

Dr. Michael Tuffly

165 South 32nd Street • Boulder, Colorado 80305 USA

• Email: mtuffly@eriaconsultants.com

Cell: (720) 841 – 6188 • URL: <http://www.eriaconsultants.com>

Linkedin Profile: <https://www.linkedin.com/in/michaeltuffly>

Education

Ph.D. Forest Ecological Science, Biostatistics, Precision Agriculture. Warner College of Natural Resources, Colorado State University (CSU), Fort Collins Colorado USA, 2012. Dissertation: Using Cellular Automata to predict the spread and intensity of the Amber-Marked Birch leaf miner infestation in Alaska.
<https://dspace.library.colostate.edu/handle/10217/71597>

M.S. Natural Resources Engineering: Remote Sensing, Geographic Information Systems (GIS), and Statistical Analysis. Humboldt State University, Arcata, California USA 1995. Thesis: *Predicting vegetation type and fire hazard in the Smith River National Recreation area using a Geographic Information System.* Remote Sensing and Ecosystem Management, Proceedings of the Fifth Forest Service Remote Sensing Applications. P. 336.1997.
(<http://hdl.handle.net/2148/839>).

B.S. Forest Ecology minor in Oceanography: Emphasizing in Botanical and Environmental Research. Humboldt State University, Arcata, California, USA 1988.

Work Experience

2005 – Current

Principal of ERIA Consultants, LLC. • Boulder Colorado.

Principal Consulting Scientist working with the US Forest Service (USFS) involved with construction, implementing, and evaluating the ecological integrity of forest carbon resources over time and space. Field Research Scientist assessing forest biomass and carbon sequestration via FIA inventory methods on DOD lands in Colorado. Expert witness testimony, analyzing ground metrics computations as it pertains to Wildland Fire Burn Severity evaluations. Construction of custom computer applications written in both python, and R used to classify forest resources, quantify forest biomass for carbon assessment. The development of a non-parametric machine learning (ML) artificial intelligent (AI) method to link forest field data to remotely sensed data to accurately and precisely assess forest carbon stocks over the landscape. REDD+ modeling in Tanzania and Myanmar. Forest growth and yield modeling in Queensland Australia.

Other clients have included Ocean Imaging, Forest Health Protection (USFS), The Nature Conservancy (TNC), NatureServe, Bureau of Land Management (BLM), and National Geospatial Administration (NGA). Previous contracts involved mapping ocean littoral kelp beds in Marine Protected zones in Oregon and California using high-resolution multispectral four-band digital imagery collected from fixed wing

aircraft. Developing fertilizer and irrigation regimes for various row crops using satellite imagery coupled with field sampling, and spatial statistics. Previous projects involved creating and conducting spatially explicit and stochastic risk assessment modeling for the potential introduction of exotic forest pathogens and insects to the United States. Additional projects include “A Spatial Model to Determine the Economic Availability of Woody Biomass in Colorado.” Other projects include REDD+ modeling for Myanmar and Carbon Farming stratification in Queensland Australia. In addition to the participation of three Carbon Offset Verification Project Services under the California Air Resources Board AB 32.

2018 – 2021

Wildfire Burn Severity Mapping various clients

Using multi-spectral data from LandSat-8OLI or Sentinel 2A or 2B; then, linking these data to products produced by Synthetic Aperture Radar (SAR) Sentinel 1A or 1B. These methods have been coupled with machine learning (ML) artificial intelligent (AI) techniques for cell base classification. An example can be viewed here: http://www.eriaconsultants.com/documents/campfire_writeup_ver1_withmap.pdf

2015 – 2017

Climate Change Researcher at Colorado State University, Natural Resource Ecology Lab (NREL), Fort Collins, Colorado.

Computing Global Greenhouse Gas emission contributions via organic matter decomposition (OMD) modeling. The inputs into the OMD model are Potential Evapotranspiration (PET), monthly temperature, monthly precipitation. The latter two are computed using the DayCent Model <http://www.nrel.colostate.edu/projects/daycent/>. Results were computed for the entire globe on an annual basis from 1983 – 2011.

2017 – 2021

Adjunct Professor at Denver University.

Teaching graduate courses in Remote Sensing and Image Processing; both online and in person.

2010 – 2016

Adjunct Instructor at Colorado State University, Fort Collins, Colorado

Teaching courses to undergraduates and graduate students in GIS and Remote Sensing. Courses include: **Geographic Information Systems and Remote Sensing Seminar (NR493), Geographic Information System, Applied Natural Resource Management (NR 422), Natural Resource Sampling (NR 421), Forest Biometrics (F321), Remote Sensing (NR323), Spatial Statistical Modeling of Natural Resources (NR512) and Inventory and Monitoring of Natural Resources (NR566).**

2002 - 2005

GIS Specialist/Ecologist • NatureServe • Boulder, Colorado

Corporate charter is to conduct spatial analysis in order to preserve Biodiversity over the natural landscape. Responsible for the assessment and classification of wide ranging critical or sensitive terrestrial, freshwater, and marine habitats in the western United States, Canada, South America, and the Caribbean using the following: Geographic Information System (GIS), Remote Sensing (RS) techniques, and mathematical modeling algorithms. Responsible for coordinating vegetation

classification, sample design, terrestrial and aquatic landscape evaluation. Developed a series of spatial models (i.e. flow accumulation, optimization selection criteria for reserve design using simulated Annealing, and Geodatabase development).

1998 to 2002

Lead Environmental Engineer • California Department of Conservation • Abandoned Mine Lands Unit • Sacramento, California

Tasked with designing, constructing, implementing, and maintaining a relational database and a GIS of abandoned mines for the State of California. Co-authoring a Strategic Plan for managing Mercury in the Sacramento River Watershed. Responsible for GPS location of mine sites, collecting field data, and conducting spatial analysis using ancillary data sets. Additional duties include locating and collecting data for "Point Source" and "Non-Point Source" occurrences of heavy metals in stream river sediments and wetlands.

1993 to 1998

Data Scientist • California Department of Fish and Game • Natural Heritage Division • Sacramento, California

Conducted spatial analysis on threaten and endanger plants and animals. Also responsible for the construction of field sampling design and implementation and accuracy assessment of the wetlands and vernal pools spatial data in the Sacramento Valley, San Joaquin Valley, and San Francisco Bay Area. Emergency response environmental scientist for Oil Spills.

Technical Computer

Python (ver 2.7.10 and 3.7)

numpy, scipy, gdal, and arcpy

Geospatial (ArcGIS ver 10.6.1, QGIS 2.18.7)

Image Processing (ERDAS 2018)

Statistics (R ver 3.5.0)

Univariate (regression), multivariate (MANOVA), nonparametric (CART), RandomForest, spatial (Kriging, IDW, GWR) and temporal (GLS)

Linux (Ubuntu 16.02)

Database

MySQL, MS Access, SQL Server

REDD+ Analysis

Forest Vegetation Simulator (FVS)

Certifications

Geographic Information Systems Professional (GISP) (Certification #: 59559)

Certified Forester (CF) license number 4050 (Society of American Foresters)

Certified Mapping Scientist - Remote Sensing (CMS) license number RS196

(American Society for Photogrammetry and Remote Sensing (**ASPRS**))

Certified Senior Ecologist (CSE) (Ecological Society of America)

Lead Verifier for Forest Carbon (California Air Resources Board)

Unmanned Aerial Vehicle (UAV) Remote Pilot, Part 107, FAA (Certification Number: 4584553).

Affiliations

- American Society for Photogrammetry and Remote Sensing (**ASPRS**) Rocky Mountain Region (RMR). I serve as the as the 2014 and 2015 President of the ASPRS RMR and as the Vice-President for 2016 to Current.
- The Society for Conservation GIS (**SCGIS**)
- Ecological Society of America (**ESA**)
- Professional Membership Forest Guild
- Society of American Foresters (**SAF**)

Publications

Tuffly, M.F. 2017. Creating a Burn Severity Map Using Classification and Regression Tree (CART)

Mapping Spruce Beetle (*Dendroctonus rufipennis* Kirby) Infestation in the Cook Inlet Ecoregion, Alaska Using Synthetic Aperture Radar (SAR) data and Multispectral imagery 2019.

Mapping Spruce Beetle (*Dendroctonus rufipennis* Kirby) Infestation in the Copper Plateau Ecoregion, Alaska Using Synthetic Aperture Radar (SAR) data 2019.

Peered Reviewed

Lundquist, J. E., R. M. Reich, and M. Tuffly. 2012. Spatial dynamics of the invasive defoliator Amber-marked birch leaf miner (*Profesusa thomsoni*) across the Anchorage landscape. Journal of Economic Entomology 105: 1659 - 1667.

Downing, M.C., T. Jung, V. Thomas, M. Blaschke, M.F. Tuffly, R. Reich. 2010 Estimating the Susceptibility to Phytophthora alni Globally Using Both Statistical Analysis and Expert Knowledge. In Advances in Threat Assessment and Their Application to Forest and Rangeland Management. General Technical Report. PNW-GTR-802. September 2010. https://www.fs.fed.us/pnw/pubs/gtr802/Vol2/pnw_gtr802vol2_downing.pdf

White Papers

1. Predicting vegetation type and fire hazard in the Smith River National Recreation area using a Geographic Information System. Remote Sensing and Ecosystem Management, Proceedings of the Fifth Forest Service Remote Sensing Applications. p 336.1997. (<http://hdl.handle.net/2148/839>).
2. Using a Geographic Information System, the Global Positioning System and a Relational Database for the Inventory of Abandoned Mines in California. July, 2000 Environmental Systems Research Institute (ESRI) Users Conference Proceedings.

3. California's Mining Legacy, Society of Ecological Restoration, Conference Paper. October 2000.
4. Impact from Historical Mining, Society for the Conservation of Geographic Information Systems, Conference Paper. July 2001.
5. Mercury in Stream Sediments in the Sierra Nevada, American Geophysical Union, Conference Poster. December 2001.
6. Managing Mercury in the Sacramento River Watershed, Delta Tributaries Mercury Council Strategic Planning Committee.
7. Upland and Wetland Ecological Systems in Colorado, Wyoming, South Dakota, Nebraska, and Kansas. Report and Map to the National Gap Analysis Program. Arlington, VA June 2003.
8. Biodiversity Values of Geographically Isolated Wetlands: An Analysis of 20 U.S. States, NatureServe, Arlington, VA. February 2005.
9. Generating Conservation Scenarios for Puerto Rico. July 2005 Environmental Systems Research Institute (ESRI) User Conference Proceedings.
10. Potential Introduction Establishment, and Susceptibility to Pine species in the Conterminous United States from Sirex Woodwasp - *Sirex noctilio* (2006) USFS Technical Paper
http://www.fs.fed.us/foresthealth/technology/invasives_sirexnoctilio_riskmaps.shtml.
11. Potential Introduction, Establishment, and Susceptibility of Forest Tree species in the Conterminous United States from European spruce bark beetle - *Ips typographus* (2007) USFS Technical Paper :
http://www.fs.fed.us/foresthealth/technology/invasives_ipstypographus_riskmaps.shtml
12. Introduction, Establishment, and Susceptibility of Alder species in the Conterminous United States from *Phytophthora alni*. (2008) USFS Technical Paper:
http://www.fs.fed.us/foresthealth/technology/invasives_phytophthoraalni_riskmaps.shtml
13. URISA's GISCorps United Nations Institute for Training and Research Operational Satellite Applications Programme (UNOSAT). Myanmar (Burma) Project. 2008
http://www.giscorps.org/index.php?option=com_content&task=view&id=71&Itemid=63
14. Resources at Risk in the Conterminous United States from Goldspotted Oak Borer (*Agrilus coxalis* [Waterhouse]) (2011) USFS Technical Paper :
http://www.fs.fed.us/foresthealth/technology/invasives_agriluscoxalis_riskmaps.shtml
15. Ph.D. Dissertation 2012. Using Cellular automata to predict the spread and intensity of the Amber-Marked Birch leaf miner infestation in Alaska.
http://digitool.library.colostate.edu///exlibris/dtl/d3_1/apache_media/L2V4bGlicmlzL2R0bC9kM18xL2FwYWNoZV9tZWVpYS8xODY2MDg=.pdf
- 16) Mapping Spruce Beetle (*Dendroctonus rufipennis* Kirby) Infestation in the Cook Inlet Ecoregion, Alaska Using Synthetic Aperture Radar (SAR) data and Multispectral imagery 2019.
http://www.eriaconsultants.com/documents/Cook_Inlet_ver2.pdf

- 17) Mapping Spruce Beetle (*Dendroctonus rufipennis* Kirby) Infestation in the Copper Plateau Ecoregion, Alaska Using Synthetic Aperture Radar (SAR) data 2019.

http://www.eriaconsultants.com/documents/Copper_ver2.pdf