- Simulating organic and inorganic chemical fate and transport in saturated and unsaturated environments, including in coal ash impoundments with intersecting groundwater and in firefighting water from battery energy storage system (BESS) fires

- Soil and groundwater sampling as part of remedial investigations on various types of contaminated sites

- Ecosystem carbon and greenhouse gas (GHG) emissions inventory accounting in the contexts of corporate climate change disclosures, voluntary carbon offset markets, and industrial supply chains

- Lifecycle assessment (LCA) to quantify greenhouse gas, water use intensity, and human and ecological health impacts, including comparative analysis to identify the benefits of re-used and recycled goods

- Developing interactive data visualizations and dashboards, such as for dose response relationships with ecotoxicological data and for coupled hydrological and geochemical models

- Studying the fate and transport of metals released in fugitive dust and acid mine drainage from current and historical mining sites and smelters

- Historical reconstruction of industrial activities, identification of contamination sources, and forensic chemistry at sites designated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, a.k.a. Superfund)

- Synthesizing scientific literature through meta-analysis and systematic reviews, particularly focusing on metals uptake by crops and the effects of land use change, natural resource management, and climate on global forest and agricultural soil resources.

Academic Credentials & Professional Honors

Ph.D., Environmental and Forest Sciences, University of Washington, 2018

M.S., Environmental and Forest Sciences, University of Washington, 2014

B.S., Creative Writing and Environmental Science, Oberlin College, 2012

Licenses and Certifications

Certified Associate Professional Soil Scientist (APSS)

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Professional Affiliations

Member, Soil Science Society of America

Mining Committee Vice Chair, ABA Section of Environment, Energy, and Resources

Publications

James et al. 2024 Chapter 2. Physics and Chemistry and Chapter 10. Environmental Forensics in The Environmental Science Deskbook 2024-2025 Edition. Ed. J.W. Conrad and W.L. Goodfellow. Clark Boardman Callaghan & Thomson Reuters Law Products. ISBN: 9798350287578

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Mayer, M., A. Baltensweiler, J. James, A. Rigling, F. Hagedorn. 2024. A global synthesis and conceptualization of the magnitude and duration of soil carbon losses in response to forest disturbances. Global Ecology and Biogeography, 00, 1-10. https://doi.org/10.1111/geb.13779.

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James, J., D. Page-Dumroese, M. Busse, B. Palik, J. Zhang, B. Eaton, R. Slesak, J. Tirocke, H. Kwon. 2021. Effects of forest harvesting and biomass removal on soil carbon and nitrogen: two complementary meta-analyses. Forest Ecology and Management 485:118935.

Mayer, M., C.E. Prescott, W. Abaker, L. Augusto, L. Cecillon, G. Ferreira, J. James, R. Jandl, K. Katzensteiner, J.P. Laclau, J. Laganiere, Y. Nouvellon, D. Pare, J.A. Stanturf, E.I. Vanguelova, L. Vesterdal. 2020. Tamm Review: Influence of forest management activities on soil organic carbon stocks: A knowledge synthesis. Forest Ecology and Management 466:118127.

Koch, J., Bogard, M., Butman, D., Finlay, K., Ebel, B., James, J. Johnston, S., Jorgenson, M., Pastick, N., Spencer, R., Striegl, R., Walvoord, M., Wickland, K. 2022. Heterogeneous patterns of aged organic carbon export driven by hydrologic flow paths, soil texture, fire, and thaw in discontinuous permafrost headwaters. Global Biogeochemical Cycles 36:4. https://doi.org/10.1029/2021GB007242.

Guerrini, I., Sampaio, T., Bogiani, J., Backes, C., Harrison, R., Oliveira, F., Gava, J., Traballi, R., Mota, R., Roder, L., Grilli, E., Ganga, A., James, J., Capra, G. 2021. Sewage sludge as a pedotechnomaterial for the recovery of soil compacted by heavy machinery on Eucalyptus commercial plantation. Journal of Cleaner Production 325:20. https://doi.org/10.1016/j.jclepro.2021.129320.

EPRI. 2020. Chemical constituents in coal combustion products: boron. EPRI Final Report 3002018777. Electric Power Research Institute. Palo Alto, CA.

Faria, M.F., I.A. Guerrini, F.C. Oliveira, M.I.Z. Sato, J.R.S. Passos, J.N. James, R.B. Harrison. 2020. Survival of thermotolerant coliforms in municipal biosolids after application in tropical soil cultivated with Eucalyptus. Journal of Environmental Management 274:111116.

Guerrini, I.A., T.F. Sampaio, J.C. Bogiani, C. Backes, R.B. Harrison, F.C. Oliveira, J.L. Gava, R.C. Traballi, R.G.M. Mota, L.B. Roder, E. Grilli, A. Ganga, J.N. James, G.F. Capra. 2021 Sewage sludge as a pedotechnomaterial for the recovery of soils compacted by heavy machinery on Eucalyptus commercial plantation. Journal of Cleaner Production 325:129320.

James, J.N., C.D. Gross, P. Dwivedi, T. Myers, F. Santos, R. Bernardi, M.F. Faria, I.A. Guerrini, R.B. Harrison, and D.E. Butman. 2019. Land use change alters the radiocarbon age and composition of soil and water-soluble organic matter in the Brazilian Cerrado. Geoderma 345:38-50.

Rocha J.H., R.B. Harrison, M. Menegale, J.L. Gonçalves, M. Rodrigues, P. Pavinato, E. Foltran, and J.N. James. 2019. Impacts of timber harvesting intensity and P fertilizer application on soil P fractions. Forest Ecology and Management 437:295-303.

F.C. Oliveira, M.F. Faria, E.I. Bertoncini, M.I. Sato, E.M. Hachich, I.A. Guerrini, J.R. Passos, J.N. James, R.B. Harrison, T.G. Feitoza, J.J. Chiaradia, C.H. Abreu-Junior, and L.P. Moraes. 2019. Persistence of fecal contamination indicators and pathogens in Class B biosolids applied to sugarcane fields. Journal of Environmental Quality 48(2):526-530.

James J.N., N. Kates, C.D. Kuhn, C.E. Littlefield, C.W. Miller, J.D. Bakker, D.E. Butman, and R.D. Haugo. The effects of forest restoration on ecosystem carbon in western North America: a systematic review. 2018 Forest Ecology and Management 2018; 429:625-641.

Gross C.D., J.N. James, E. Turnblom, and R.B. Harrison. 2018 Thinning treatments reduce deep soil carbon and nitrogen stocks in a coastal Pacific Northwest forest. Forests 9(238).

Dietzen C., E. Marques, J.N. James, R. Bernardi, S. Holub, and R.B. Harrison. 2017. Response of deep soil carbon pools to forest management in a highly productive Andisol. Soil Science Society of America Journal 81:970-978.

James J.N., R.B. Harrison. 2016. The effect of harvest on forest soil carbon: A meta-analysis. Forests 7(308).

Menegale M., J. Rocha, R.B. Harrison, J.L. Gonçalves, R. Almeida, M. Picollo, A. Hubner, J.N. James,

and S. Michelson-Correa. 2016. Effect of timber harvest intensities and fertilizer application on stocks of soil C, N, P, and S. Forests 7(319).

Faria M.F., I.A. Guerrini, F.C. Oliveira, M. Sato, E. Hachich, J. Passos, L. Goulart, T. Silva, J. Gava, J. Furches, J.N. James, and R.B. Harrison. 2016. Persistence of Ascaris spp. ova in tropical soil cultivated with Eucalyptus and fertilized with municipal biosolids. J. Environ. Qual. 46(3):522-527.

James J.N., K. Littke, T. Bonassi, and R.B. Harrison. 2016. Exchangeable cations in deep forest soils: separating climate and chemical controls on spatial and vertical distribution and cycling. Geoderma 279:109-121.

James J.N., C. Dietzen, J. Furches, and R.B. Harrison. 2015. Lessons in buried horizons and pedogenesis from deep forest soils. Soil Hor. 56(6).

James J.N., E. Knight, V. Gamba, and R.B. Harrison. 2015. Deep soil: Quantification, modeling, and significance of subsurface nitrogen. For. Ecol. and Manag. 336:194-202.

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Project Experience

Field Experience

Sampled soils and evaluated the spatial distribution of lead around lead-sheathed telecommunication cables.

Sampled groundwater in a historical crude oil pipeline release site in Minnesota to evaluate the metabolites and organic chemistry of oil biodegradation.

Sampled surface soils and logged soil borings as part of an extensive remedial investigation at a former Washington State Department of Transportation site. Soil and groundwater samples were analyzed for TPH, VOCs, SVOCs, heavy metals, and dioxins/furans due to a wide variety of activities at the site including burning waste, dumping of highway debris, and rinsing out asphalt trucks with diesel.

Classified and described soils for a long-term study aimed at identifying organic and chemical soil amendments to reduce bioavailability of lead and arsenic in soils near the Columbia River in Washington. Identified potentially cost efficient and effective amendments to prevent loss of sensitive plant species.

Fate and Transport of Contaminants

Simulated the fate and transport of metals and metalloids leaching from coal ash impoundments and landfills with intersecting groundwater using PHAST, a coupled hydrological and equilibrium geochemistry software platform developed by the U.S. Geological Survey. Evaluated base cases with no engineering controls on leaching and transport behavior as well as simulations of capping, permeable reactive barriers with zero valent iron, in-situ solidification, groundwater extraction, and ash removal.

Mined California's GeoTracker database for petroleum spill data and evaluated rolling-window trends in concentrations using Mann-Kendall trend analysis. Performed analysis across a portfolio of sites to prioritize sites for further evaluation and remediation.

Developed a model for the fate and transport of metals and PFAS entrained in firefighting water following fires at grid-scale battery energy storage system (BESS) facilities. Simulated the potential concentrations

of lithium, cobalt, and other battery constituents in surface soil, groundwater, and surface water to assist utilities assessing the need for firefighting water containment.

Evaluated the environmental effects and distribution of benzene, toluene, ethylbenzene, xylenes (BTEX), PAHs, and petroleum hydrocarbons associated with seven former manufactured gas plants (MGPs) in the greater New York area. Reconstructed the history of operations and examined the environmental impacts in the context of historical standards of care.

Evaluated the loading and transport of metals from a variety of mine adits and waste piles in the Bonita Peak Mining District Superfund Site following the release of acid mine drainage from the Gold King Mine in Colorado. Tracked the sources and contributions from multiple drainages through reconstruction of historical records and monitoring data spanning multiple decades.

Evaluated the environmental persistence, bioaccumulation, and toxicity of industrial chemicals as part of public safety due diligence and product stewardship. Gathered publicly available data on selected chemicals from the European Chemicals Agency (ECHA), US EPA, and OECD and evaluated for potential harm to the environment. Modeled the environmental fate of a pesticide on Brazilian soils using the US EPA Pesticide Water Calculator model, which integrates a modified Universal Soil Erosion model, a groundwater model, and a water column model. The study provided an environmental risk assessment for the use of the pesticide in Brazil across 11 different crop species and 10 Brazilian states. Identified differences in potential ecological risk to algae due to differences in application techniques, including aerial application, tilling the pesticide into the soil, and adding a buffer zone near freshwater.

Prepared a manuscript evaluating the changes in barium, cadmium, lead, and zinc concentrations in tussock tundra soils over 15 years. Found preferential exclusion of certain metals (particularly lead) from plant tissues, with stronger correlations between soil and non-vascular (lichen and moss) tissue concentrations and weaker correlations in annual grass and perennial tree tissues.

Analyzed a spatially and temporally complex dataset that examined the long-term persistence of pathogens following the application of biosolids in forests and sugarcane plantations. Evaluated the regulatory frameworks for biosolids policy.

Hydrology

Created a spatially explicit water budget model to recreate historical groundwater pumping in the Kern County Subbasin and evaluated the performance of a groundwater sustainability plan (GSP) to comply with the California Sustainable Groundwater Management Act (SGMA) using a Monte Carlo approach to predict water supply conditions for future scenarios based on historical hydrology.

Constructed a water balance analysis for a slow-moving landslide in Hawaii utilizing remotely sensed data, site-specific soil information, and hydrologic modeling. Assessed how temporal trends in rainfall, infiltration, and evapotranspiration affected the rate of movement in the landslide.

Modeled the fate and transport of light non-aqueous phase liquid (LNAPL) released from a pipeline in Colorado. Evaluated the range of potential start dates for the release utilizing Darcy flow analysis.

Evaluated the hydrologic properties controlling plume migration of LNAPL released from a pipeline in the Piedmont region. Used Darcy flow principles adjusted for the presence of bedrock fractures, as well as differences in fluid density and viscosity.

Soil Health

Established and monitored a two-year field experiment to show how biologically active compost and compost extract applications improved soil biology, including improving the abundance of fungi and protozoa, as well as improving the capability for soil to retain water and provide drought resilience.

Performed third party review of risk assessments for the application of enhanced rock weathering (ERW) projects applying materials such as basalt and olivine on agricultural soils to improve soil conditions as well as sequester carbon.

Evaluated the soil physical, chemical, and erosion factors leading to a turfgrass failure at a park in Louisiana.

Ecosystem Carbon Sequestration & GHG Emissions

Reviewed a forestry carbon offset credit project for permanence, additionality, immediacy, appropriate baseline modeling and assumptions, deviations from the registry standards and methodologies. Identified risks associated with carbon registries, standards, and methodologies.

Used remote sensing data to model carbon sequestration in open space areas in the context of California's Cap and Trade program. Evaluated changes in aboveground ecosystem production and soil carbon sequestration following periodic wildfires.

Performed a literature review of the GHG emissions associated with substituting forest biomass for coal coke in the production of pig iron and steel. Evaluated available literature and lifecycle assessments in the context of corporate supply chain accounting.

Performed a meta-analysis on the effects of additional biomass removal from forests to create biofuel on the soil carbon cycle. Gathered and synthesized data from the peer-reviewed literature and analyzed data with multi-level, random effects models to account for publication bias, spatial autocorrelation, and nested effects.

Developed a machine learning tool to examine controls on dissolved organic carbon fluorescence in 15 US rivers sampled over two years. Identified relationships with radiocarbon age, dissolved nutrients and metals, and land use change gradients that help quantify the mobilization of terrestrial carbon into freshwater ecosystems.

Led a systematic review of the literature examining the impacts of prescribed fire and forest thinning on ecosystem carbon in western North America. Analyzed data using mixed effects models and published findings in Forest Ecology and Management.

Managed and authored a meta-analysis examining the impact of forest harvesting, including pretreatment strategies such as prescribed fire and litter removal, on soil carbon worldwide. Presented findings at the UN Food and Agriculture Organization in Rome as part of an international effort to establish international agreements and legislation to improve soil management, maintain agricultural and forest productivity, and sequester carbon.

Planned, organized, and led a study examining the effect of land use change from native Cerrado forest in Brazil to Eucalyptus plantations on both soil and dissolved organic matter biodegradability, radiocarbon age, and chemical characteristics. Utilized multivariate statistical techniques to combine highly complex chemical and biological datasets to identify relationships that control the release of organic carbon into soil solution following forest conversion.

Conducted field research on the impacts of land use change and application of municipal biosolids and chemical fertilizers in maintaining productivity and soil nutrition in forestry and agricultural applications.

Tracked the persistence of pathogenic microbiota and examined the effects on soil carbon and nutrients including nitrogen, phosphorus, sulfur, and exchangeable cations.

Managed a multi-year study to examine the ecological and environmental importance of deep soil (> 1 m) for the productivity, nutrition, and carbon dynamics of forests.

Peer Reviews

• Applied Soil Ecology

• Forest Ecology and Management

• Forests

• Geoderma

• Global Change Biology

• Journal of Geophysical Research - Biogeosciences

• Nature

• Science of the Total Environment

• Soil Science Society of America Journal