

Marc H Weber

Geographer

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I'm a geographer with the US EPA. My research interests include spatial analysis in R and Python, Geographic Information Science (GIS), aquatic ecology, remote sensing, open source science and environmental modeling.

Employment

June 2008 - **Geographer**, *US Environmental Protection Agency*, Corvallis, Oregon.

- Present
- Provide geospatial support for the EPA National Aquatic Resource Surveys (NARS)
 - Develop spatial approaches to produce national predictive models and maps of watershed integrity and aquatic condition
 - Process landscape data for spatial designs and modeling using libraries in Python and R and ArcGIS
 - Generate hydrologic analyses using the National Hydrography Dataset Plus (NHD-Plus) as well as help develop the future direction of the National Hydrography Dataset as part of the interagency 3D Hydrography Working Group
 - Develop national scale geospatial products such as StreamCat and LakeCat - datasets of national scale watershed characteristics
 - Produce R packages such as StreamCatTools and spsurvey for applying data and methods to aquatic resources work

Jan 2023 - **Instructor, GIS Certificate Program**, *University of Washington*, Seattle, WA.

- Present
- Instructor for GIS Project Planning course and GIS in the Pacific Northwest course for GIS certificate program
 - Design and deliver lectures focused on project planning for GIS, GIS technology, and trends in the GIS profession
 - Mentor GIS certificate student programs in developing skills to enter the GIS workforce

June 2005 - **GIS Specialist**, *U.S. Forest Service, Rocky Mountain Research Station Fire Sciences Lab*, Missoula, MT.

- May 2008
- Worked on the USFS Landfire program on the fire regimes team
 - Ran and modified fire / landscape simulation models (LANDSUM, VDDT)
 - Processed spatial data using scripting languages (Python and AML), and performed advanced spatial analysis on fire and fuels data using SQL, Python, VBA, and R
 - Processed raster data using map algebra for analysis of national fire and fuels mapping products
 - Interacted and worked closely with personnel from partner agencies such as USGS EROS data center and the Nature Conservancy

- May 2003 - **Biologist**, *U.S. Forest Service, Rocky Mountain Research Station Fire Sciences Lab*, Missoula, MT.
- Managed research project examining historical fire regimes in Utah
 - Planned and located research plots and gathered field measurements using increment borers, chainsaws, gps units and laser rangefinders
 - Applied dendrochronology techniques using software such as COFECHA and FHX2 for dating fire-scarred samples
 - Processed, summarized, analyzed data and prepared reports on fire history data collected
 - Performed spatial analysis and map production using ArcMap software and AML scripts
 - Performed statistical analyses on data using SAS and R
- June 2001 - **Ecologist**, *U.S. Forest Service, Pacific Northwest Research Station Forestry Sciences Lab*, Portland, OR.
- April 2003
- Supervised field crew for the Forest Inventory and Analysis (FIA) program
 - Prepared field methods and summarized data
 - Performed database development in Access and Oracle of inventory plot data
 - Used advanced photo interpretation, plant identification, and forest pathogen identification skills
 - Applied expertise with laser rangefinder, GPS, data logger, increment borer, and clinometer
 - Prepared plot maps and performed spatial queries using ArcGIS, helped model forest mortality from plot data as part of a pilot study
- September 2000 - **Instructor**, *Portland Community College*, Portland, OR.
- May 2003
- Taught two geography field courses each term, one on Mt. St. Helens and one on the Oregon High Desert
 - Delivered day-long courses focusing on geography and natural history of the areas
 - Developed course curriculum, supervised approximately 50 community college students on day long field classes, and graded student papers
- September 1999 - **Assistant Editor**, *Himalayan Research Bulletin*, *Portland State University*, Portland, OR.
- May 2001
- Managed layout and editing of international journal on geographic and cultural research on the Himalayas
 - Performed journal layout using Adobe Pagemaker, Adobe Photoshop, and Adobe Illustrator software
 - Performed general office management tasks such as updating membership, correspondence, billing and mailing
- June 1999 - **Research Assistant**, *Portland State University Department of Geography*, Portland, OR.
- September 1999
- Assisted in research project on tree-islands (kipukas) in lava flows at Newberry Crater National Monument, examining fire history and insect outbreaks
 - Collected tree increment cores, identified plants using plant keys, and measured fuel loading on sample plots

Education

- 2001 **Portland, OR**, *Portland State University*, MS in Geography.
- **Advisor:** Dr. Keith Hadley
 - **Committee:** Barbara Brower, Andrew Fountain, Peter Frenzen, Robert Tinnin
 - **Title:** Patterns in Forest Succession and Mortality Following Burial by Mudflow at Cedar Flats, Mount St. Helens, Washington

1988-1992 **Eugene, OR**, *University of Oregon*, BA in English.
○ Robert D. Clark Honors College
○ **Minor**: Environmental Studies

Selected Workshops Taught

September 2024 **R Spatial Data Half-Day Workshop for the EPA R User Group Annual Meeting**, Virtual.

April 2024 **StreamCat and LakeCat: Landscape Characteristics for Rivers and Lakes for the Conterminous US**, Research Triangle Park, NC.

April 2023 **Development of the StreamCat API for the National Monitoring Conference**, Virginia Beach, VA.

September 2018 **R Spatial Workshop for EPA R User Group Annual Meeting**, Virtual.

May 2022 **R and Python Tools for Geospatial Water Applications for the AWRA Spring Specialty Conference**, Austin, TX.

September 2018 **R Spatial Workshop for EPA R User Group Annual Meeting**, Research Triangle Park, NC.

November 2019 **Earth Engine Tutorial for the EPA Pacific Ecological Sciences Division**, Corvallis, OR.

April 2018 **R and Spatial Data for the AWRA Spring Specialty Conference**, Orlando, FL.

April 2017 **R Fundamentals for Spatial Data and Advanced Visualization Techniques**, Portland, OR.

June 2013 **R for Spatial Analysis for the EPA Pacific Ecological Sciences Division**, Newport, OR.

Selected Presentations

- April 2025 **StreamCat 101 Presented to EPA Region 5 and States and Tribes**, Virtual.
- March 2025 **Spatial Hydrologic Data Analysis in R - PNW Tribal Coding Workshop**, Olympia, WA.
- April 2024 **GIS in Python using Open-Source Python Libraries**, presented to the **EPA Python Community of Practice**, Virtual.
- April 2024 **Developing National Scale Watershed Data Presented to the Annual EPA GIS Workgroup Meeting**, Research Triangle Park, NC.
- April 2024 **Developing a National Aquatic Resource Survey ESRI Hub Site Presented to the Annual EPA GIS Workgroup Meeting**, Research Triangle Park, NC.
- May 2024 **Using Spatiotemporal Asset Catalogs (STAC) and Cloud Optimized GeoTiffs (COG)**, presented to the **EPA Python Community of Practice**, Virtual.
- April 2023 **Development of the StreamCat API**, presented to **National Monitoring Conference**, Virginia Beach, VA.
- October 2022 **Using Geospatial Indicators of Watershed Condition to Support Freshwater Conservation Actions**, EPA Watershed Academy Webinar Series.
- May 2018 **Invited Presentation for Portland State University: An Overview of Geospatial Work at the US EPA Western Ecology Division Supporting National-Scale Aquatic Condition Assessments and Watershed Health Prediction**, Portland, OR.
- April 2015 **Invited Panelist: Advancing US EPA Integration of Environmental and Information Sciences**, Research Triangle Park, NC.

Awards

- 2025 US EPA Shooting Star Award.
- 2024 US EPA PESD Division Honor Award.
- 2024 US EPA Mason Hewitt Award for Excellence in GIS for StreamCat / LakeCat.
- 2024 US EPA Shooting Star Award.
- 2023 University of Washington Continuum College Team Instructional Excellence Award.
- 2022 US EPA PESD Division Honor Award.
- 2021 US EPA Special Service Award: Developing the data and Methods Enabling the Strategic Analysis of the Nation's Surface Waters.
- 2019 US EPA PESD Division Honor Award.
- 2018 US EPA PESD Division Honor Award.
- 2016 US EPA ORD Bronze Medal.
- 2015 US EPA Office of Water Achievement in Science & Technology Award.
- 2015 US EPA Western Ecology Division Certificate of Recognition.
- 2013 US EPA Western Ecology Division Certificate of Recognition.
- 2012 US EPA PeerOvation Top Innovation Award.
- 2012 US EPA Office of Water Bronze Medal.
- 2010 US EPA Office of Water Bronze Medal.
- 2010 US EPA ORD Exceptional Technical Assistance to Regions / Program Offices Award.

2007 **USFS LANDFIRE Program Appreciation Award.**

2005 **USFS Certificate of Appreciation for Fire history fieldwork.**

Open Source Software

- Author **StreamCatTools**, *R package to work with the StreamCat API within R and access the full suite of StreamCat catchment and watershed scale metrics for all NHDPlusV2 stream reaches and catchments..*
- Co-author **spsurvey**, *spsurvey is an R package that implements a design-based approach to statistical inference, with a focus on spatial data..*
- Co-author **micromap**, *micromap is an R package for developing small multiple maps with corresponding statistical summaries in R.*
- Contributor **DOI-USGS/nhdplusTools**, *Manipulating hydrographic data with the NHD-Plus data model..*

Publications

1. Handler, A., Weber, M., Dumelle, M., Jansen, L., Carleton, J., & al., B. S. et. (2025). Ecological condition of mountain lakes in the conterminous united states and vulnerability to human development. *Ecological Indicators*, 173, 113402.
2. Markley, S., Weber, M., Brehob, M., Sabo, R., Pennino, M., Hill, R., & al., S. A. et. (2025). 30 years of local drainage and upstream watershed nutrient mass balances provide key insights into managing surface and ground water quality. *AGU, U25*.
3. Brehob, M., Pennino, M., Compton, J., Zhang, Q., Weber, M., & al., R. H. et. (2025). The US EPA's national nutrient inventory: Critical shifts in US nutrient pollution sources from 1987 to 2017. *Environmental Science & Technology*.
4. Markley, S., Weber, M., Brehob, M., Sabo, R., Pennino, M., Hill, R., & al., S. A. et. (2025). Tandem evolutionary algorithm highlights catchment and watershed attributes that drive resiliency and vulnerability to nutrient inputs. *AGU, U25*.
5. Alford, S., Hill, R., Markley, S., Weber, M., Compton, J., Brehob, M., & Sabo, R. (2025). Development of a wetland geospatial framework to support nutrient management across the conterminous united states. *AGU, U25*.
6. Markley, S., Weber, M., Brehob, M., Sabo, R., Pennino, M., Hill, R., & al., J. C. et. (2025). Incorporating 30 years of US EPA's national nutrient inventory into nationally consistent and spatially explicit catchment and watershed metrics. *At Oregon State University Clean Water Symposium, Corvallis, OR*.
7. Alford, S., Hill, R., Markley, S., Weber, M., Compton, J., Brehob, M., & Sabo, R. (2025). Development of a wetland geospatial framework to support agricultural nutrient management across the conterminous united states. *Oregon State University Clean Water Symposium, Corvallis, OR*.
8. Handler, A., Compton, J., Reynolds, M., Dumelle, M., Hill, R., & al., S. L. et. (2025). Multiplying the impact of field data through models understand the extent, drivers, and risk for lake harmful cyanobacteria blooms. *Oregon State University Water Seminar Series, Corvallis, OR*.

9. Lin, J., Compton, J., Sabo, R., Herlihy, A., Hill, R., Weber, M., & al., J. B. et. (2024). The changing nitrogen landscape of united states streams: Declining deposition and increasing organic nitrogen. *PNAS Nexus*, 3 (1), pgad362.
10. Kaufmann, P., Carlisle, D., Faustini, J., Weber, M., Herlihy, A., & al., R. H. et. (2024). Quantifying form resistance is essential for estimating summer low and bankfull flow from stream survey channel morphology. *Geomorphology*, 466, 109360.
11. Nowakowski, C., Nahlik, A., Brooks, R., Compton, J., Weber, M., Hill, R., & al., R. S. et. (2024). ¹⁵N reflects wetland nitrogen processing on a national scale as predicted by soil chemistry stoichiometry. *American Geophysical Union Annual Fall Meeting, Washington, DC*.
12. Brooks, J., Compton, J., Kaufmann, P., Fergus, C., Weber, M., Rugh, W., & al., L. T. et. (2024). Assessing the condition of the nation's waters: How can stable isotopes help. *Spring Water Resources Science Series, Oregon State University, Portland ...*
13. Lin, J., Compton, J., Sabo, R., Herlihy, A., Hill, R., Weber, M., & al., J. B. et. (2024). The changing nitrogen landscape of united states streams: Declining deposition and increasing organic nitrogen. PNAS nexus. *Oxford University Press, OXFORD, Uk,, Pgad, d362*.
14. Dumelle, M., Kincaid, T., Olsen, A., & Weber, M. (2023). Spsurvey: Spatial sampling design and analysis in r. *Journal of Statistical Software*, 105, 1-29.
15. Leibowitz, S., Hill, R., Creed, I., Compton, J., Golden, H., & al., M. W. et. (2023). National hydrologic connectivity classification links wetlands with stream water quality. *Nature Water*, 1 (4), 370-380.
16. Sabo, R., Pickard, B., Lin, J., Washington, B., Clark, C., & al., J. C. et. (2023). Comparing drivers of spatial variability in US lake and stream phosphorus concentrations. *Journal of Geophysical Research: Biogeosciences*, 128 (8), e2022JG007227.
17. Mengistu, S., Golden, H., Lane, C., Christensen, J., Wine, M., & al., E. D. et. (2023). Wetland flowpaths mediate nitrogen and phosphorus concentrations across the upper mississippi river basin. *JAWRA Journal of the American Water Resources Association*, 59 (5), 1162-1179.
18. Riato, L., Leibowitz, S., Weber, M., & Hill, R. (2023). A multiscale landscape approach for prioritizing river and stream protection and restoration actions. *Ecosphere*, 14 (1), e4350.
19. Kaufmann, P., Hughes, R., Paulsen, S., Peck, D., & al., C. S. et. (2022). Physical habitat in conterminous US streams and rivers, part 1: Geoclimatic controls and anthropogenic alteration. *Ecological Indicators*, 141, 109046.
20. Christensen, J., Golden, H., Alexander, L., Pickard, B., & al., K. F. et. (2022). Headwater streams and inland wetlands: Status and advancements of geospatial datasets and maps across the united states. *Earth-Science Reviews*, 235, 104230.
21. Fergus, C., Brooks, J., Kaufmann, P., Pollard, A., Mitchell, R., & al., G. G. et. (2022). Natural and anthropogenic controls on lake water-level decline and evaporation-to-inflow ratio in the conterminous united states. *Limnology and Oceanography*, 67 (7), 1484-1501.
22. Brooks, J., Compton, J., Lin, J., Herlihy, A., Nahlik, A., Rugh, W., & Weber, M. (2022). ¹⁵N of chironomidae: An index of nitrogen sources and processing within watersheds for national aquatic monitoring programs. *Science of the Total Environment*, 813, 151867.

23. Lin, J., Compton, J., Hill, R., Herlihy, A., Sabo, R., Brooks, J., & al., M. W. et. (2021). Context is everything: Interacting inputs and landscape characteristics control stream nitrogen. *Environmental Science & Technology*, 55 (12), 7890-7899.
24. Fergus, C., Brooks, J., Kaufmann, P., Pollard, A., Herlihy, A., & al., S. P. et. (2021). National framework for ranking lakes by potential for anthropogenic hydro-alteration. *Ecological Indicators*, 122, 107241.
25. Fergus, C., Brooks, J., Kaufmann, P., Herlihy, A., Pollard, A., & al., M. W. et. (2020). Lake water levels and associated hydrologic characteristics in the conterminous US. *JAWRA Journal of the American Water Resources Association*, 56 (3), 450-471.
26. Aho, K., Flotemersch, J., Leibowitz, S., Johnson, Z., Weber, M., & Hill, R. (2020). Adapting the index of watershed integrity for watershed managers in the western balkans region. *Environmental Management*, 65 (5), 602-617.
27. Riato, L., Leibowitz, S., & Weber, M. (2020). The use of multiscale stressors with biological condition assessments: A framework to advance the assessment and management of streams. *Science of The Total Environment*, 737, 139699.
28. Aho, K., Flotemersch, J., Leibowitz, S., LaCroix, M., & Weber, M. (2020). Applying the index of watershed integrity to the matanuska-susitna basin. *Arctic, Antarctic, and Alpine Research*, 52 (1), 435-449.
29. Aho, K., Flotemersch, J., Leibowitz, S., Johnson, Z., Weber, M., & Hill, R. (2020). EPA public access. *Environ Manage*, 65 (5), 602-617.
30. Olsen, A., Kincaid, T., Kentula, M., & Weber, M. (2019). Survey design to assess condition of wetlands in the united states. *Environmental Monitoring and Assessment*, 191 (Suppl 1), 268.
31. Herlihy, A., Sifneos, J., Lomnický, G., Nahlik, A., Kentula, M., & al., T. M. et. (2019). The response of wetland quality indicators to human disturbance indicators across the united states. *Environmental Monitoring and Assessment*, 191 (Suppl 1), 296.
32. Hill, R., Weber, M., Debbout, R., Leibowitz, S., & Olsen, A. (2018). The lake-catchment (LakeCat) dataset: Characterizing landscape features for lake basins within the conterminous USA. *Freshwater Science*, 37 (2), 208-221.
33. Thornbrugh, D., Leibowitz, S., Hill, R., Weber, M., Johnson, Z., & al., A. O. et. (2018). Mapping watershed integrity for the conterminous united states. *Ecological Indicators*, 85, 1133-1148.
34. Bellmore, R., Compton, J., Brooks, J., Fox, E., Hill, R., & al., D. S. et. (2018). Nitrogen inputs drive nitrogen concentrations in US streams and rivers during summer low flow conditions. *Science of the Total Environment*, 639, 1349-1359.
35. Fox, E., Hill, R., Leibowitz, S., Olsen, A., Thornbrugh, D., & Weber, M. (2017). Assessing the accuracy and stability of variable selection methods for random forest modeling in ecology. *Environmental Monitoring and Assessment*, 189 (7), 316.
36. Hill, R., Fox, E., Leibowitz, S., Olsen, A., Thornbrugh, D., & Weber, M. (2017). Predictive mapping of the biotic condition of conterminous US rivers and streams. *Ecological Applications*, 27 (8), 2397-2415.
37. Omernik, J., Griffith, G., Hughes, R., Glover, J., & Weber, M. (2017). How misapplication of the hydrologic unit framework diminishes the meaning of watersheds. *Environmental Management*, 60 (1), 1-11.

38. Hill, R., Fox, E., Leibowitz, S., Olsen, A., Thornbrugh, D., & Weber, M. (2017). EPA public access. *Ecol Appl*, 27 (8), 2397-2415.
39. Hill, R., Weber, M., Leibowitz, S., Olsen, A., & Thornbrugh, D. (2016). The stream-catchment (StreamCat) dataset: A database of watershed metrics for the conterminous united states. *JAWRA Journal of the American Water Resources Association*, 52 (1), 120-128.
40. Kincaid, T., Olsen, A., & Weber, M. (2016). Spsurvey: Spatial survey design and analysis. *R Package Version*, 3 (3).
41. Leibowitz, S., Comeleo, R., Wigington Jr, P., Weber, M., & al., E. S. et. (2016). Hydrologic landscape characterization for the pacific northwest, USA. *JAWRA Journal of the American Water Resources Association*, 52 (2), 473-493.
42. Omernik, J., Paulsen, S., Griffith, G., & Weber, M. (2016). Regional patterns of total nitrogen concentrations in the national rivers and streams assessment. *Journal of Soil and Water Conservation*, 71 (3), 167-181.
43. Glover, J., Omernik, J., Hughes, R., Griffith, G., & Weber, M. (2016). Watersheds, ecoregions and hydrologic units: The appropriate use of each for research and environmental management decisions. *Headwaters to Estuaries: Advances in Watershed Science and Management*, 119.
44. Xue, J., Zartarian, V., Mintz, B., Weber, M., Bailey, K., & Geller, A. (2015). Modeling tribal exposures to methyl mercury from fish consumption. *Science of the Total Environment*, 533, 102-109.
45. Payton, Q., McManus, M., Weber, M., Olsen, A., & Kincaid, T. (2015). Micromap: A package for linked micromaps. *Journal of Statistical Software*, 63, 1-16.
46. Brooks, J., Gibson, J., Birks, S., Weber, M., Rodecap, K., & Stoddard, J. (2014). Stable isotope estimates of evaporation: Inflow and water residence time for lakes across the united states as a tool for national lake water quality assessments. *Limnology and Oceanography*, 59 (6), 2150-2165.
47. Symanzik, J., Dai, X., Weber, M., Payton, Q., & McManus, M. (2014). Linked micromap plots for south america—general design considerations and specific adjustments. *Revista Colombiana de Estadística*, 37 (2), 451-469.
48. Payton, Q., Olsen, A., Weber, M., McManus, M., & Kincaid, T. (2014). Micromap: Linked micromap plots. *R Package Version*, 1.
49. Symanzik, J., Carr, D., McManus, M., & Weber, M. (2014). Micromaps. *Wiley StatsRef: Statistics Reference Online*, 1-11.
50. Peck, D., Olsen, A., Weber, M., Paulsen, S., Peterson, C., & Holdsworth, S. (2013). Survey design and extent estimates for the national lakes assessment. *Freshwater Science*, 32 (4), 1231-1245.
51. Weber, M. (2013). Environmental justice challengers for ecosystem service valuation. Chapter 0, building a green economy. *Michigan State University Press, East Lansing, MI*.
52. Weber, M., & Ringold, P. (2012). Ecosystems and people: Qualitative insights. *Environmental Health and Society Bulletin*, 3, 2-8.
53. Hughes, R., Kaufmann, P., & Weber, M. (2011). National and regional comparisons between strahler order and stream size. *Journal of the North American Benthological Society*, 30 (1), 103-121.

54. Heyerdahl, E., Brown, P., Kitchen, S., & Weber, M. (2011). Multicentury fire and forest histories at 19 sites in utah and eastern nevada. *Gen. Tech. Rep. RMRS-GTR-, -261WWW. Fort Collins, CO: US Department of ...*
55. Brown, P., Heyerdahl, E., Kitchen, S., & Weber, M. (2008). Climate effects on historical fires (1630–1900) in utah. *International Journal of Wildland Fire*, 17 (1), 28-39.
56. Weber, M., Hadley, K., Frenzen, P., & Franklin, J. (2006). Forest development following mudflow deposition, mount st. Helens, washington. *Canadian Journal of Forest Research*, 36 (2), 437-449.
57. Gayton, D., Weber, M., Harrington, M., Heyerdahl, E., & al., E. S. et. (2006). Fire history of a western montana ponderosa pine grassland: A pilot study. *In: Speer, James H., Ed. Experiential Learning and Exploratory Research: The ...*
58. Frenzen, P., Hadley, K., Major, J., Weber, M., Franklin, J., & al., J. H. I. et. (2005). Geomorphic change and vegetation development on the muddy river mudflow deposit. *Ecological Responses to the, 1980 eruption of Mount St. Helens*, 75-91.
59. Weber, M. (2001). Patterns in forest succession and mortality following burial by mud-flow at cedar flats, mount st. Helens, washington. *Portland State University*.

Selected Presentations

- April 2025 **StreamCat 101 Presented to EPA Region 5 and States and Tribes**, Virtual.
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- April 2015 **Invited Panelist: Advancing US EPA Integration of Environmental and Information Sciences**, Research Triangle Park, NC.

Trainings, Certificates and Courses

- 2024 **Modern Geo Apps**, *ESRI*.
- 2023 **GIS for Climate Action**, *ESRI*.

2023 **Imagery in Action**, *ESRI*.

2022 **Evaluating Ecosystem Services with Remote Sensing**, *NASA ARSET*.

2022 **Monitoring and Modeling Floods Using Earth Observations**, *NASA ARSET*.

2021 **Cartography**, *ESRI*.

2020 **Forest Mapping and Monitoring with SAR Data**, *NASA ARSET*.

2020 **Spatial Data Science**, *ESRI*.

2017 **Pandas Foundations**, *Data Camp*.

2017 **Plotly and R Course**, *Data Camp*.

2016 **Introduction to Python for Data Science**, *Data Camp*.

2016 **SQL and R - Introduction to Database Queries**, *Statistics.com*.

2016 **Developing Data Products**, *Coursera*.

2016 **The Data Scientist's Toolbox**, *Coursera*.

2015 **Exploratory Data Analysis**, *Coursera*.

2012 **Visualization in R with ggplot2**, *Data Camp*.

2008 **Introduction to PHP and MySQL**, *Oregon State University E-Campus*.

2008 **Introduction to Geoprocessing Scripts Using Python**, *ESRI*.

2008 **Writing Advanced Geoprocessing Scripts Using Python**, *ESRI*.

2007 **Introduction to ArcGIS Server**, *ESRI*.

2007 **Learning Python**, *Mark Lutz*.

2006 **Learning ArcGIS 9 Spatial Analyst**, *ESRI*.

- 2006 **ArcGIS GeoProcessing and the ModelBuilder**, *Kessler GIS*.
- 2006 **Skills for the GeoDatabase**, *Kessler GIS*.
- 2005 **Working With Rasters in ArcGIS 8**, *ESRI*.
- 2005 **Introduction to SQL**, *Oregon State University E-Campus*.
- 2003 **SAS Programming 1**, *SAS Institute*.