Bailey D. Morrison
Department of Environmental Engineering
University of California Merced, Merced, CA USA
bmorrison3@ucmerced.edu 707 318 5350
ORCiD 0000-0001-5824-8605

PROFESSIONAL PREPARATION

University of California Davis	Environmental Science and Management	B.S.	2014
University of Illinois at Urbana-Champaign	Ecology, Evolution, and Conservation Biology	Ph.D.	2018

APPOINTMENTS

2021-   Postdoctoral Scholar, Department of Environmental Engineering, University of California Merced, USA

2018-2021   Postdoctoral Research Associate, Environmental Climate and Sciences Department, Brookhaven National Lab, USA

PEER REVIEWED PUBLICATIONS

5. Dokoohaki, H., **Morrison, B.D.**, Raiho, A., Serbin, S., Dietze, M. (2021). A novel model-data fusion approach to terrestrial carbon cycle reanalysis across the contiguous U.S. using SIPNET and PEcAn state data assimilation system v. 1.7.2. *Geoscientific Model Development Discussions*.

4. Yang, D., **Morrison, B.D**., Hantson, W., Breen, A.L., McMahon, A., Li, Q., Salmon, V.G., Hayes, D.J., Serbin, S.P. (2021). Landscape-scale characterization of Arctic tundra vegetation composition, structure, and function with a multi-sensor unoccupied aerial system. *Environmental Research Letters* 16(8): 085005.

3. Burnett, A.C., Anderson J., Davidson K.J., Ely, K.S., Lamour, J., Li, Q., **Morrison, B.D.**, Yang, D., Rogers, A., Serbin, S.P. (2021). A best-practice guide to predicting plant traits from leaf-level hyperspectral data using partial least squares regression. *Journal of Experimental Botany*.

2. Yang, D, Meng R., **Morrison, B.D.**, McMahon, A., Hantson, W., Hayes, D.J., Breen A.L., Salmon, V.G., Serbin, S.P. (2020). A Multi-Sensor Unoccupied Aerial System Improves Characterization of Vegetation Composition and Canopy Properties in the Arctic Tundra. *Remote Sensing* 12(16), 2638.

1. **Morrison, B. D.**, Heath, K., & Greenberg, J. A. (2019). Spatial scale affects novel and disappeared climate change projections in Alaska. *Ecology and Evolution*, 9(21), 12026-12044.

PUBLISHED DATASETS

2. Serbin, S.P., Meng, R., Wu, J., **Morrison, B.D.**, Ely, K.S. (2021). "G-LiHT Campaign Leaf Carbon and Nitrogen Content, Mar2017: Puerto Rico". Next-Generation Ecosystem Experiments Tropics; Brookhaven National Lab.

1. **Morrison, B.D.**, Greenberg, J.A. (2019). Climate Normals for Last Glacial Maximum and Modern (1975-2005), Alaska. ORNL DAAC, Oak Ridge, Tennessee, USA. (2019).

MANUSCRIPTS IN REVIEW & PREPARATION

7. Yang, D., **Morrison, B.D.**, Hanston, W., McMahon, A., Baskaran, L., Hayes, D.J., Miller, C.E., Serbin, S.P. "Integrating Very-High-Resolution UAS and Hyperspectral Airborne Data to Map the Fractional Composition of Arctic Plant Functional Types in Western Alaska". Remote Sensing of Environment. In Review.

6. Yang, D., **Morrison, B.D.**, Davidson, K.J., Lamour, J., Li, Q., Nelson, P.R., Hanston, W., Hayes, D.J., Swetnam, T.L., McMahon, A., Anderson, J., Ely, K.S., Rogers, A., Serbin, S.P. "Remote Sensing from Unoccupied Aerial System: Opportunities to Enhance Arctic Plant Ecology in the Era of Climate Change". Journal of Ecology, Grime Reviews. In Review.

5. Yang. D, **Morrison, B.D.**, Nawrocki, T., Breen, A., Serbin, S. "Empirical evidence for divergent environmental limiting of Salix and Alnus shrub". In Prep.

4. Yang, D., Erb, A., **Morrison, B.D.**, Elmes, A., Levy, C., Schaaf, C., Serbin, S. "Vegetation composition drives spatial and temporal variation in surface albedo". In Prep.

3. **Morrison, B.D.**, Dokoohaki, H., Dietze, M., Serbin, S. "A novel state data assimilation system for estimating carbon budget reanalysis products with reduced uncertainty". In Prep.

2. **Morrison, B.D.**, Fraterrigo, J., Punyasena, S., Greenberg, J.A. "California forest community migration responses to 21st century climate change". In Prep.

1. **Morrison, B.D.**, Fraterrigo, J., Greenberg, J.A. "Climate velocity is a measure of climate displacement, not species migration". *Global Ecology and Biogeography*, In Review.

CONFERENCE ABSTRACTS

11. Dietze, M., Zhang, D., Andrews, A., Dokoohaki, H., Helgeson, A., Kennedy, R.E., Li, Q., **Morrison, B.D.**, Serbin, S.P. (2021). "Continental bottom-up data assimilation to support terrestrial carbon cycle and disturbance Monitoring, Reporting, Verification, and Forecasting". AGU Fall Meeting. Poster.

10. Yang, D., **Morrison, B.D.**, Serbin, S.P. (2021). "Integrating Field Observations and Multi-scale Remote Sensing to Understand Tall Shrub Distribution and Environmental Limits in Arctic Tundra". AGU Fall Meeting 2021. Presentation.

9. Dietze, M., Serbin, S.P., Dokoohaki, H., **Morrison, B.D.**, Zarada, K. (2020). "Assimilating disturbance: Toward real-time carbon monitoring and forecasting". AGU Fall Meeting Abstracts. Poster.

8. Dokoohaki, H., Raiho, A., **Morrison, B.D.**, Serbin, S.P., Dietze, M. (2020). "Application of a Generalized Ensemble Filter for Estimating Terrestrial Carbon Budgets across the Contiguous United States". 100th American Meteorological Society Annual Meeting. Presentation.

7. Dokoohaki, H., **Morrison, B.D.**, Serbin, S.P., Dietze, M. (2019). "A model-data fusion approach to estimating terrestrial carbon budgets across the contiguous US". AGU Fall Meeting Abstracts. Poster.

6. **Morrison, B.D.**, de Lafontaine, G., Napier, J. (2019). "Multiple LGM Alnus micro-refugia suggest resilience to climate change in Arctic vegetation". AGU Fall Meeting Abstracts.

e-Lightening Poster.

5. Reed, C.C., Greenberg, J.A., Sullivan, B.W., Parra, A.S., Smith, W.K., **Morrison, B.D.** (2018). "Modeling soil carbon losses following anthropogenic disturbance in Sierra Nevada meadows using field measurements, remote sensing products, and downscaled climate data". AGU Fall Meeting Abstracts. Presentation.

4. **Morrison, B.D.**, Napier, J., de Lafontaine, G., Heath, K., Li, B., Hu, F.S., Greenberg, J.A. (2017). "The species velocity of trees in Alaska". AGU Fall Meeting Abstracts. Presentation.

3. Greenberg, J.A., Xu, Q., **Morrison, B.D.**, Xu, Z., Man, A., Fredrickson, M.M., Ramirez, C., Li, B. (2016). "Towards a portable, scalable, open source model of tree cover derived from Landsat spectra". AGU Fall Meeting Abstracts. Presentation.

2. **Morrison, B.D.**, Napier, J., de Lafontaine, G., Heath, K., Li, B., Hug, B., Hu, F.S., Greenberg, J.A. (2016). "How spatial scale influences novel and disappeared climate predictions in Alaska". AGU Fall Meeting Abstracts. Presentation.

1. **Morrison, B.D.**, Napier, J., Kelly, R., Li, B., Heath, K., Hug, B., Hu, F.S., Greenberg, J.A. (2015). "The Post-Glacial Species Velocity of Picea glauca following the Last Glacial Maximum in Alaska". AGU Fall Meeting Abstracts. Poster.

RESEARCH EXPERIENCE

CA DELTA WATER PRIMROSE   **2021-Present**
University of California, Merced
- Develop and plan field campaign sampling strategies to collect data to understand and model trajectories of water primrose marsh invasions in the California Delta.
    o Includes drone imagery, plant sampling, and eDNA collection.
- Supervise a junior specialist lab employee
- Develop and prepare manuscripts of CA Delta Marsh biodiversity resistance to water primrose invasion and trajectories of potential future marshes vulnerable to water primrose invasion.

DOE ARM AMF3   **2020-2021**
Brookhaven National Laboratory
- Derive evaporative demand products from PRISM downscaled climate for CONUS.
- Perform cluster analysis to identify unique environmental spaces (climate and remotely sensed vegetation products) throughout the South Eastern United States (SEUS).
- Conduct an Environmental Limiting Factor (ELF) analysis to model and investigate the climatic factors limiting biomass growth in SEUS.
- Identify potential locations to deploy the Department of Energy's AMF3 (Third ARM Mobile Facility) based on cluster and ELF analyses.

NGEE Arctic   **2019-Present**
Brookhaven National Laboratory
- Mentoring a TEST group PhD student in data analysis, writing and publishing processes.
- Assist in developing/implementing statistical analyses and data processing procedures to investigate Arctic Tundra shrub community distributions, functions, and structure using

data collected from the Osprey UAS platform (See publication #1, and manuscripts in prep #6-9).

DARPA   **2019**

Brookhaven National laboratory

- Assisted poplar (*Populus tremula*) mesocosm experiment to investigate if remote sensing technologies are capable of detecting underground tunnel systems. Duties included:
    - o Leaf harvest/sampling, LI-COR photosynthetic gas exchange measurements, PSR+ spectroscopy measurements, leaf temperature, LPI, leaf water potential, biomass, and cryo-sampled leaf biochemistry.

NASA CMS State Data Assimilation   **2018-Present**

Brookhaven National Laboratory

- Investigate sources of uncertainty in carbon cycle models using the PEcAn (The Predictive Ecosystem Analyzer) (www.pecanproject.org) model-data informatics system to improve monitoring, reporting, and verification of carbon pools and fluxes. Duties include:
    - o Coordinate with the NASA CMS team to include a wider range of airborne lidar, satellite lidar, hyperspatial forest cover, disturbance products, etc., and data from new sensors (e.g. GEDI, ICESat-2) in PEcAn SDA system.
    - o Address spatio-temporal limitations of the PEcAn framework that are not addressed through uncertainty analysis.
    - o Improve, adjust, and produce code to account for more complex observed data scenarios for SDA system (i.e. multi-site sampling, multi-variable assimilation, multi-temporal scale assimilation, dual variable assimilation (AVHRR and MODIS LAI observations), ingestion asymmetric/incomplete datasets).
    - o Present research at conferences and publish results in peer-reviewed journal (See manuscripts in prep #3-4, non-reviewed presentations/posters #2).

3D Change Detection of Aboveground Biomass   **2018**

University of Nevada, Reno

- Assisted in setting up 30x30 m pre-scan plots for 3D scans of a variety of different disturbance regimes in collaboration with the US Forest Service throughout the Sierra Nevada's, CA.
- Scanned forest plots across Plumas National Forest using a Terrestrial Laser Scanner (TLS, Riegl VZ-400i) for a first summer season campaign to help decrease uncertainties in estimating changes in forest biomass and provide information on disturbance risk and successional dynamics impacting long-term ecosystem processes.

NASA Earth and Space Science Fellowship   **2015-2018**

University of Illinois at Urbana-Champaign

- For my proposal entitled "The velocity of tree cover in California", I created two downscaled climate datasets for the entire state of California (Tmin, Tmax, Tave, Total Precipitation, Rain, Snow, Potential Evapotranspiration, Actual Evapotranspiration, Water Deficit, and Total Surface Radiation)

- o Monthly, 30-meter resolution climate from 1982-2019 to compliment the NASA Landsat Archives spatio-temporal resolution.
  - o Monthly, 30-meter resolution climate data as 30 year climate normals for the modern era (1985-2015) and future era RCP 8.5 2070-2100) to be used for anthropogenic climate change investigations.
- ● Data from dataset 2 was used to model the bioclimatic niche velocity of 72 native California tree species and identify if species of forest communities will migrate together, or independent of one another in response to climate change. Conclusions suggest that California forest communities will not migrate together, and future conservation efforts should consider management strategies outside of traditional community ecology theory (See manuscripts in prep #5).

Alaskan Species Refugia and Population Dynamics

University of Illinois at Urbana-Champaign   **2014-2018**
- ● Statistically downscaled 100km modeled climate data to 60m resolution in Alaska for the LGM and modern era (1975-2005) using CMIP/PMIP modeled climate data to determine how choice in climate grid resolution affects the distribution of novel and disappeared climates. Conclusions suggest that coarser climate data estimates larger fractional areas of novel and disappeared climates (see publication #2).
- ● Modeled the distribution of white spruce populations and derived the bioclimatic niche velocity to estimate the rate and direction white spruce migrated to help understand how species may respond to past, present, and future climate change in arctic regions. I then compared the white spruce bioclimatic velocity estimates to climate velocities estimates to determine if climate velocity is a suitable predictor of species responses to climate change. Conclusions suggest that climate velocity is a very poor predictor of species migration responses to climate and should not be used to continue predicting plant-climate interactions alone (See manuscript in review #1).

TEACHING EXPERIENCE
- ● *Spatial Analysis and Modeling* (ENGR-180, 4 credits with lab). Developed Spatial Models and Modeling Lecture/Lab, Guest Lecturer, University of California, Merced.
- ● *Principles of Pedagogy II*, Teaching Certificate,University of California, Merced.
- ● *Spatial Analysis and Modeling* (ENGR-180, 4 credits with lab). Guest Lecturer, University of California, Merced.
- ● *Mobile Institute on Scientific Teaching*, Scientific Teaching Fellow, University of California, Merced.
- ● Climate Change and Plant Distributions: Using models to understand how plants respond to climate change. NSF Climate Change and Ecology Teaching Workshop, Developed. Instructor, University of Illinois at Urbana-Champaign.
- ● *Organismal & Evolutionary Biology* (IB150, 4 credits with discussion). Teaching Assistant, University of Illinois at Urbana Champaign.

OUTREACH
- ● UC Davis EPAP/ESM Mentor Program, Mentor, University of California, Davis.
- ● Ag-Food-Tech Internship (FACTS), Mentor, University of California, Merced.

- Girl Scouts of America, Invited Panel Speaker, Brookhaven National Laboratory.
- "Why it's important to code", Invited Speaker for Girls Inc., Brookhaven National Laboratory.
- CyberForce Cyber Security Competition, Staff Volunteer, Brookhaven National Laboratory.
- DOE National High School Science Bowl, Science Judge, Brookhaven National Laboratory
- UC Davis Aggie EnvironMentor Program, Mentor.University of California, Davis.

HONORS & AWARDS

2020	Department of Energy S2 Work Safety Grant, $1,000
2015-2018	NASA Earth and Space Science Fellowship, $105,000
2014	UC Davis Departmental Citation (Env. Sci. and Management)
2014	UC Davis Departmental Citation (Env. Sci. and Policy)
2014	Graduate *cum laude*
2013	Luther and Marie Davis Scholarship, $2,000
2012-2013	Dean's List, Agriculture and Environmental sciences
2012	Jarena D. Wright Scholarship , $500
2012	UC Davis Entering Undergraduate Scholarship, $2,615

PROFESSIONAL ACTIVITIES

Reviewer, Ecological Processes	2021-
Reviewer, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing	2020-
Reviewer, Remote Sensing of the Environment	2020-
Member, NASA Arctic Boreal Vulnerability Experiment (ABOVE) Team	2019-
Member, NASA Carbon Monitoring Systems (CMS) Biomass Working Group	2019-2021
Member, NASA Carbon Monitoring Systems (CMS) Uncertainties Working Group	2019-2021
Member, Brookhaven Women in Science	2019-2021
Reviewer, Ecology and Evolution	2019-
Member, NASA Ecological Forecasting and Biodiversity Team	2015-2018
Member, American Geophysical Union	2015-2018, 2020
Convener, Chair, American Geophysical Union Fall Meeting. Remote Sensing to Support Investigations in Plant-Climate Interactions	2015, 2017-2020

COMPUTER SKILLS

Remote Sensing

ArcGIS	ArcGIS Pro	ENVI	GDAL
GRASS GIS	LAStools	NCDF	OpenDroneMaps
QGIS	Trimble Pathfinder	TauDEM	

Mathematical/Data Analysis/Database Software

Microsoft Access	Microsoft Excel	MySQL	PEcAn
PostGIS/PostgreSQL	SIPNET	SQLite	

<u>Programming Languages/Scripting Languages</u>

Bash/Shell scripting	IDL	MATLAB	Python/Anaconda
R			

<u>Parallel Computing</u>

GNU Parallel	OpenMPI	slurm	snow
TORQUE (OpenBPS)			

<u>Operating Systems</u>

	*NIX	Windows	
MacOS 7-10	(Debian, Ubuntu,	(95/98/2000/XP/Vista/7	
	Redhat, Centos)	-11)	

<u>Miscellaneous</u>

Singularity	Docker	GitHub	BitBucket