Jeffrey K. Gillan, Ph.D.

Remote Sensing Scientist

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Education

Ph.D. in Natural Resources/Remote Sensing, University of Arizona, 2019
Dissertation: Rangeland Monitoring with unmanned aerial system imagery
Advisor: Willem van Leeuwen, Ph.D.
Committee Members: Mitch McClaran Ph.D., Steve Archer Ph.D., Jason Karl Ph.D.
GPA: 4.0

M.S. in Environmental Science, Certificate in GIS, University of Idaho, 2011
Emphasis: geographic information systems, remote sensing, and wildlife habitat modeling
Advisor: Eva Strand, Ph.D.
Committee Members: Kerry Reese Ph.D., Raymond Dezzani Ph.D., Tamara Laninga Ph.D.,
GPA: 4.0

Honors B.S. in Park Management and Conservation, Kansas State University, 2005
Secondary Major in Natural Resources of Environmental Science
Minor in Business Administration
GPA: 3.7
Gamma Sigma Delta Agriculture Honor Society; Phi Kappa Phi Honors Society; Golden Key

Technical Skills

- Unmanned Aerial Imagery for Natural Resource Applications: Mission Planning, Image Acquisition, Soft-copy photogrammetric processing, 2D and 3D image analysis methods to measure vegetation, soil, and habitat characteristics
- Rangeland vegetation and soil field methods for monitoring land health
- Knowledge of machine learning image analysis algorithms for object-oriented and pixel-based imagery products
- Software knowledge: R statistics, Pix4D, Erdas Imagine & LPS, Agisoft Metashape, ArcMap & ArcGIS Pro, Exelis ENVI, QGIS, CloudCompare, Adobe Creative Suite, Google Earth Engine, PDAL
- Languages: R statistics, Python, some html, Javascript, Castellano Spanish (intermediate)
- High performance computing (HPC) and container environments for big-data analysis and archival
- Total Station Surveying/RTK GPS Surveying/Terrestrial Laser Scanning

Certifications

- Remote Pilot sUAS Rating – 2017 to present (500+ flying hours)

Work Experience

Data Scientist III – University of Arizona, Bio5 Institute
Sept. 2022 – Present
- Worked with university research groups to store, analyze, and share large volumes of aerial imagery on the cloud

Data Scientist III & Drone Pilot – University of Arizona, School of Natural Resources & Environment
Feb. 2019- Aug. 2022

- Led research on drone-mounted hyperspectral/LiDAR imagery for dryland vegetation species productivity and identification
- Led multi-scale remote sensing project (drone, aerial LiDAR, satellite) to thematically map time-series of wildfire vegetation change in Coronado National Forest, AZ
- Led multi-scale remote sensing project (drone, aerial LiDAR & imagery) to map vegetation time-series along Santa Cruz River, AZ.
- Lead instructor of university course on UAS mapping of natural resources
- Developed innovative workflow to collect, process, and share large volumes of drone imagery using high performance computing, scripting, and Google Earth Engine for rangeland monitoring
- Used drone and aerial LiDAR point clouds to assess fire risk to homes adjacent to Santa Fe National Forest, New Mexico
- Developed terrestrial LiDAR processing workflow to calculate biomass/carbon for individual trees
- Supervised and mentored a student employee
- Developed method of using close-range photogrammetry to estimate plot-scale vegetation structure

Graduate Research Asst. - Arizona Remote Sensing Center, University of Arizona
Sept. 2017 – May 2018; 25 hours/week
- Led unmanned aerial imagery projects related to pecan orchard disease, wetland restoration, dryland geomorphology, and invasive species mapping
- Processed and interpreted airborne hyperspectral, LiDAR, Landsat, and PlanetScope imagery

Asst. Professor/Geospatial Specialist- New Mexico State University/USDA-ARS Jornada Experimental Range
March 2011-Sept. 2017; 40 hour/week; $57,000 yearly salary
- Researched high-resolution aerial photography from manned and unmanned platforms to map and monitor vegetation, soil erosion, and surface hydrology in dryland ecosystems
- Developed remote sensing monitoring methods for Bureau of Land Management's Assessment, Inventory and Monitoring (AIM) national program
- Developed and managed science websites:
    landscapetoolbox.org : A platform for knowledge exchange for field, remote sensing, and statistical methods
    journalmap.org: A science literature search engine that empowers scientists to find research based on topic, location, and ecological context
- Managed 5 student employees

GIS Technician – Yellowstone National Park, National Park Service
June 2010-Sept. 2010; 40 hours/week; GS-5 STEP
- Developed bison pasture monitoring program using satellite imagery (MODIS)
- Updated remotely sensed land cover maps using fire history
- Managed GIS databases and created a variety of maps for various park projects including comprehensive planning and biological inventories
- Attributed geospatial product metadata using Federal Geographic Data Committee standards

Graduate Research Asst. – University of Idaho Department of Rangeland Ecology and Management
June 2008 – Jan. 2011; 25 hours/week
- Researched and wrote sage-grouse habitat guide book for Idaho landowners

- Worked with BLM, Idaho Fish and Game, U.S. Fish and Wildlife Service, ranchers, and other stakeholders to complete the book

Contract Technical Writer – The Nature Conservancy
Sept. 2009 – Feb. 2010; 20 hours/week; $20/hour

- Wrote web content related remote sensing methods, rangeland ecology, and wildlife habitat

Geographic Information Specialist, Intern – National Park Service, Petersburg National Battlefield
Dec. 2007 – May 2008; 40 hours/week

- Managed geodatabase of invasive flora, earthworks, utilities, and other park data
- Created maps for park projects
- Collected field data with GPS unit
- Attributed geospatial product metadata using Federal Geographic Data Committee standards

Botany/Biology Field Technician - National Park Service, Whiskeytown National Recreation Area
Sept. 2006-Nov. 2006; 40 hours/week

- Managed exotic plant species using hand tools, power tools, and chemical agents
- Mapped and managed spatial data with GPS and GIS technology

Prairie Ecology Research Assistant – Konza Prairie, The Nature Conservancy and Kansas State University
July –Aug. 2003; 40 hours/week;

- Gathered vegetation field data on plant pathogens at varying fire intervals
- Installed vegetation plots
- Organized data on computer spreadsheets

Government Reports

Gillan, J.K., K. Hartfield, and W.J.D van Leeuwen. 2022. *Assessing Watershed Impacts of the Bighorn Fire – A collaboration with Pima County Regional Flood Control District*.

Gillan, J.K., and C. Peck. 2022. *Supporting restoration of Santa Cruz River in Tucson, AZ with remotely sensed mapping and monitoring of vegetation*

Aerial Photography Contract and Collaborative Work

Riparian Vegetation Mapping - Palo Verde Ecological Reserve, CA, April & Oct. 2021
Watershed mapping and delineation - Santa Rita Experimental Range, August 2020
Woody plant encroachment - Walnut Gulch Experimental Watershed, Oct. 2019
Pecan orchard health study - San Simon, AZ, Oct. 2017
Geomorphic research - Walnut Gulch Experimental Watershed, Sept. 2017
Woody plant establishment - Santa Rita Experimental Range, August 2017
Squirrel surveying - Santa Rita Experimental Range, April 2017
Wetland restoration - Cibola National Wildlife Refuge, March 2017, 2018
Post-fire monitoring - Santa Rita Experimental Range, March 2017
Photogrammetric modeling of biological soil crust and erosion - Bandelier National Monument, May 2015, 2016

Publications

Hartfield, K., **J.K. Gillan**, C.L. Norton, C. Conley, & W.J.D. van Leeuwen. 2022. A novel spectral index to identify cacti in the Sonoran desert at multiple scales using multi-sensor hyperspectral data acquisitions. *Land 11*, 786. DOI: 10.3390/land11060786

Gillan, J.K., G. Ponce-Campos, T.L. Swetnam, A. Gorlier, M.P. McClaran, & P. Heilman. 2021. Innovations to expand drone data collection and analysis for rangeland monitoring. *Ecosphere, 12*(7). DOI: 10.1002/ecs2.3649

Hartfield, K., W.J.D. van Leeuwen, and **J.K. Gillan.** 2020. Remotely Sensed Changes in Vegetation Cover Distribution and Groundwater along the Lower Gila River. *Land*, 9(9), 326. DOI: 10.3390/land9090326

Gillan, J.K., J.W. Karl, W.J.D. van Leeuwen. *2020*. Integrating drone imagery with existing rangeland monitoring programs. *Environmental Monitoring and Assessment 192*(5). DOI: 10.1007/s10661-020-8216-3

Gillan, J.K., M.P. McClaran, T.L. Swetnam, & P. Heilman. *2019*. Estimating forage utilization with drone-based photogrammetric point clouds. *Rangeland Ecology and Management, 72(4), 575-585*. DOI: 10.1016/j.rama.2019.02.009.

Swetnam, T.L., **J.K. Gillan**, T.T. Sankey, M. McClaran, M. Nichols, P. Heilman, and J. Mcvay. 2017. Considerations for achieving cross-platform point cloud data fusion across different dryland ecosystem structural states. *Frontiers in Plant Science*. doi: 10.3389/fpls.2017.02144

Gillan, J.K., J.W. Karl. And M.C. Duniway. 2017. High-resolution repeat topographic surveying of dryland landscapes using UAS-based structure-from-motion photogrammetry: assessing accuracy and precision against traditional ground-based erosion measurement. *Remote Sensing* 9(5), 437. DOI: 10.3390/rs9050437

Gillan, J.K., J.W. Karl, N.N. Barger, A. Elaksher, and M. Duniway. 2016. Spatially explicit rangeland erosion monitoring using high-resolution digital aerial imagery. *Rangeland Ecology and Management*, *69*, 95-107. DOI: 10.1016/j.rama.2015.10.012.

Gillan, J.K., J.W. Karl, M. Duniway, and A. Elaksher. 2014. Modeling Vegetation Heights from High Resolution Stereo Aerial Photography: An Application for Broad-Scale Rangeland Monitoring. *Environmental Management* 144: 226-235. DOI: 10.1016/j.jenvman.2014.05.028

Browning, D. M., J. Franklin, S. R. Archer, **J. K. Gillan** and D. P. Guertin. 2014. Spatial pattern of grassland-shrubland state transitions: a 74 year record on grazed and protected areas. *Ecological Applications* 24: 1421-1433. DOI: 10.1890/13-2033.1

Karl, J. W., **J. K. Gillan**, N. N. Barger, J. E. Herrick, and M. Duniway. 2014. Interpretation of high-resolution imagery for detecting vegetation cover composition change after fuels reduction treatments in woodlands. *Ecological Indicators* 45: 570-578.

Gillan, J.K., E. K. Strand, J. W. Karl, K. P. Reese, and T. Laninga. 2013. Using spatial statistics and point pattern simulations to assess the spatial dependency between greater sage-grouse and anthropogenic features. *Wildlife Society Bulletin* (37) 2: 301-310. DOI: 10.1002/wsb.272

Karl, J.W., J.E. Herrick, R. S. Unnasch, **J.K. Gillan**, E.C. Ellis, W.G. Lutters, and L. J. Martin (2013). Geo-semantic searching: discovering ecologically-relevant knowledge from published studies. *Bioscience* (63)8: 674-682. DOI:10.1525/bio.2013.63.8

Karl, J. W., **J.K. Gillan**, and J. E. Herrick (2013). Geographic searching for ecological studies: a new frontier. *Trends in Ecology and Evolution* (28)7: 383-384. DOI: 10.1016/j.tree.2013.05.001

University of Oregon Geography Department (2012) *Atlas of Yellowstone*. University of California Press. Contributing author on sagebrush steppe chapter that included Sage-grouse distribution modeling.

Gillan, J. K. and E. K. Strand. 2010 (version 1), 2017 (version 2). *Sage-grouse Habitat in Idaho: A Practical Guide for Land Owners and Managers.* University of Idaho Department of Rangeland Ecology and Management.

Professional Presentations

Remote Sensing for Land and Resource Management, Tucson Arizona
Invited talk – Arizona Geographic Information Council, Prescott, AZ, May 2022

Rangeland Drones: Latest Innovations and Next Steps
Presentation – Society for Range Management conference, virtual, Feb. 2021

Enhancing rangeland monitoring with unmanned aerial systems
Symposium – Society for Range Management conference, Denver, CO, Feb. 2020

Rangeland Monitoring with unmanned aerial system imagery
Presentation – Dissertation defense, Tucson, AZ, April 15, 2019

Rangeland Monitoring with Drone Imagery
Presentation – Hereford & Whitewater Draw Natural Resource Conservation Districts, Douglas, AZ, Feb. 25, 2019

Estimating Forage Utilization with Drone-based 3D imagery
Presentation – Society for Range Management conference, Reno, NV, Jan. 2018

Estimating Forage Utilization with Drone Imagery
Poster – University of Arizona GIDP Student Showcase, Dec. 2017

Rangeland Monitoring with Drone-based 3D Imagery
Presentation – University of Arizona GIS day, Nov. 2017

Estimating Forage Utilization with Unmanned Aerial Imagery (2nd place award)
Poster – Research Insights in Semi-Arid Environments, Tucson, AZ, Oct. 2017

Extensifying Rangeland Monitoring with Unmanned Aircraft Systems (2nd place award)
Poster – University of Arizona Earth week Graduate Student Showcase, March 2017

Using small unmanned aircraft to monitor public rangeland ecosystems
Poster - Achievement Reward for College Scientists Banquet, Phoenix, AZ, April 2016

Aerial Photogrammetry Referencing: Producing Accurate Imagery Products from your drone
Poster – University of Arizona Graduate Interdisciplinary Degree Program Showcase, December 2015

Protocols for Vegetation and Habitat Monitoring with Unmanned Aerial Vehicles
Presentation – Ecological Society of America meeting, Baltimore, MD, August 2015

Leveraging the Where of Ecological Research: Lessons from JournalMap
Ignite Presentation – Ecological Society of America meeting, Baltimore, MD, August 2015

Aerial Photogrammetry Control: Producing Accurate Image Products from your Drone
Poster – Ecological Society of America meeting, Baltimore, MD, August 2015

Monitoring rangeland soil erosion from a Unmanned Aerial System
Presentation – American Society for Photogrammetry and Remote Sensing Pecora Symposium, Denver, CO, November 2014

Monitoring rangeland soil erosion from an Unmanned Aerial System
Presentation – Southwest Association of American Geographers meeting, Albuquerque, NM, October 2014

Using JournalMap to improve ecological knowledge discovery and visualization
Poster – Ecological Society of America Conference, Sacramento, CA, August 2014
http://f1000.com/posters/browse/summary/1096636

Modeling Rangeland Soil Erosion with High-Resolution Aerial Photogrammetry
Poster – Ecological Society of American Conference, Minneapolis, MN, August 2013
http://f1000.com/posters/browse/summary/1094146

Modeling Vegetation Heights from High Resolution Stereo Aerial Photography: An Application for Broad-Scale Rangeland Monitoring
Presentation – Society for Range Management conference, Oklahoma City, OK, February 2013

JournalMap: Discovering Ecologically-Relevant Knowledge from Published Studies
Poster – Southwest Association of American Geographers meeting, Las Cruces, NM, October 2012

Modeling Vegetation Heights from High Resolution Stereo Aerial Photography: An Application for Broad-Scale Rangeland Monitoring
Presentation – Southwest Association of American Geographers meeting, Las Cruces, NM, October 2012

JournalMap: Discovering Ecologically-Relevant Knowledge from Published Studies
Poster – Ecological Society of America conference, Portland, Oregon, August 2012

JournalMap: Harness the Power of Geography to Find Relevant Ecological Research
Poster – International Dryland Symposium, Las Cruces, NM, July 2012

Deriving Vegetation Heights from High Resolution Stereo-Pair Aerial Photography: An Application for Broad-Scale Rangeland Monitoring
Poster – Society for Range Management Conference, Spokane, Washington, January 2012

Journal and Grant Peer-Reviewer

Elsevier - *Remote Sensing of the Environment; Ecological Engineering; Rangelands*
IEEE - *Journal of selected topics in applied earth observation and remote sensing*
MDPI – *Forestry; Remote Sensing; Sensors*
ESA – *Ecosphere*
International Journal of Plant Sciences
Methods in Ecology and Evolution
Journal of Geophysical Research – Biogeosciences
National Science Foundation CAREER proposal

Teaching

2022 UAS mapping for Natural Resources, University of Arizona; Lead-Instructor
2021 UAS mapping for Natural Resources; University of Arizona; Co-Instructor
2020 UAS mapping for Natural Resources; University of Arizona; Guest Lecturer
Seminar for Ag and Biosystems Engineering; University of Arizona; Guest Lecturer
2018 Natural Resource Mapping; University of Arizona; Guest Lecturer
2015 Seminar for Survey Engineering; New Mexico State University; Guest Lecturer

Awards

Midwest Regional Award for Notable Technology Development by the US Federal Labs Consortium for JournalMap.org

Press Coverage

"The Potential of Drones", Daniel Stolte, University of Arizona LoQue Pasa. Nov. 27, 2019.
"Researchers use aerial modeling to track soil erosion", Kristen Sullivan, Las Cruces Sun-News. May 11, 2015.

Grants and Fellowships

2021-2022 **Pima County Regional Flood Control District**, research grant *'Supporting restoration of the Santa Cruz River in Tucson, AZ with remotely sensed mapping and monitoring of vegetation'* ($46,599; Principal Investigator)

2020-2021 **Pima County Regional Flood Control District**, research grant 'Assessing Watershed Impacts of Bighorn Fire' ($77,762; Co Principal Investigator)

2016-2017 **Achievement Reward for College Scientists**, Ph.D. Fellowship

2015-2016 **University of Arizona Fellow Award**, Ph.D. Fellowship

Professional Development

ASPRS UAS Conference
Palm Spring, CA, September 2016

Responsible Conduct of Research (Spring 2016)
Introduction to the Responsible Conduct of Research: 1.5 hrs
The Ethics of Mentoring: 1.5 hrs
The Ethics of Authorship and Publication: 1.5 hrs
The Ethics of Peer Review: 1.5 hrs
Introduction to Data Acquisition, ownership, and management: 1.5 hrs

Interpreting and Measuring Indicators of Rangeland Health workshop (NRCS, USGS, BLM, ARS)
Las Vegas, Nevada, May 2011

Ecological Site workshop (USDA-ARS)
Society for Range Management Conference, Spokane, Washington, January 2012

Photogrammetric Processing: Surface Model and Orthophotography workshop
ASPRS Conference, Sacramento, California, March 2012

Airborne GPS and Inertia in Support of Triangulation and Orientation of Airborne Framing and Pushbroom Sensors
Workshop. ASPRS Conference, Sacramento, California, March 2012

Professional References

Mitchell P. McClaran, Ph.D.
Professor – University of Arizona; Director – Arizona Experiment Station
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Phil Heilman, Ph.D.
Research Leader – Southwest Watershed Research Group, USDA-ARS
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