Allison Goodwell

Visiting Research Scientist, Prairie Research Institute goodwel2@illinois.edu
University of Illinois at Urbana-Champaign

EDUCATION

Ph.D. Civil Engineering, University of Illinois	GPA 4.0/4.0	2017
M.S. Civil Engineering, University of Illinois	GPA 4.0/4.0	2013
B.S. Civil Engineering, Purdue University, IN	GPA 3.9/4.0	2010

HONORS, AWARDS, AND FELLOWSHIPS

NASA New Investigator Program Award (NIP)	2021
Lorenz G. Straub Award for Best Dissertation, St. Anthony Falls Laboratory	2017 (award 2019)
Creative Research Collaborative (CRC) Fellow, CU Denver	2018
University Council on Water Resources (UCOWR) Dissertation Honorable Mention	2018
NASA Earth and Space Science Fellow	2015-2017
Illinois CEE PhD Professional Development Certificate	2016
NSF Graduate Research Fellowship Honorable Mention	2012, 2013
SURGE Fellowship, University of Illinois at Urbana-Champaign	2012-2016
Carver Fellowship, University of Illinois at Urbana-Champaign	2011
Outstanding Civil Engineering Senior Award, Purdue University	2010

EXTERNALLY FUNDED PROJECTS

(PI) NASA New Investigator Program (NIP): Leveraging information theory and flux tower footprints towards improved satellite-based evapotranspiration estimates, 2021-2024
Description: The goal of this project is to improve the way we validate high resolution satellite-based evapotranspiration (ET) data products based on eddy covariance flux tower data.

(Co-PI) Network Cluster CINet: Critical Interface Network in Intensively Managed Landscapes
NSF EAR # 2012850, 2021-2025
Description: The objective of this multi-disciplinary and multi-institutional project is to better understand critical interfaces, which are important interfaces that regulate material fluxes, storage, and transformations in an intensively managed critical zone. Within the large scope, my focus is on the near-surface and modeling themes, where we study land-atmosphere fluxes and near-surface processes and evaluate ecohydrological model behaviors.
Co-PIs and senior collaborators: Kumar, P., Anders, A., Stumpf, A., Rhoads, B., Druhan, J., Blair, N., Filley, T., Dere, A., Fisher, S., Welp. L, Schaeffer, S.
News release: https://ucdengineeringnews.com/2021/03/10/goodwells-nsf-funded-research-studies-the-critical-interfaces-for-material-transport-in-the-environment/

National Great Rivers Research Corsortium (NGRREC)-funded summer undergraduate internships
Description: This funding supported 2 full-time undergraduate researchers for 10-week internships. Interns work with me on projects related to CINet and have opportunities to travel to sites in the agricultural Midwest for field work.

Creative Research Collaborative (CRC, CU Denver) internal grant: Food-water-energy nexus (2018)

Center for Faculty Development (CFD) Young Upwardly Mobile Professors grant, CU Denver (2020)

CU Denver Teaching Enhancement Grant: Enhancing computing education in undergraduate engineering with Jupyter Notebooks (2021-2022)

CU Denver-seeded Grand Challenge Project: Infrastructure Informatics (2022)

PROFESSIONAL APPOINTMENTS

Visiting Research Scientist, Prairie Research Institute 2023-current

Assistant Tenure-track Professor, University of Colorado, Denver 2018-2023

Postdoctoral Researcher, University of Illinois 2017
Intensively Managed Landscape Critical Zone Observatory (IML-CZO) project

Graduate Research Assistant, University of Illinois 2011-2017
Resilience under Accelerated Change (REACH), Minnesota River Basin project
Intensively Managed Landscape Critical Zone Observatory (IML-CZO) project
Dissertation: Temporal Information Partitioning Networks to infer ecohydrologic behaviors
Masters Thesis: Assessment of floodplain vulnerability during extreme Mississippi River Flood 2011

Summer Undergraduate Research Fellowship, Purdue University 2010
Topic: Analysis of coastal upwelling events in southern Lake Michigan

TEACHING

Part-time Lecturer, University of Louisville 2023-current
ENVS 219: Weather and Climate Lab

Assistant Tenure-Track Professor, CU Denver 2018-2023
CVEN 2200/3200: Computational Methods for Civil Engineers
CVEN 5407: Complex Systems Methods
CVEN 5464: Sustainability and Climate Change

Online Skills Mastery (OSM) Certificate, CU Online 2020
8-week course on online teaching methods

Distinguished Teaching Assistant 2014-2015
CEE 202: Risk and Uncertainty for Civil Engineers
Graduate Teacher Certificate, Center for Innovation in Teaching 2016

Graduate Mentor for Research Experience for Undergraduates (REU) 2013-2014
Purdue Women in Engineering Program (WIEP) tutor 2008-2010

STUDENT ADVISING (University of Colorado, Denver)

<u>*PhD students*</u>
Mozhgan Askarzadeh Farahani 2019-2023
Thesis topic: How ecohydrological models use or misuse available information

<u>*Masters Thesis students (MS degree)*</u>
Mushfika Zahan 2020-2024 (exp.)
Thesis Title: *Disentangling the effect of landcover heterogeneity on land-atmosphere fluxes in an intensively managed landscape*

Nicholas Campbell 2019-2020
Thesis Title: *Characterizing complex networks of salmon migration through a reservoir network*

Stephanie Vasteno 2019-2020
Thesis Title: *An information-theory approach to comparing evapotranspiration models*

Samuel Franzen 2018-2019
Thesis Title: *Detecting shifts in temporal dependencies between rainfall and streamflow using information theory: a Colorado Headwaters case study*

Masters Report students (MS and MEng degrees)
Amanda Salzman
Report title: *Ozone dynamics and strategies in the Colorado Front Range* 2022-2023 (exp)

Nicole Scardigno
Report title: *An analysis of green roof water requirements in Denver, Colorado* 2022-2023 (exp)

Eric Mathers 2021-2023 (exp)
Report title: *Front Range water resources: a streamflow and water use analysis*

Eric Thomas 2018-2020
Report title: *Changing interactions between streamflow, precipitation, and population within a Denver Watershed*

Nicholas Petersen 2020-2021
Report title: *Sensitivity analysis of a 2D flux footprint model*

Allyssa Brewer 2018-2019
Report title: *Drivers of water quality in the Upper Sangamon River Basin*

Undergraduate Researchers

Sydney Curts:	*Landcover-specific fluxes based on ECOSTRESS*	2021
Ritzwi Chapagain:	*Data visualization for precipitation variability across U.S.*	2021
Magdalena Francois:	*Inside and Outside the Flux Footprint*	2022

PhD and Masters Thesis Committees:

Maya Woods, MS thesis student, advised by David Mays	2021
Fred Sturgell, MS report student, advised by David Mays	2021
Louis Benson, MS thesis student, advised by David Mays	2021
Mahdi Ghafoori, PhD candidate, advised by Moatassem Abdallah	2020-current
Ed Autterson, MS report student, advised by Jim Guo	2020
Evan Croft, MS report student, advised by Jim Guo	2020
Ryan Tigera, MS thesis student, advised by David Mays	2020
Michelle Swenson, MS thesis student, advised by Arun Karuninithi	2020
James Lindsay, MS thesis student, advised by Jim Guo	2020
Umang Khatiwada, MS report student, advised by Arun Karuninithi	2019

SERVICE

CU Denver College of Engineering, Computing and Design (CEDC)
- Computing Committee 2020-2022

American Geophysical Union (AGU) Hydrology Section
- Judge for OSPA (Outstanding Student Presentation Award) 2020
- Technical Committee on Hydrologic Uncertainty, member 2017-2019
- Hydrology Section Student Subcommittee (H3S), member 2016-2017

CEE Graduate Student Advisory Council (GSAC), University of Illinois 2013-2015

UIUC International Water Resources Association (IWRA)
- President of Student Chapter 2012-13
- Newsletter and Social Chair 2013-2015

Purdue Society of Women Engineers (SWE)
- Executive Board Member 2007-2010

CONFERENCES AND MEETINGS

Organizer for Summer School in Information Theory in Earth Sciences (SITES)
- Santander, Spain 2019
- Virtual meeting 2020

American Geophysical Union
- Frontiers in Hydrology Meeting (FIHM) session convener
  - Hydrocomplexity session 2022
- AGU Fall Meeting session convener
  - H51: *Critical Interfaces in the Critical Zone* 2021
  - H053. *Better Informed than Uncertain: Applications of Information Theory in the Earth Sciences* 2018

PUBLICATIONS

*Since 2014, see Google Scholar for complete list of publications and presentations

Kumar, P, Anders, A., Bauer, E., Cain, M., Dere, A., Druhan, J., Filley, T., Giannopoulos, C., **Goodwell, A.,** Grimley, D., Karwan, D., Keefer, L, Kim, J., Marini, L., Muste, M., Papanicolaou, T., Rhoads, B., Hernandez Rodriguez, L, Roque-Malo, S., Schaeffer, S., Stumpf, A., Ward, A., Welp, L., Wilson, C., Yan, Q, Zhou, S. (2023) *Emergent Role of Critical Interfaces in the Dynamics of Intensively Managed Landscapes*. Earth-Science Reviews, Vol. 244, DOI 10.1016/j.earscirev.2023.104543

Hernandez Rodriguez, L.C., **Goodwell, A**., and Kumar, P. (2023) *Inside the flux footprint: the role of organized landcover heterogeneity on the dynamics of observed land-atmosphere exchange fluxes*. Frontiers in Water, DOI 10.3389/frwa.2023.1033973

Goodwell, A. and Bassiouni, M (2022) *Source dependency and model structure determine information flow paths in ecohydrologic models*, Water Resources Research, DOI 10.1029/2021WR031164

Farahani, M., Vahid, A., **Goodwell A**. (2022) *Evaluating ecohydrological model sensitivity to input variability with an information theory-based approach*, Entropy, DOI 10.3390/e24070994

Goodwell, A. and Campbell, N. (2022) *Characterizing complex networks of salmon migration through a reservoir network*, PLoS ONE, DOI 10.1371/journal.pone.0269193

Goodwell, A. and Chapagain, R. (2021) *Chains of spatial and temporal precipitation occurrence predictability across the continental U.S.* Frontiers in Climate, Volume 3, DOI 10.3389/fclim.2021.780879

Goodwell, A. (2020) "*It's raining bits": Patterns in directional precipitation persistence across the U.S.* Journal of Hydrometeorology, Volume 21, Issue 12, pp 2907–2921, DOI 10.1175/JHM-D-20-0134.1

Franzen, S., Farahani, M., **Goodwell, A.** (2020) *Information flows: Characterizing precipitation-streamflow dependencies in the Colorado Headwaters with an information theory approach.* WRR, Volume 56, Issue 10, DOI 10.1029/2019WR026133

Goodwell, A., Jiang, P., Ruddell, B., Kumar, P. (2020) *Debates - Does Information Theory provide a new paradigm for Earth science? Identifying causality, interaction, and feedback. WRR, Volume 56, DOI:* 10.1029/2019WR024940

Goodwell, A., Kumar, P. (2019) *A changing climatology of rainfall persistence using information-based measures*. Journal of Hydrometeorology, DOI: 10.1175/JHM-D-19-0013.1

Wilson, C., …, **Goodwell, A.,** et al (2018) *The Intensively Managed Landscape Critical Zone Observatory: A scientific testbed for understanding critical zone processes in agroecosystems.* Vadose Zone Journal, DOI: 10.2136/vzj2018.04.0088

Goodwell, A., Kumar, P., Fellows, A., Flerchinger, G. (2018) *Process connectivity explains ecohydrologic responses to rainfall pulses and drought.* PNAS, 201800236, DOI: 10.1073/pnas.1800236115

Goodwell, A., Kumar, P. (2017) *Temporal Information Partition Networks (TIPNets): A process network approach to infer ecohydrologic shifts*. WRR, Volume 53, pp. 5899-5919, DOI: 10.1002/2016WR020218

Goodwell, A., Kumar, P. (2017) *Temporal Information Partitioning: Characterizing synergy, redundancy, and uniqueness in interacting environmental variables*. WRR, Volume 53, pp. 5920-5942, DOI: 10.1002/2016WR020216

Dutta, D., Wang, K., Lee, E., **Goodwell, A.**, Wagner, D., and Kumar, P. (2016) *Characterizing Vegetation Canopy Structure using Airborne Remote Sensing Data*, IEEE Trans. in Geoscience and Remote Sensing, Issue 99, Nov. 2016, DOI: 10.1109/TGRS.2016.2620478

William, R., **Goodwell, A.**, Richardson, M., Le, P., Stillwell, A., Kumar, P. (2016) *An environmental cost-benefit analysis of alternative green roofing strategies.* Ecological Engineering, Volume 95, pp. 1–9, 2016, DOI: 10.1016/j.ecoleng.2016.06.091

Goodwell, A., Kumar, P. (2015) *Information theoretic measures to infer feedback dynamics in coupled logistic networks.* Entropy, Volume 17, pp. 7468-7492, DOI: 10.3390/e17117468

Plale, B., Kouper, I., Suriarchchi, I., **Goodwell, A.** (2015) *Thread of Trust: Big Data and Science.* Book chapter in Big Data is Not a Monolith, edited by Cassidy R. Sugimoto, Hamid R. Ekbia, and Michael Mattioli. The MIT Press, Cambridge Massachusetts

Dutta, D., **Goodwell, A.**, Greenberg, J., Kumar, P., Garvey, J., Darmody, R., Berretta, D. (2014) *On the feasibility of characterizing soil properties from AVIRIS spectrometer data* (2015) IEEE Transactions on Geoscience and Remote Sensing, Volume 53, Issue 9, 10.1109/TGRS.2015.2417547

PRESENTATIONS

*selected, since 2020, underlined names are CU Denver undergraduate students, postdocs, or graduate students

Goodwell, A, Zahan, M., URycki, D. (2023) Information flows from landscape and meteorological drivers to land-atmosphere fluxes in intensively managed landscapes. American Geophysical Union (AGU) Fall Meeting, San Francisco, December 2023

Goodwell, A, Bassiouni, M. (2023) Source dependencies and model structures impact information pathways in ecohydrologic models. Poster presentation, American Meteorological Society (AMS) Annual Meeting, Denver, January 2023

Farahani, M.A., **Goodwell, A.** (2023) Information flow paths determine causal mechanisms of vertical carbon fluxes in models and data. Oral presentation, American Meteorological Society (AMS) Annual Meeting, Denver, January 2023

URycki, D.R., **Goodwell, A.,** Anderson, M.A., Yang, Y., Xue, J. (2022). Information Theory and Flux Footprints to Characterize Drivers of Daily Satellite-Based and Flux Tower Evapotranspiration. Poster presentation, AGU Fall Meeting. Chicago, IL. 12-16 Dec.

Goodwell, A., URycki, D., Farahani, M., Zahan, M. (2022) Causal attribution of landscape versus meteorological drivers of eddy covariance fluxes. Poster presentation, AGU Fall Meeting 2022, online.

Goodwell, A., Bassiouni, M. (2021) Source dependencies and model structures impact information pathways in ecohydrologic models. Oral presentation, AGU Fall Meeting 2021, New Orleans, Session H51C

Zahan, M., **Goodwell, A.** (2021) Evaluating the effect of flux footprint on flux magnitudes in an agricultural landscape. Oral presentation, AGU Fall Meeting 2021, New Orleans

Goodwell, A. (2020) It's raining more bits: Patterns in directional precipitation persistence across the U.S. Oral presentation, AGU Fall Meeting 2020, virtual, Session H132

Cambell, N., **Goodwell, A**. (2020) Drivers of Chinook salmon population dynamics in the Columbia River Basin, Poster presentation, AGU Fall Meeting 2020, virtual, Session H171

Farahani, M.A., **Goodwell, A.,** Vahid, A. (2020) Evaluating ecohydrological model sensitivity to forcing variability with an information theory-based approach. Poster presentation, AGU Fall Meeting 2020, virtual, Session H195