Toby Maxwell
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## Education

*University of California at Davis, September 2012-Present*
Ph.D., Agricultural and Environmental Chemistry, Advisors: William Horwath, Lucas Silva

*State University of New York at Geneseo, Graduated 2011*
Bachelor of Science in Chemistry, Magna Cum Laude

## Research Experience

*Efficiency-productivity tradeoffs in California cropping systems: how environmental gradients regulate responses to rising $CO_2$ levels and climatic variability in California*
Advisors: William Horwath, Lucas Silva
This project focuses on understanding long-term changes in physiological performance and agricultural efficiency of the most important crops grown in CA. Two main response variables are being considered: productivity and efficiency. These are critical components of climate adaptation strategies needed to promote agricultural sustainability. Water and nutrient use efficiency, which are being evaluated for long term trends associated with climate, rising $CO_2$ and technological advancements. A spatial component of this project will map trends in yield and efficiency while evaluating sensitivity to future climate and management scenarios.

*Integrating plant to ecosystem carbon-water relations across edaphic and climatic gradients, Spring 2013 – Present*
Advisors: William Horwath, Lucas Silva
As a part of my Ph.D. I am studying how plant, litter and soil chemistry and stable isotope composition relate to the physiological performance of trees. This study tracks these changes across elevation gradients and across varied geologic settings to both develop an understanding of how specific species respond to climatic differences, and identify the roll of soil properties in determining this status. New methods are being evaluated by tracking factors which impact stable isotope signal integration from the plant to litter to soil to evaluate how shifts in climate affect forest productivity at various scales.

*Greenhouse Gas Monitoring on Agricultural Fields, UC Davis, 2012 – 2014*
Advisors: William Horwath, Martin Burger
Exploring the impact of various farming and fertilization methods on greenhouse gas emissions and nitrogen mineralization rates in agricultural wheat production. Studies have been conducted on by monitoring $N_2O$ and $CO_2$ fluxes in response to management. Enriched $^{15}N$ fertilizers were applied allowing for a mass balance analysis, separating fertilizer and soil nitrogen contributions to better understand how specific fertilizers contribute to plant nutrition.

**Lab Experience and Data Analysis**

*R*
Extensive experience with efficient data management, multivariate statistical modeling, time series analysis, structural equation modeling, multi-model inference.

*GIS*
I am experienced in working with spatial data, including both descriptive and predictive techniques to help determine appropriate interpolation methods in R. A basic knowledge of ArcGIS allows me to perform basic tasks including mapping, merges, calculations, and integration of satellite data.

*Cryogenic Leaf Water Extraction*
Independently built a cryogenic leaf water extraction system allowing for isotopic analysis of leaf, stem, and soil water. System was built from scratch with guidance from recent literature.

*Analytical Chemistry*
Extensive experience troubleshooting methodology and working with GC/MS and HPLC data, significant experience maintaining and troubleshooting instrument software and hardware. Also familiar with extraction, purification, and derivatization procedures for many compound classes from soil and plant material.

*Organic Chemistry*
Extensive experience with organic separations and purifications. I am comfortable working with volatile, flammable, and toxic chemicals. I have extensive experience with flash column chromatography, extraction from complex matrices, and method calibration.

**Relevant Coursework**

*University of Utah Summer Course in Stable Isotope Ecology and Biogeochemistry, June 2014*
The course is a multi-instructor lecture and lab short course offered to graduate students about the application of stable isotopes to environmental and ecological studies.

*Completed Graduate Coursework:* GEO200: Quantitative Geography, ETX 220/L Analysis of Toxicants, SSC 205 Field Studies of Soils in California Ecosystems, SSC 208 Plant Soil Interrelations, PLS 205 Experimental Design and Analysis, PLS 206 Multivariate Statistical Modeling, SSC 202 Environmental Soil Chemistry, CHE 226 Transition Metal Chemistry, SSC 120 Soil Genesis and Classification, SSC 111 Soil Microbiology, SSC 109 Soil Physics

*Completed Undergraduate Coursework:* CHEM 340/L Modern Analytical Chemistry, CHEM 313 Lab Techniques in Organic Chemistry, CHEM 330/L Inorganic Chemistry, CHEM 302/304/L Biochemistry, CHEM 211/213/L Organic Chemistry, CHEM 320/322 Physical Chemistry, GEO 200 Environmental Geology

**Honors/Awards**

Jastro Shields Research Award, 2015 - $3000
William and Linda Sullivan Graduate Research Fellowship, 2014 - $1240
Gamma Sigma Epsilon National Chemistry Honor Society

**Publications**

1. **Maxwell, T.M.**, Silva, L. C. R., Horwath, W.R., Dynamic and inertial controls on forest carbon-water relations. *In review (PNAS).*

2. **Maxwell, T.M.**, Silva, L. C. R., Horwath, W.R., Predictable oxygen isotope exchange between plant lipids and environmental water. *In review (JGR Biogeosciences).*

3. Jerszurki, D., Couvreur, V., **Maxwell, T.M.**, Silva, L. C. R., Matsumoto, N., Shackel, K., Souza, J. L. M., Hopmans, J. Impact of root growth and hydraulic condiuctance on water availability of young walnut trees (*Juglans regia L.)* under drought stress. *Sci. Hortic-Amsterdam.*

2. **Maxwell, T. M.**, Silva, L. C. R. & Horwath, W. R. Using multielemental isotopic analysis to decipher drought impacts and adaptive management in ancient agricultural systems. *Proc. Natl. Acad. Sci.* 2–3 (2014).

3. Culman, S.W., Haden, V.R., **Maxwell, T.M.**, Waterhouse, H., and William Horwath. 2014. Greenhouse Gas Mitigation Opportunities in California Agriculture: Review of California Cropland Emissions and Mitigation Potential. NI GGMOCA R 3. Durham, NC: Duke University.

**Presentations**

1. Maxwell, T.M., Silva, L.C.R., Horwath, W.R. (2017), Dynamic and inertial controls on forest carbon-water relations. Abstract PP31D-2311, presented at 2016 Fall Meeting, AGU, San Francisco, Calif., Dec. 12-16.
2. Maxwell, T.M., Silva, L.C.R., Horwath, W.R. (2016), Predictable oxygen isotope exchange of plant lipids improves our ability to understand hydrologic shifts and partition evapotranspiration across scales. Abstract PP31D-2311, presented at 2016 Fall Meeting, AGU, San Francisco, Calif., Dec. 12-16.
3. Maxwell, T.M., Silva, L.C.R., Horwath, W.R. (2016), Soil Properties Drive Carbon-Water Relations Across a Climate Gradient in Sierra Nevada Forests. Abstract 60315, presented at 2017 Annual Meeting, ESA, Ft. Lauderdale, FL, Aug. 7-12.
4. Maxwell, T.M., Silva, L.C.R., Horwath, W.R. (2015), Soil Properties Drive Changes in Water Use Efficiency Across a Climatic Gradient. Abstract 68367, presented at 2015 Fall Meeting, AGU, San Francisco, Calif., Dec. 14-18.
5. Maxwell, T.M., Silva, L.C.R., Horwath, W.R. (2014), Expanding lipid proxies to the next dimension: Developing methods for the measurement of oxygen isotopes in plant waxes, Abstract 30432, presented at 2014 Fall Meeting, AGU, San Francisco, Calif., Dec. 15-19.
6. Maxwell, T.M., Silva, L.C.R., Pedroso, G., Doane, T.A., Mukome, F.N.D., and Horwath, W.R. (2014), Quantifying Water Balance-Carbon Storage Relationships Using Oxygen

Isotope Ratios of Plant Lipids, Poster 27, presented at 2014 Soil's Role in Restoring Ecosystem Services Conference, Soil Science Society of America, Sacramento, Calif., Mar. 7-9.

**Teaching Experience**

*Teaching Assistant for Science and Society 5, Forests in Society, Spring 2014, 2015, 2016*
Professor: William Horwath
I teach 3x1 hour sessions each week including classroom introductions to various topics associated with the importance of forests as a natural resource. Additionally, taught lab components using field trips.

*Teaching Assistant for CHEM 313 Lab Techniques in Organic Chemistry, Fall, 2010*
Professor: Christina Geiger
I helped students with troubleshooting in using NMR and GC-MS to elucidate structures from their products. Additionally, I taught lab techniques in organic synthesis, such as basic reflux reactions, liquid extractions and use of TLC to determine if reactions had gone to completion.

*Teaching Assistant for CHEM 324, Principles of Physical Chemistry, Spring, 2010*
Professor: Kazushige Yokoyama
Offered support to students for studying and understanding material for tests.

*Lab Assistant for CHEM 119 Freshman Introductory Chemistry Lab, Fall, 2009*
Professor: James McGarrah
Helped explain set up processes for basic titrations and reactions. I helped to develop understanding of the principles of lab techniques and report writing skills.

**Extracurricular**

*Volunteer, Pacific Crest Trail Association, Winter 2016-Present*
I write scientific blog posts and aid in office work for the Pacific Crest Trail association. See link below.
http://www.pcta.org/2016/desert-survives-keys-natures-success-californias-vibrant-desertscape-38536/

*Mentor at Center for Land Based Learning SLEWS program, Spring 2013-Present*
I assist middle and high school programs to create compost buckets, harvest crops and understand the study of soil as a resource. We participate in ecological restoration projects at reclaimed wilderness sites through organizations partnered with the Center.