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 - Present — **Geographer**, *US Environmental Protection Agency*, Corvallis, Oregon.

- 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 (NHDPlus) 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 - Present — **Instructor, GIS Certificate Program**, *University of Washington*, Seattle, WA.

- 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 - May 2008 — **GIS Specialist**, *U.S. Forest Service, Rocky Mountain Research Station Fire Sciences Lab*, Missoula, MT.

- 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 - June 2005 **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 dendrochonology 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 - April 2003 **Ecologist**, *U.S. Forest Service, Pacific Northwest Research Station Forestry Sciences Lab*, Portland, OR.

- 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 - May 2003 **Instructor**, *Portland Community College*, Portland, OR.

- 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 - May 2001 **Assistant Editor**, *Himalayan Research Bulletin, Portland State University*, Portland, OR.

- 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 - September 1999 **Research Assistant**, *Portland State University Department of Geography*, Portland, OR.

- Assisted in research project on tree-islands (kipukas) in lava flows at Newbarry 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

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.

Septermber 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.

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 NHDPlus 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., Lomnicky, 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 mudflow 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.

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 Montioring 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.

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*.