

KAI C. RAINS, KRAINS@USF.EDU
USF WATER INSTITUTE AND THE ECOHYDROLOGY RESEARCH GROUP
SCHOOL OF GEOSCIENCES, UNIVERSITY OF SOUTH FLORIDA

EDUCATION

PhD Ecology	University of California, Davis
M.S. Botany	University of Washington, Seattle
B.S. Biochemistry/Biophysics	Oregon State University, Corvallis

PROFESSIONAL EXPERIENCE & APPOINTMENTS

Research Associate Professor	School of Geosciences, USF, 2015-Present
Secretary General	Executive Board, Society of Wetland Scientists, 2023-Present
Senior Wetland Scientist/Botanist	Three Parameters Plus, Fairbanks, AK 2005-2014
Instructor/Academic Advisor	Environmental Science & Policy Dept, USF, 2003-2005
Plant Ecologist	Foster Wheeler Environmental Corp, Bellevue WA, 1997
Associate Ecologist	L.C. Lee & Associates, Seattle, WA 1996

PEER REVIEWED PUBLICATIONS

Rains, K.C., C. Bledsoe, T.E.C. Kraus, N. Wurzburger (2024) Evidence that ericoid mycorrhizal shrubs can outcompete ectomycorrhizal trees for nitrogen in tannin-rich litter. *Ecosphere* 15(3).
<https://doi.org/10.1002/ecs2.4818>

Van Alphen, R., K.C. Rains, M. Rodgers, R. Malservisi, T. Dixon (2024) UAV-Based Wetland Monitoring: Multispectral and Lidar Fusion with Random Forest Classification. *Drones* 8(3), 113.
doi.org/10.3390/drones8030113

Lawlor, S. K.C. Rains, S. Landry, M. Rains (2023) Forensic wetland and deepwater habitat mapping for setting pre-development conditions. *Wetland Science and Practice* October Issue

Rains, M., **K. Schmidt**, S. Landry, W. Kleindl, **K.C. Rains** (2023) Reorganizing the waterscape: asymmetric loss of wetlands and gain of artificial water features in a mixed-use watershed. *Wetlands* 43(91).
doi.org/10.1007/s13157-023-01732-0

Guerrón-Orejuela E, K. Rains, T. Brigino, W. Kleindl, S. Landry, P. Spellman, C. Walker, M. Rains (2023) Mapping groundwater recharge potential in high latitude landscapes using public data, remote sensing, and analytic hierarchy process. *Remote Sensing* 15:2630. doi.org/10.3390/rs15102630

Stepchinski L.M., M.C. Rains, L.C. Lee, R.A. Ris, W.L. Nutter, **K.C. Rains**, S.R. Stewart (2023) Hydrologic Connectivity and Flow Generation from California Vernal Pool, Swale, and Headwater Stream Complexes to Downstream Waters *Wetlands* 43(34) doi.org/10.1007/s13157-023-01678-3

- Gerlach M.E., K.C. Rains, E.J. Guerrón-Orejuela, W.J. Kleindl, J. Downs, S.M. Landry, M.C. Rains, (2022) Using remote sensing and machine learning to locate groundwater discharge to salmon-bearing streams. Remote Sensing. 14(1):63. <https://doi.org/10.3390/rs14010063>*
- Creed I.F., C.L. Lane, L. Alexander, N.B. Basu, A. Calhoun, M.J. Cohen, C. Craft, E. D'Amico, E. DeKeyser, L. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, M. Lang, S.G. Leibowitz, D.B. Lewis, J. Marton, D.L. McLaughlin, H. Raanan-Kiperwas, M.C. Rains, **K.C. Rains**, L. Smith, (2017) Enhancing protections for vulnerable waters. *Nature Geoscience* DOI: 10.1038/NNGEO3041
- Callahan, M.K., D.K. Whigham, M.C. Rains, K.C. Rains, R.S. King C.M. Walker, J.R. Maurer, S.J. Baird (2017) Nitrogen subsidies from hillslope alder stands to streamside wetlands and headwater streams, Kenai Peninsula, Alaska. Journal of the American Water Resources Association 53:478-492. doi:10.1111/1752-1688.12508*
- Rains M.C., M.J. Cohen, H.E. Golden, **K.C. Rains** (2017) Connecting the dots: hydrologic connectivity between wetlands and other wetlands and waterbodies. *Water Resources IMPACT* 19:9-10 <http://www.awra.org/impact/Mar17IMPACTSample.pdf>
- Rains, M.C., S. Landry, **K.C. Rains**, V. Seidel, and T.L. Crisman (2013) Using net wetland loss, current wetland condition, and planned future watershed condition for wetland conservation planning and prioritization, Tampa Bay Watershed, Florida. *Wetlands* 33:949-963. DOI:10.1007/s13157-013-0455-4
- Rains, K.C.** and C.S. Bledsoe (2007) Rapid uptake of ¹⁵N-ammonium and glycine-¹³C, ¹⁵N by arbuscular and ericoid mycorrhizal plants native to a Northern California coastal pygmy forest. *Soil Biology and Biochemistry* 39:1078-1086. 10.1016/j.soilbio.2006.11.019
- Rains, K.C.** (2004) Ericoid mycorrhizas in organic soils: Distribution of ericoid mycorrhizas among epiphytes in a Costa Rican cloud forest and uptake of organic nitrogen by ericoid, ecto-, and arbuscular mycorrhizal pygmy forest plants. Ph.D. Dissertation, *University of California, Davis, California*.
- Rains, K.C.**, N.M. Nadkarni, and C.S. Bledsoe (2003) Epiphytic and terrestrial mycorrhizas in a lower montane Costa Rican cloud forest. *Mycorrhiza* 13:257-264. DOI: 10.1007/s00572-003-0224-y

**Italics indicate student author*

RESEARCH FUNDING

Pilot Scale Development of a Septic-to-Sewer Conversion Prioritization Tool Using Analytical Hierarchy Process, Phase II: Landscape Vulnerability. Office of Environmental Accountability and Transparency, Florida Department of Environmental Protection. DEP Agreement # AT020. PI K.C. Rains. \$78,262 2024.

Assessment of Nutrients in Water and Sediment in Martin County/ St Lucie River and Estuary Watershed: Impact of Land Use. US Environmental Protection Agency. PI K.C. Rains. \$101,998, 2024–2027.

Pilot Scale Development of a Septic-to-Sewer Conversion Prioritization Tool Using Analytical Hierarchy Process, Phase I. Office of Environmental Accountability and Transparency, Florida Department of Environmental Protection. DEP Agreement # AT015. PI K.C. Rains co-PI Shawn Landry. \$27,710.49, 2023

Utilizing Beavers to Mitigate Climate Drying Peatland Wildlife Conservation Society Climate Adaptation Fund PI K.C. Rains; co-PI M.C. Rains. \$122,000 2023-2025

Wetlands and Water Quality: A Multimetric Tool for Restoration Prioritization in the Indian River Lagoon Watershed, FL. US Environmental Protection Agency, Wetland Program Development Grant. PI K.C. Rains; co-PIs M.C. Rains, S. Landry. \$249,000, 2021-2024

Groundwater Vulnerability in Coupled Human-Natural Systems. Source of Funding: National Oceanographic and Atmospheric Administration Investigators: PI M.C. Rains; co-PIs K.C. Rains. \$119,000, 2020-2022

Ranking Inundation Potential of Wetlands in the Northern Tampa Bay Area, FL. Source of Funding: Tampa Bay Water Investigators: PI K.C. Rains; co-PIs T.M. Lee, G. Fouad. \$176,875, 2019-2021

Wetland Vulnerability and Resiliency Study, St Lucie County, FL, Phase III: Historic Mapping and Wetland Change Analysis. Source of Funding: St. Lucie County Investigators: PI K.C. Rains; co-PIs M.C. Rains, S. Landry. \$29,000, 2020

Rapid Assessment of Shallow Groundwater Recharge-Discharge in Salmon-Bearing Watersheds, Kenai Lowlands, Alaska Source of Funding: National Estuarine Research Reserve System Science Collaborative Investigators: PI M.C. Rains; co-PI K.C. Rains. \$159,000, 2017-2019

Detailed Analysis of the Florida Fish and Wildlife Conservation Commission Saltwater Angler Licensing System. Source of Funding: NOAA/Florida Fish and Wildlife Conservation Commission Investigators: PI S. Landry, co-PI K.C. Rains. \$96,748, 2016-2016.

Development of a System for Measuring Current and Historic Conditions of a Mangrove Wetland. Sources of Funding: Paso Pacifico and the World Bank Investigators: PI M.C. Rains; co-PI K.C. Rains. \$9,000, 2015-2015.

Wetland Inventory and Evaluation Study of St Lucie County, FL. Source of Funding: St. Lucie County, Florida Investigators: PI M.C. Rains; co-PIs K.C. Rains, T. Crisman. \$85,000, 2010-2013.

TEACHING

University of South Florida, Tampa, FL, 2003-2006, 2015-current

Environmental Science & Policy Senior Seminar EVR 4921

Environmental Science & Policy Internship EVR 4940

Hydrogeology Field Methods GLY4948L

Mangrove Ecosystem Field Research Techniques GLY4930/6739

Plant Taxonomy of Florida, EVR 4930/6930

Soil Genesis and Classification GEO 4265

Wetland Environments EVR 4027

Professional Workshops Instructed, Three Parameters Plus, Alaska, 2006-2014

Field Assessment of Wetland Function

Field Methods: Methods for Conducting Surveys of Rare or Non-Native Plants

Field Methods: Vegetation Sampling and Habitat Analysis

Techniques for Collecting and Preserving Herbarium Specimens

Wetland Delineation: Regulatory Techniques for Determination of Hydrophytic Vegetation

Development of Online Modules for Professional Development, Three Parameters Plus, Alaska, 2012-2014

Field Methods: Design and Implementation of Targeted Plant Surveys (Non-Native or Rare Plants)

Field Methods: Plant Material Collection Techniques for DNA Analysis

Field Methods: Vegetation Sampling and Habitat Analysis

Methods for Collecting and Preserving Plants as Voucher Specimens

Reporting and Validation Procedures for Incidental Observations of Rare or Non-Native Plants

Wetland Delineation: Regulatory Techniques for Determination of Hydrophytic Vegetation

PRESENTATIONS, SCIENCE SOCIETY MEETINGS

K Rains, E. Guerron-Orejuela, S. Lawlor, S. Landry, M Rains (2024) *Tool for wetlands and water project prioritization in the Indian River Lagoon watershed* UF Water Institute Symposium Gainesville, FL

Reed A., **K Rains** (2024) *Tampa Bay groups with few financial resources lack benefits from natural and artificial wetlands*. UF Water Institute Symposium Gainesville, FL

Lawlor S., **K Rains**, S Landry, M Rains (2024) *Forensic wetland and deepwater habitat mapping for setting pre-development conditions*. UF Water Institute Symposium Gainesville, FL

Guerron-Orejuela, E., **K. Rains**, M. Okonkwo, M. Rains (2024) *Pilot scale septic-to-sewer conversion prioritization map using analytic hierarchy process*. UF Water Institute Symposium Gainesville, FL

Brigino T, **K. Rains**, S. Bentz, J. Argueta, M. Rains. (2024) *Groundwater sustains salmon streams: Support to streamflow and temperature in south-central Alaska*. UF Water Institute Symposium Gainesville, FL

Van Alphen T, **K. Rains**, M. Rodgers, R. Malservisi, T. Dixon. (2024) *UAV-based Wetland Monitoring: Mapping Coastal Habitats and Elevation Change with Digital Terrain Models*. European Geophysical Union, Vienna, Austria

Rains M, Fransbergen S, **Rains K**, Fouad G (2023) *The flow-pulse concept: spatial and temporal variability in connectivity in stream-wetland flow networks*. Society of Wetland Scientists, Spokane, Washington

Brigino T, **Rains K**, Rains M, Guerron-Orejuela E, Intveld A, Bentz S, Walker C. (2023) *From mountains to streams, wetlands are key: groundwater and salmon-bearing stream connectivity in south-central Alaska*. Society of Wetland Scientists Annual Meeting, Spokane, Washington

Rains, M., **K. Rains**, S. Fransbergen, G. Fouad (2022) *Expansion-contraction: Spatial and temporal variability in connectivity in a stream-wetland flow network*. AGU American Geophysical Union, Chicago, IL

Brigino T., **K. Rains**, M. Rains, A. Intveld, S. Bentz, C. Walker (2022) *No water, no fish: The crucial role of groundwater in supporting streamflow in non-glacial, salmon-bearing streams in south-central Alaska*. AGU American Geophysical Union, Chicago, IL

Intveld, A., T. Brigino, E. Guerrón Orejuela, **K. Rains**, M. Rains, C. Walker (2022) *Understanding hydrochemical data through a geological context in the Anchor River Watershed, Kenai Peninsula Lowlands, Alaska*. AGU American Geophysical Union, Chicago, IL

Guerrón-Orejuela, E., **K. Rains**, M. Rains, S. Landry, W. Kleindl, S. Church (2022) *Groundwater risk and resilience in social-hydrological systems* Joint Aquatic Sciences Meeting, Grand Rapids, MI.

Rains, K., M. Gerlach, E. Guerrón-Orejuela, W. Kleindl, J. Downs, S. Landry, C. Walker, S. Bentz, M. Rains (2022) *Using remote sensing and machine learning to locate groundwater discharge to salmon-bearing streams* Joint Aquatic Sciences Meeting, Grand Rapids, MI.

Stepchinski, L, M. Rains, L. Lee, R. Lis, W. Nutter, **K. Rains**, S. Stewart (2022) *Vernal pools, swales, and headwater streams are integrated tributaries to navigable waters* Joint Aquatic Sciences Meeting, Grand Rapids, MI.

Rains, M. S. Bentz, T. Brigino, M. Gerlach, E. Guerrón-Orejuela, W. Kleindl, **K. Rains**, C. Walker (2022) *Groundwater flows support the integrity of riparian wetlands and salmon-bearing streams, Alaska* Joint Aquatic Sciences Meeting, Grand Rapids, MI.

Rains, K., M. Rains, S. Lawlor, Landry, S (2022) *Forensic mapping of the stunning transformation of Florida's coastal watersheds over 150+ years* UF Water institute Symposium, Gainesville, FL.

Rains, K. and M. Rains, (2022) *Fewer wetlands, more ditches: How knowledge of land use change can inform water-quality restoration in the Indian River Lagoon*. Presentations delivered to the Indian River Lagoon National Estuary Program Management STEM Advisory Committee and to the IRL Council Management Board, Grant-Valkaria, FL.

Van Alphen, R., M. Rodgers, R. Malservisi, T. Dixon, **K. Rains** (2021) *Coastal land use classification using multispectral and RGB imagery from an unoccupied aerial vehicle (UAV)* American Geophysical Union New Orleans, LA.

Stepchinski, L., M. Rains, L. C. Lee, R. Lis, W. Nutter, **K.C. Rains**, S. Stewart. (2021) *Headwater wetlands or headwater streams? Hydrologic connectivity and flow generation from California vernal depressions to downstream waters* American Geophysical Union New Orleans, LA.

Lawlor, S. **K.C. Rains**, M Rains, S Landry, C. Flannagan (2021) *Quantifying changes in wetland distribution and drainage patterns (1850s-2004) to inform conservation and restoration in an agricultural landscape, St. Lucie County, FL*. Society of Wetland Scientists, Spokane, WA.

Fransbergen, S., **K.C. Rains**, G. Fouad, M Rains (2021) *Field validation of the National Hydrography Dataset and a Regional Hydrography Dataset in Tampa Bay, FL, USA* Society of Wetland Scientist, Spokane, WA.

Fouad, G, T. Lee, **K.C. Rains** (2021) *Estimating intermittent streamflow rates between geographically isolated wetlands and rivers using watershed terrain and historical runoff* Society of Wetland Scientists, Spokane, WA.

Rains, K.C., N. Wurzbarger, C. S. Bledsoe (2017) *Acquisition of N by plants from 15N-labelled root and leaf litter* Annual Meeting of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America. Tampa, FL.

Rains, K.C., M.C. Rains, S. Landry, V., Seidel, T. Crisman (2014) *Using net wetland loss, current wetland condition, and planned future watershed condition for wetland conservation planning and prioritization, Tampa Bay watershed, Florida*. Joint Aquatic Sciences Meeting (JASM): Society for Freshwater Science

(SFS), Phycological Society of America (PSA), Association for the Sciences of Limnology and Oceanography (ASLO), Society of Wetland Scientists (SWS). Portland, OR.

Rains, K.C. (2013) *Analysis of the response of wetland functional assessment indices to landscape-level perturbations* 3PPI Wetland Restoration Meetings; Fairbanks, Alaska.

Rains, K.C., M.C. Rains, S.M. Landry, V. Seidel and T.L. Crisman (2013) *Net wetland loss (1950s-2007) and current wetland condition (2007), Tampa bay watershed, Florida* Joint Conference of the Society of Wetland Scientists South Atlantic Chapter (SWS SAC), Florida Assoc of Environmental Soil Scientists (FAESS), and SW Chapter of the Florida Association of Environmental Professionals (SWFAEP). Tampa, FL.

Rains, K.C. (2012) *Vegetation structure and composition across 125,000 acres of the Bristol Bay Watershed* Government Agency Briefings and Webinar: Pebble Partnership Baseline Environmental Team Agency Meeting; Anchorage, Alaska.

PUBLICATIONS: TECHNICAL REPORTS

Guerron-Orejuela E. and **K.C. Rains** (2023) Pilot Scale Development of a Septic-to-Sewer Conversion Prioritization Tool Using Analytical Hierarchy Process. Ecohydrology Research Group, University of South Florida, Tampa, FL. Prepared for: Office of Environmental Accountability and Transparency, Florida Department of Environmental Protection. DEP Agreement # AT015.

Brigino T, **K Rains**, E Guerron-Orejuela, M. Rains, S. Bentz (2023) City of Homer Reservoir Project: Groundwater Study Ecohydrology Research Group, University of South Florida, Tampa, FL and The Kachemak Bay National Estuary Research Reserve, Homer AK. Prepared for: City of Homer. ERG Report # 2023-01/Final Report Agreement # 069687242

Rains K.C., K. Bornhorst (2016) *A Detailed Analysis of the Florida Saltwater Angler Registry*. Water Institute, School of Geosciences, University of South Florida, Tampa, FL. Prepared for: Florida Fish and Wildlife Conservation Commission <http://waterinstitute.usf.edu/publications>

Rains KC, M.C Rains (2015) *Mangrove and Mangrove-Fringe Wetlands in Ostional, Nicaragua: Current Conditions and Pathways Forward*. University of South Florida, School of Geosciences, Tampa, FL

Three Parameters Plus (2014) *Vegetation Field Methods, Summary Statistics, Descriptions of Habitat Types, Digital Mapping, and Landscape Distribution*, Total Project Size: 332,000 acres, Southwest Alaska in "Preliminary jurisdictional wetland determination for the Donlin Gold Project" Prepared for Barrick Gold Corp. Role: Lead Author

Three Parameters Plus (2014) *Vegetation: Field Methods, Summary Statistics, Descriptions of Habitat Types, and Landscape Distribution*, Total Project Size: 12,697 acres, Interior Alaska in "Preliminary jurisdictional wetland determination for the Pogo Project", Prepared for Sumitomo Metal Mining, LLC, Role: Lead Author

Three Parameters Plus (2014) *Vegetation Field Methods, Summary Statistics, Descriptions of Habitat Types, and Landscape Distribution*, Total Project Size: 8,500 acres, Interior Alaska in "Preliminary jurisdictional wetland determination for the Tanana Project", Prepared for Sumitomo Metal Mining, LLC, Role: Lead Author

Three Parameters Plus (2014) *Disposal and control of invasive plant species*. Prepared for the Alaska Dept. of Transportation and Public Facilities, Southeastern Region. Role: Lead Author
www.dot.state.ak.us/stwddes/desenviron/assets/pdf/resources/se_invasive_final.pdf

Three Parameters Plus (2014, 2013, and 2012) *Botanical resource studies: Annex Creek/ Salmon Creek Hydroelectric Project (FERC Project No. 2307)*. Annual reports prepared for: Alaska Electric Light and Power, Juneau, Alaska. Role: Lead Author

Three Parameters Plus (2013) *Vegetation Field Methods, Summary Statistics, Descriptions of Habitat Types, Digital Mapping, and Landscape Distribution*, Total Project Size: 103,747 acres, North Slope, Alaska in "Preliminary jurisdictional wetland determination for the Foothills West Transportation Access Project", Prepared for the Alaska Department of Transportation and Public Facilities, Northern Region, Role: Lead Author

Three Parameters Plus (2013) *Vegetation Field Methods, Summary Statistics, Descriptions of Habitat Types, Digital Mapping, and Landscape Distribution*, Total Project Size: 62,587 acres in "Preliminary jurisdictional wetland determination for the Livengood Gold Project", Interior Alaska. Prepared for International Tower Hill, Role: Lead Author

Rains, K.C. (2013) *Non-native plant species survey, Umiat airstrip and associated road system, North Slope, Alaska*. Prepared for the Alaska Department of Transportation and Public Facilities, Northern Region.

Three Parameters Plus (2012) *Vegetation (Bristol Bay Drainages), Field Methods, Summary Statistics, Descriptions of Habitat Types, Digital Mapping, and Landscape Distribution*, Total Project Size: 250,000 acres, Southcentral Alaska Chapter 13 and related appendices in "The Environmental Baseline Document" Prepared for Pebble Partnership. <http://pebbleresearch.com/> Role: Co-Author

Rains, K.C. and T. Van Diest (2012) *Guide to common plants in northern Alaska: referencing Inupiaq and English names*. Prepared for native communities in Northern Alaska and funded by the Alaska Department of Transportation and Public Facilities, Northern Region.

Rains, M.C., K.C. Rains, W.J. Kleindl, S. Landry, T.L. Crisman, A. Brown, and L. van Maurik (2011) *Wetland inventory, functional classification, and regulatory code evaluation, St. Lucie County, Florida (440,320 acres)* Prepared for St. Lucie County, Fort Pierce, Florida.

Three Parameters Plus (2009) *Off-site functional assessment of wetlands in Interior Alaska*. Prepared for Donlin Creek LLC (Barrick Gold Corporation). Role: Co-Author

Rains, K.C. (2009) *Field guide to plants of the Donlin Gold Project*. (Western Alaska, 229 target species and potential look-alike species) Prepared for Barrick Gold Corp.

Rains, K.C. (2009) *Field guide to the plants of the Foothills West Transportation Access Project, North Slope*. (Northern Alaska, 148 target species and potential look-alike species) Prepared for the Alaska Department of Transportation and Public Facilities, Northern Region.

Rains, K.C. and L. Lewis (2008) *Field Guide to Plants of the Pebble Project*. (Southwestern Alaska, 270 target species and potential look-alike species) Prepared for Pebble Partnership, Anchorage, AK.

Rains, K.C. (2008) *Indices of Ecosystem Functions in Lacustrine Fringe Wetlands* In “Draft functional assessment guidebook to wetlands of Southcentral Alaska”. Prepared for Pebble Limited Partnership, Anchorage, AK.

MEMBERSHIPS AND CERTIFICATIONS

Memberships:

American Geophysical Union
Ecological Society of America
Society of Wetland Scientists
Soil Science Society of America
Florida Association of Environmental Soil Scientists
Florida Native Plant Society

Certifications

Professional Wetland Scientist No. 1958; Society of Wetland Scientists
Wilderness First Aid, CPR