KAI COSHOW RAINS

School of Geosciences, University of South Florida
4202 E Fowler Ave, NES 107, Tampa FL, 33620
Phone: 813.727.3671, Email: krains@usf.edu

EDUCATION

PhD	Ecology (Soil Nutrients & Mycorrhizal Ecology)	University of California, Davis
M.S.	Botany	University of Washington, Seattle
B.S.	Biochemistry/Biophysics	Oregon State University, Corvallis

PROFESSIONAL EXPERIENCE

2014 - present	Courtesy Research Associate Professor, School of Geosciences, University of South Florida, Tampa, Florida
2004 - present	Vice President, Coshow Environmental Inc., Temple Terrace, Florida
2005-2014	Senior Wetland Scientist/Botanist, Three Parameters Plus, Fairbanks, AK
2003-2005	Instructor/Academic Advisor, Dept. of Environmental Science & Policy, University of South Florida, Tampa, Florida

RESEARCH INTERESTS AND PEER REVIEWED PUBLICATIONS

The fundamental theme central to my research is plant adaptation to environmental stresses, such as inundation and soil toxicity, extending from the scale of the individual to the landscape. My experience encompasses more than two decades in academia and the private sector investigating plant-soil-water dynamics and landscape ecology, including soil nutrient dynamics, root growth, mycorrhizal associations, and analyses of wetland functions and resource.

Rains, K.C. and Bledsoe, C.S. In Preparation. Effects of changes in fertility and acidity on root growth and mycorrhizal colonization in a coniferous forest, California. *Soil Biology and Biochemistry.*

Rains, K.C. and Bledsoe, C.S. In Preparation. Differential nitrogen acquisition from ^{15}N enriched root and foliage litter by ecto- and ericoid mycorrhizal plants. *Journal of Ecology.*

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.

Rains, K.C. and C.S. Bledsoe (2007) Rapid uptake of ^{15}N-ammonium and glycine-^{13}C, ^{15}N by arbuscular and ericoid mycorrhizal plants native to a Northern California coastal pygmy forest. *Soil Biology and Biochemistry* 39:1078-1086.

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.

Coshow, K.A. (1992) Screening of *Arabidopsis thaliana* ecotypes for resistance to two agriculturally important fungal pathogens, *Leptosphaeria maculans* and *Plasmodiophora brassicae*. M.S. Thesis, *University of Washington*, Seattle, WA.

TEACHING

I teach a variety of courses at the intersection of hydrology, soil science, and botany. Recently I have taught wetland science and functional assessment, plant identification, and associated field methods.

Instructor –Professional Workshops, 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

Instructor- Development of Online Learning 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

Instructor, University of South Florida, Tampa, FL, 2003-2006
Mangrove Ecosystem Field Research Techniques (in Mexico) GLY4930/6739, 2 credits
Plant Taxonomy of Florida, EVR 4930/6930, 4 credits
Wetland Environments EVR 4027, 3 credits
Environmental Science & Policy Senior Seminar EVR 4921, 1 credit
Internship and Project Experience EVR 4640/4910, variable credits

Instructor, Community Colleges 1993-1995
Botany Costa Mesa Community College, California, (in Costa Rica), 3 credits
Environmental Science, Bellevue Community College, Washington, 3 credits
Biology & Lab, North Seattle Community College, Washington, 4 credits
Introductory Biology & Lab, North Seattle Community College, Washington, 4 credits

FUNDED PROPOSALS, PROJECTS, AND AWARDS

2014: Alaska Department of Transportation and Public Facilities. Southeastern Region, $3,450: *Development of a contractor plan to manage invasive species*. Role: Project Manager

2013-2014. Alaska Department of Transportation and Public Facilities. Southeastern Region, $25,000: *Options for invasive plant species control and disposal management.* Role: Project Manager

2012-2014. Alaska Electric Light & Power $119,624: *Rare/Sensitive and non-native plant surveys, Tongass National Forest.* Role: Project Manager

2009-2010. St Lucie County, Florida, $85,000: *Wetland Inventory and Evaluation for Enhancement of Regulatory Protocols* (440,320 acres). Role: Co-Principal Investigator

2003. UC Davis Graduate Group in Ecology Block Grant Full tuition waiver and graduate student stipend, 6 months: *Nitrogen acquisition in temperate forests: Do plants actively degrade and assimilate organic nitrogenous compounds?*

2003. UC Davis Graduate Group in Ecology Travel Award, $500: Travel to Ecological Society of America meeting to present results of scientific research. *Acquisition of nitrogen from decomposing plant residues by ectomycorrhizal bishop pine* (Pinus muricata) *and ericoid mycorrhizal evergreen huckleberry* (Vaccinium ovatum).

2002. UC Davis Jastro Shields Research Grant, $3000: *Competition at the source: Utilization of nitrogen in plant litter by foraging plant roots and mycorrhizas.*

2001-2002. UC Davis Graduate Group in Ecology Block Grant, Full tuition waiver and graduate student stipend, 13 months: *Ecological and physiological studies of the ericoid mycorrhiza.*

2000. UC Davis Jastro Shields Research Grant, $2000: *Patchy distribution of epiphytic mycorrhizas challenges fundamental assumption of the ecological role of mycorrhizas.*

1997-2001. National Science Foundation, $350,000: *Polyphenols as a Plant Adaptation to Acidic, Infertile Soil—A Positive Feedback?* Role: Research Assistant.

SELECTED PAPERS PRESENTED AT MEETINGS

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" Oral Presentation: 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). May 18-23, Portland, Oregon.

Rains, K.C. (2013) "Analysis of the response of wetland functional assessment indices to landscape-level perturbations" Oral Presentation: 3PPI Wetland Restoration Meetings; August 12-16, 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" Oral Presentation: Joint Conference of the Society of Wetland Scientists South Atlantic Chapter (SWS SAC), Florida Association of Environmental Soil Scientists (FAESS), and Southwest Chapter of the Florida Association of Environmental Professionals (SWFAEP). October 7-9, Tampa, FL.

Rains, K.C. (2012) "Vegetation structure and composition across 125,000 acres of the Bristol Bay Watershed" Oral Presentation: Government Agency Briefings and Webinar: Pebble Partnership Baseline Environmental Team Agency Meeting; January 31-February 3, Anchorage, Alaska.

Rains K.C. and C.S. Bledsoe (2003) "Acquisition of nitrogen from decomposing plant litter by ectomycorrhizal Bishop pine and ericoid mycorrhizal evergreen huckleberry and salal" Oral Presentation: Joint Meetings of The Ecological Society of America (ESA) and the International Society for Ecological Modeling (ISEM), August 3-8, Savannah, Georgia.

Rains K.C. and C.S. Bledsoe (2001) "Epiphytic and terrestrial mycorrhizas in four common plant families in a Costa Rican cloud forest" Poster Presentation: The International Union of Forest Research Organizations (IUFRO) Canopy Processes Working Group, Portland, Oregon.

Rains K.C. and C.S. Bledsoe (1999) "Fertilization and liming increase growth differentially for ericoid mycorrhizal hair roots and ectomycorrhizal fine roots of pygmy forest pines and shrubs" Oral Presentation: The Ecological Society of America 84th Annual Meeting, Spokane, Washington.

PUBLICATIONS: TECHNICAL REPORTS

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 Poject", 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) in "The environmental baseline document" Prepared for Pebble Partnership. **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.

Rains, M.C. M.M. Brinson, M. Clark, **K.A. Coshow**, J. Hall, G. Hollands, W.J. Kleindl, D. LaPlant, L. C. Lee, W. L. Nutter, R. Post, J. Powell, T. Rockwell, and D. Whigham (1997) *Draft guidebook for the application of hydrogeomorphic functional assessments in precipitation-driven wetlands in Interior Alaska.* Prepared for the State of Alaska Department of Environmental Conservation.

Lee, L.C., J.A. Mason, K.L. Fetherston, **K.A. Coshow**, M. Brinson, G. Hollands, W. Nutter, and D. Whigham (1996) *Draft regional guidebook to HGM functional assessments in riverine waters/wetlands and slope wetlands in Southeast Alaska.* Prepared for the State of Alaska Department of Environmental Conservation.

CERTIFICATIONS AND RECENT PROFESSIONAL TRAINING

Certified Professional Wetland Scientist (Current) No. 1958; Society of Wetland Scientists.

Wilderness First Aid (expiration 6/2017) Certification includes epinephrine administration, CPR, AED use. Instructed by the Wilderness Medical Associates International, June 1-2, 2014.

Wilderness Defense Firearms Training (Annual Training 2006-2014) Led by Ed Marsters, the range master firearms instructor for the State of Alaska Department of Public Safety Training Academy. Held in Anchorage, Alaska, 3 days per year.

Bear Behavior Training (Annual Training, 2006-2014) Led by Alaska Department of Fish and Game wildlife biologist, John Hechtel. Held in Anchorage, Alaska.

Applied Fluvial Geomorphology (2013) Dr. David Rosgen, Wildland Hydrology Consultants, Fort Collins, Colorado. Held in Anchorage, Alaska, 5 days.

Hydric Soils and Fall Grass Identification Workshop (2013) Society of Wetland Scientists and the Florida Association of Environmental Soil Scientists; Thonotosassa, Florida, 1 day.

Wetland Assessment Procedure (WAP) Training (2013, 2011, 2010) Southwest Florida Water Management District. New Port Richey, Florida, 2 days per year.

Basic Survey Skills (Hydrology) (2012) Wildland Hydrology Consultants; Anchorage, Alaska. 2 days

Sedge Identification Techniques (2012) Dr. Anton Resnicek, Curator, University of Michigan Herbarium. Held in Anchorage, Alaska, 3 days.

Wetland Functional Assessment: Applications to Large-Scale Mining in Alaska (2011) Invited Workshop Participant, Sedona, Arizona, 5 days.

Willow Identification Techniques. (2011) Dr. George Argus, Research Emeritus, Canada Museum of Nature, Ottawa. Held in Anchorage, Alaska, 3 days.

Advanced Hydric Soils (2010) Led by Joe Moore and Doug Van Patten of the USDA Natural Resources Conservation Service. Held in Anchorage, Alaska, 3 days.

REPRESENTATIVE PROJECTS

Wetland Science and Ecosystem Modeling

Wetland Delineation, Analysis, and Permitting–Three Parameters Plus, Alaska
Project manager, senior wetland scientist, botanist, geoanalyst, and database manager on large-scale (i.e., 10,000-350,000 acres) mapping projects for international mining companies and agencies throughout Alaska. Field work primarily was conducted in remote regions. Tasks included project management; development of field scientist training programs and quality control protocols; soil description and classification; plant identification; water resource functional assessment; photointerpretation, development, and analysis of wetland and vegetation GIS-based maps; statistical analyses of vegetation data and site characteristics; management and component design of a vegetation database including species composition and structure data collected from over 30,000 ecological plots; design and management of targeted plant surveys; development of vegetation management plans; and preparation of budgets, proposals, and reports.

Wetland Mapping and Analysis, St. Lucie County, Florida
Co-Principal investigator on a study that included evaluation of the distribution of functional classes of wetlands that lack adequate regulatory protection, identification and quantification of the ways that artificial drainage has changed hydrological, biogeochemical, and biological connectivity between geographically isolated wetlands and the near-shore estuarine environment, and analysis of this information to propose revisions to the St. Lucie County Comprehensive Code to ensure that critical functions performed by freshwater and estuarine wetlands are protected.

Wetland Conservation Planning and Prioritization, Tampa Bay Watershed, Florida
Project Team Member of a group responsible for development of GIS-based tools to enhance identification of freshwater wetland resources for conservation. The project included 1) a wetland change analysis designed to describe changes to both wetland area and functional class between the 1950s and 2007 and, 2) development of GIS-based screening layers to characterize hydrologic connectivity and wetland condition past, present, and projected. These tools enable stakeholder agencies to run customizable queries to facilitate development of a watershed master plan for freshwater wetland conservation.

National Wetland Plant List Review- Western Mountains, Valleys, and Coasts Region
One of three nationwide external reviewers supporting government efforts to update the National Wetland Plant List, which had not been updated in over 20 years, by reviewing wetland fidelity rankings of plants native to the Western Mountains, Valleys, and Coasts. The National Wetland Plant List is integral to wetland delineation and to the design of wetland restoration projects. The government agencies participating in this on-going effort are the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, and the U.S. Environmental Protection Agency.

Mangrove Productivity and Function in a Disturbance Zone, Manzanillo, Mexico
Co-Principal investigator studying the structure and function of mangrove wetlands and the roles they play in supporting communities in the Costa Alegre region, Mexico. The study was refined through a highly collaborative field-based workshop including university faculty and students from California, Nevada, and Florida. Components of the study addressed basic science questions as well as conservation and economic development; integrated multiple physical, chemical, and biological science disciplines; and incorporated research, education, and community service.

Wetland Ecosystem Functional Assessment Tools – Three Parameters Plus, Alaska
Project Team Member and Field Lead: Conducted field sampling and drafted documents for development of functional assessment models to rapidly assess wetland and stream functions in southwestern and southcentral Alaska for two international mining clients. The first model was applicable to wetlands in tundra of the Bristol Bay watershed and the second was applicable to wetlands in the forested tributaries of the Kuskokwim river.

Hydrogeomorphic Approach to Functional Assessments Model for the State of Alaska
Project Team Member (Ecologist/Botanist): Conducted field work and analyses to construct functional assessment models sensitive to changes in wetland function. Two models were developed. The first is applicable to precipitation-driven wetlands on discontinuous permafrost in Interior Alaska, and the second is applicable to riverine waters/wetlands and slope wetlands in Southeast Alaska.

Plant Taxonomy and Management

Plant Identification Guidebooks- Alaska
Author of five plant identification manuals developed in conjunction with large wetland mapping projects in Alaska. Four were designed for use by environmental consultants and included characteristic plants as well as high probability rare species and non-native species (up to 270species). The fifth was developed for Inupiaq communities in Northern Alaska and focused on identification of species of ethnobotanical importance to those native communities.

Invasive Plant Species Management Plans- Alaska Project manager and lead author of an extensive manual for control and disposal of invasive plant species along highways and airstrips in Southeast Alaska. This manual currently is the primary reference for construction and maintenance projects funded by the Alaska Department of Transportation, Southeastern Region. Additional related projects include development of draft plans for management of invasive species established along remote airstrips and accessory roads in interior and in northern Alaska (Clients: Barrick Gold Corporation and the Alaska Department of Transportation and Public Facilities).

Plant Surveys: Rare and Non-Native Species
Designed and/or conducted field surveys for rare and/or non-native plants in conjunction with grazing permits (Oregon); timber sales and land exchanges (Washington State); mining permits, hydroelectric license renewals, and transportation projects (Alaska). Primary roles have included: Project Manager, Field Manager, Botanist.

Instruction of Plant Identification
Faculty Instructor: Developed and taught plant taxonomy lectures and labs at the University of South Florida. Topics included: plant phylogeny, dichotomous keys, and diagnostic characteristics of select plant families, genera, and species. *Graduate Teaching Assistant:* Plant collection and instruction of plant taxonomy labs at the University of Washington, Seattle and at the University of California, Davis. *Extended Learning:* Instruction of Botany to college exchange students in Costa Rica, and ecological interpretation for ecotourism in the Peruvian Amazon. Mentor and field lead for junior professional scientists in Alaska learning to identify plants using regional dichotomous keys and dissecting microscopes.

Vegetation Assessment – Ecology Studies and Environmental Permitting
Ecologist: Established vegetation plots and surveyed plant species in conjunction with development of plant association handbooks (USDA-United States Forest Service, Washington State) and with a study of riparian forest dynamics (Washington and British Columbia). *Senior Scientist:* Designed database queries to assist with calculation and analyses of summary statistics of vegetation data across large-scale wetland and habitat mapping projects in Alaska.

Soil Science

Plant-Soil-Fungi Research, University of California, Davis
Graduate research assistant on a study funded by the National Science Foundation focused on (a) evaluating the role of organic nitrogen in nutrient-poor environments by investigating plant acquisition of N from root litter, foliar and root litter, and amino acids and (b) quantifying the effects of soil property manipulations (pH and nutrients levels) on root growth and mycorrhizal colonization in a soil chronosequence in Central California. Research appointment location was the Soils Department, Land Air Water Resources, University of California, Davis.

Soil Descriptions and Classification- Three Parameters Plus, Alaska
Described and classified upland and wetland soils in hundreds of soil pits in Alaska using techniques consistent with the Key to Soil Taxonomy (USDA-Natural Resources Conservation Service). Soils were described in a variety of topographic settings across hundreds of thousands of acres. The descriptions and classifications were incorporated into landscape maps, environmental reports, wetland functional assessments, and/or wetland restoration planning.