

**Mary E. Whelan**

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 Department of Environmental Sciences  
 Rutgers University  
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**Research Interests**

biosphere-atmosphere interactions, novel approaches for estimating land carbon uptake

**Education**

Ph.D., Geography, University of California, Berkeley 2013 Fall  
 Terrestrial-Atmospheric Exchange of Reduced Sulfur Compounds in Natural Ecosystems

B.A., honors, Chemistry / Political Science, New College of Florida 2004 Spring  
 the honors college of the Florida state university system

**Appointments**

*Assistant Professor* Fall 2019  
 Department of Environmental Sciences, Rutgers University

*Postdoctoral Researcher* 2017-2019  
 Department of Atmospheric and Ocean Sciences, UC Los Angeles

*NSF Postdoctoral Research Fellow* 2015-2017  
 NSF Atmospheric and Geospace Sciences, UC Merced & Carnegie Institute

*Postdoctoral Scholar* 2014-2017  
 Sierra Nevada Research Institute,  
 joint appointment with Lawrence Livermore National Laboratory

*Instructor/Researcher* 2013-2015  
 Future Scientists Improving the Public's Climate Literacy  
 Lawrence Hall of Science, NSF Geoscience Education Grant

*Graduate Student Researcher* 2007-2013  
 Atmospheric Biogeochemistry Laboratory, UC Berkeley

*Staff Chemist* 2005-2006  
 Dept of Chemical Ecology, Mote Marine Laboratory and Aquarium  
 Sarasota, FL

**Honors and Awards**

AGU Biogeosciences Caregiver Award 2018  
 Postdoctoral Innovation Award, Carnegie Institution for Science 2017  
 NSF Atmospheric and Geospace Sciences Postdoctoral Fellowship 2015-2017  
 Janet Witter Award for Environmental Science Research 2013  
 Outstanding Graduate Student Instructor Award 2012  
 Martin Foundation Research Funding Award 2012  
 UC Berkeley Graduate Division Summer Grant 2012  
 Graduate Student Association Community Leader Award 2010

**Grants Funded**

Soil exchange of carbonyl sulfide (COS): towards an independent proxy for terrestrial gross primary production (GPP) NSF Postdoctoral Fellowship, NSF Atmospheric and Geospace Sciences, 2015-2017

New Estimates of Terrestrial Carbon and Water Fluxes by Combining the Carbonyl Sulfide-Stomatal Conductance Tracer Framework and High Resolution Surface Data, NASA ECOSTRESS Science Team, 2020-2022.

**Scholarly Publications**

26. Villalba, G, **ME Whelan**, S Montzka, P Cameron-Smith, M Fischer, A Zumkehr, T Hilton, J Stinecipher, I Baker, RP Bambha, HA Michelsen, B LaFranchi, C Estruch, E Campbell: "Using carbonyl sulfide to track the urban biosphere signal" JGR-Atmosphere [in press].

25. Parazoo, N, K Bowman, J Liu, M Lee, L Kuai, B Baier, Y Shiga, I Baker, **ME Whelan**, S Feng, M Krol, K Davis: Covariation of airborne biogenic tracers (CO<sub>2</sub>, COS, and CO) supports stronger than expected growing season photosynthetic uptake in the southeastern US, *Global Biogeochemical Cycles*, [in review].

24. Hu, L, S Montzka, A Kaushik, A Andrews, C Sweeney, J Miller, I Baker, S Denning, E Campbell, Y Shiga, P Tans, C Siso, M Crotwell, K McKain, K Thoning, B Hall, I Vimont, J Elkins, **ME Whelan**, P Suntharalingam: Gross primary production over the North American Arctic and Boreal region inferred from atmospheric carbonyl sulfide measurements, *Proceedings of the National Academy of Sciences*, 2021.

23. Maignan, F, C Abadie, M Remaud, LMJ Kooijmans, K Kohonen, R Commane, R Wehr, JE Campbell, S Belviso, SA Montzka, N Raoult, U Seibt, YP Shiga, N Vuichard, **ME Whelan**, P Peylin: Carbonyl Sulfide: Comparing a Mechanistic Representation of the Vegetation Uptake in a Land Surface Model and the Leaf Relative Uptake Approach, *Biogeosciences Discussions*, 2021, <https://bg.copernicus.org/preprints/bg-2020-381/>.

**22. Whelan, ME**, LDL Anderegg, G Badgley, JE Campbell, R Commane, C Frankenberg, TW Hilton, L Kuai, N Parazoo, Y Shiga, Y Wang, J Worden: Two Scientific Communities Striving for a Common Cause: innovations in carbon cycle science, *Bulletin of the American Meteorological Society*, 2020.

21. Walker, AP, MG De Kauwe, A Bastos, S Belmecheri, K Georgiou, R Keeling, SM McMahon, BE Medlyn, DJP Moore, RJ Norby, S Zaehle, KJ Anderson-Teixeira, G Battipaglia, RJW Brienen, KG Cabugao, M Cailleret, JE Campbell, J Canadell, P Ciais, ME Craig, D Ellsworth, G Farquhar, S Fatichi, JB Fisher, D Frank, H Graven, L Gu, V Haverd, K Heilman, M Heimann, BA Hungate, CM Iversen, F Joos, M Jiang, TF Keenan, J Knauer, C Körner, VO Leshyk, S Leuzinger, Y Liu, N MacBean, Y Malhi, T McVicar, J Penuelas, J Pongratz, AS Powell, T Riutta, MEB Sabot, J Schleucher, S Sitch, WK Smith, B Sulman, B Taylor, C Terrer, MS Torn, K Treseder, AT Trugman, SE Trumbore, PJ van Mantgem, SL Voelker, **ME Whelan**, PA Zuidema: Integrating the evidence for a terrestrial carbon sink caused by increasing atmospheric CO<sub>2</sub>, *New Phytologist*, 2020, <https://doi.org/10.1111/nph.16866>.

**Scholarly Publications (continued)**

20. Berkelhammer, M, B Alsip, R Matamala, D Cook, **ME Whelan**, C Bernacchi, J Miller, T Meyers: Seasonal evolution of canopy stomatal conductance for a prairie and maize field in the midwestern US from continuous carbonyl sulfide fluxes, *GRL*, 2020.

19. Meredith, LK, J Ogée, K Boye, E Singer, L Wingate, C von Sperber, A Sengupta, **ME Whelan**, E Pang, M Keiluweit, N Brüggemann, JA Berry, and PV Welander: Soil exchange rates of COS and CO-18O differ with the diversity of microbial communities and their carbonic anhydrase enzymes, *ISME Journal*, 2019.

18. Rastogi, B, M Berkelhammer, S Wharton, **ME Whelan**, FC Meinzer, D Noone, and CJ Still: Ecosystem fluxes of carbonyl sulfide in an old-growth forest: temporal dynamics and responses to diffuse radiation and heat waves, *Biogeosciences*, 2018.

17. Meredith, LK, K Boye, C Youngerman, **ME Whelan**, J Ogée, J Sauze, L Wingate, Coupled biological and abiotic mechanisms driving carbonyl sulfide production in soils, *Soil Systems*, 2018.

16. Rastogi, B, M Berkelhammer, S Wharton, ME Whelan, MS Itter, JB Leen, MX Gupta, D Noone, CJ Still: Large uptake of atmospheric OCS observed at a moist old growth forest: Controls and implications for carbon cycle applications, *JGR: Biogeosciences*, 2018.

15. Zumkehr, A, TW Hilton, **ME Whelan**, S Smith, L Kuai, J Worden, JE Campbell, Global gridded anthropogenic emissions inventory of carbonyl sulfide, *Atmospheric Environment*, 2018.

14. **Whelan, ME**, ST Lennartz, TE Gimeno, R Wehr, G Wohlfahrt, Y Wang, L Kooijmans, TW Hilton, S Belviso, P Peylin, R Commane, W Sun, H Chen, L Kuai, I Mammarella, K Maseyk, M Berkelhammer, K-F Li, D Yakir, A Zumkehr, Y Katayama, J Ogée, FM Spielmann, F Kitz, B Rastogi, J Kesselmeier, J Marshall, K-M Erkkilä, L Wingate, LK Meredith, W He, R Bunk, T Launois, T Vesala, JA Schmidt, CG Fichot, U Seibt, S Saleska, ES Saltzman, SA Montzka, JA Berry, and JE Campbell: Reviews and Syntheses: Carbonyl Sulfide as a Multi-scale Tracer for Carbon and Water Cycles, *Biogeosciences*, 2018.

13. Campbell, JE, **ME Whelan**, JA Berry, TW Hilton, A Zumkehr, J Stinecipher, Y Lu, A Kornfeld, U Seibt, TE Dawsome, SA Montzka: Coastal redwood sink of atmospheric carbonyl sulfide provides a new biogeochemical tracer for coastal fog-mediated processes, *JGR-Biogeosciences*, 2017.

12. Hilton, TW, **ME Whelan**, A Zumkehr, S Kulkarni, JA Berry, I Baker, SA Montzka, C Sweeney, BR Miller, JE Campbell: Peak growing season gross uptake of carbon in North America is largest in the Midwest, USA, *Nature Climate Change*, 2017.

11. Campbell, JE, J Kesselmeier, D Yakir, JA Berry, P Peylin, S Belviso, T Vesala, K Maseyk, U Seibt, H Chen, **ME Whelan**, TW Hilton, SA Montzka, MB Berkelhammer, ST Lennartz, L Kuai, G Wohlfahrt, Y Wang, NJ Blake, DR Blake, J Stinecipher, I Baker, and S Sitch: Assessing a New Clue to How Much Carbon Plants Take Up, *EOS*, 2017.

10. Zumkehr, A, TW Hilton, **ME Whelan**, S Smith, JE Campbell: Gridded anthropogenic emissions inventory and atmospheric transport of carbonyl sulfide in the U.S., *JGR-Atmospheres*, 2017.

### **Scholarly Publications (continued)**

9. **Whelan, ME**, TW Hilton, JA Berry, M Berkelhammer, AR Desai, and JE Campbell: Carbonyl sulfide exchange in soils for better estimates of ecosystem carbon uptake, *Atmospheric Chemistry and Physics*, 2016.
8. **Whelan, ME** and RC Rhew: Reduced sulfur trace gas exchange between a seasonally dry grassland and the atmosphere, *Biogeochemistry*, 2016.
7. Campbell JE, **ME Whelan**, U Seibt, SJ Smith, JA Berry, and TW Hilton: Atmospheric carbonyl sulfide sources from anthropogenic activity: Implications for carbon cycle constraints, *Geophysical Research Letters*, 2015.
6. Hilton TW, A Zumkehr, S Kulkarni, JA Berry, **ME Whelan**, and JE Campbell: Large variability in ecosystem models explains uncertainty in a critical parameter for quantifying GPP with carbonyl sulphide, *Tellus B*, 2015.
5. **Whelan, ME** and RC Rhew: Carbonyl sulfide produced by abiotic thermal and photo-degradation of soil organic matter from wheat field substrate, *Journal of Geophysical Research Biogeosciences*, 2015.
4. Rhew, RC, **ME Whelan**, and D-H Min: Large methyl halide emissions from south Texas salt marshes, *Biogeosciences*, 11, 2014.
3. Khan, MAH, RC Rhew, K Zhou, and **ME Whelan**: Halogen biogeochemistry of invasive perennial pepperweed (*Lepidium latifolium*) in a peatland pasture, *Journal of Geophysical Research Biogeosciences*, 2013.
2. **Whelan, ME**, D-H Min, and RC Rhew: Salt marshes as a source of atmospheric carbonyl sulfide, *Atmospheric Environment*, 2013.
1. Khan, MAH, **ME Whelan**, and RC Rhew: Analysis of low concentration reduced sulfur compounds (RSCs) in air: storage issues and measurement by gas chromatography with sulfur chemiluminescence detection, *Talanta*, 2012.

### **Conference Abstracts**

**Since 2017, author on 17 AGU and EGU abstracts, presented 4.**

**Since 2015, organized a carbon cycle session at AGU**

### **Other Publications**

Whelan, Mary, "Zen and the art of the remote conference meeting", SEBS Newsroom, <https://sebsnjaesnews.rutgers.edu/2021/02/zen-and-the-art-of-the-remote-conference-meeting/>

Interview in "Rutgers Big Ideas: Earth 2100", <https://support.rutgers.edu/big-ideas/rutgers-earth-2100/>

**Service Activities****Science community**

2015 - Maintains communications for international collaboration of carbon cycle researchers using carbonyl sulfide (cosanova.org) since 2015  
Organizes annual Cosanova meetings at AGU and EGU since 2015

2020 Sept – Takes minutes for monthly Environmental Sciences faculty meeting

2021 March – Serves on EOAS steering committee

2021 Spring Served on search committee for Applied Climatologist

2020 Fall Served on search committee for Environmental Engineer Faculty

2020 Dec Organized a remote meeting with 80 researchers over 12 time zones

2019 Nov Assisted in organizing a meeting of 30 researchers in Obergurgl, Austria

**Peer Reviews**

Reviewed multiple manuscripts for Atmospheric Chemistry and Physics, Biogeosciences, and two dissertation proposals for Wageningen University  
Adhoc grant reviewer for the European Research Council (an ERC grant and a cruise proposal) and NSF Geosciences post-doctoral fellowship program

**Public outreach**

Subject specialist for NSF-sponsored Promoting Climate Literacy Project with the Lawrence Hall of Science. Developed course curriculum to teach undergraduate and graduate students how to carry out climate change outreach to informal (museum) audiences. This course will be taught at Rutgers with Janice McDonnell and Mary Nucci in Fall 2022.

Promoted a press release for the scholarly article “Two Scientific Communities Striving for a Common Cause: innovations in carbon cycle science”, covered in several news outlets:  
EurekaAlert, “How to get a handle on carbon dioxide uptake by plants”  
[https://www.eurekaalert.org/pub\\_releases/2020-09/ru-htg092120.php](https://www.eurekaalert.org/pub_releases/2020-09/ru-htg092120.php)  
Phys.org “Combining two tools would boost understanding of climate change”  
<https://phys.org/news/2020-09-combining-tools-boost-climate.html>  
Newswise: “How to get a handle on carbon dioxide uptake by plants”  
<https://www.newswise.com/articles/how-to-get-a-handle-on-carbon-dioxide-uptake-by-plants>  
Rutgers Today, “How to get a Handle on carbon dioxide uptake by plants”, <https://www.rutgers.edu/news/how-get-handle-carbon-dioxide-uptake-plants>  
And one WMBC-TV Interview

**Teaching Activities**

Fall 2019 None, Teaching release

Spring 2020 16:375:540, Atmospheric Chemistry,

Fall 2020 11:375:431, Special Topics in Environmental Sciences: The Terrestrial Carbon Cycle (newly created course)

Spring 2021 16:375:540, Atmospheric Chemistry/  
11:375:346 Introduction to Atmospheric Chemistry  
16:375:511 Journal Club in Environmental Sciences

Fall 2021 16:375:540, Atmospheric Chemistry/  
11:375:346 Introduction to Atmospheric Chemistry  
11:090:101 Byrne Seminar: Ecosystems and Climate Change (newly created honors course, co-taught with Benjamin Lintner)

Instructional development

August 2020 CTAAR Zoom integration with Canvas workshop  
 May 2020 CTAAR Course Development Workshop (3-day)

Student Mentorship

Callie McFadden, Atmospheric Sciences, main advisor  
 Kassia Symstad, Atmospheric Sciences, main advisor  
 Hua Shang, Ecology and Evolution, dissertation committee member  
 Rohi Muthyala, Geography, dissertation committee member  
 Matt Amato, Environmental Sciences, qualifying exam committee member

Invited Seminars

Rutgers Department of Ecology and Evolution <i>What do plants do all day?</i>	Apr 2021
University of Delaware Department of Geography <i>The Persistent Mystery of Land Carbon Uptake</i>	March 2021
Lamont Observatory <i>Unraveling the Carbon Cycle with Carbonyl Sulfide</i>	Oct 2020
NASA Goddard GISS Group <i>Tracers in the Trees: Innovations in Carbon Cycle Tools</i>	Mar 2020
NASA ECOSTRESS Science Team Meeting <i>New Estimates of Terrestrial Carbon and Water Fluxes</i>	Feb 2020
<b>Keynote talk:</b> 2 <sup>nd</sup> International OCS Workshop, Austria <i>What we don't know about OCS-specific uncertainties</i>	Nov 2019
ORNL Integrating Evidence for CO <sub>2</sub> Fertilization, Biosphere, AZ <i>Carbon fertilization from the ice core record</i>	Sept 2018
USGS Research Seminar Series, Golden, CO <i>The carbon cycle via gas tracers and satellites</i>	Mar 2018
Keck Institute for Space Studies, Pasadena, CA <i>Soil Carbonyl Sulfide Exchange: A Primer for Modelers</i>	Sept 2017
Carbonyl Sulfide Research Group Workshop, Hyytiälä, Finland <i>Many paths to GPP estimates</i>	Sept 2016
Lawrence Livermore National Laboratory <i>New approaches to evaluate land carbon models</i>	Aug 2016
Carnegie Institution for Science, Department of Plant Biology <i>Better estimates of ecosystem carbon uptake using measurements of COS exchange</i>	Feb 2015

**Fieldwork Experience**

<i>Big Sur, CA: Big Creek UC Reserve</i>	2015-2020
Design and construction of “Trees-not-Towers” gas sampling device, diurnal observation of trace gases from different canopy heights in a coastal redwood forest in collaboration with Todd Dawson of UC-Berkeley and Elliott Campbell of UC-Santa Cruz	
<i>Urbana, IL: Bondville FLUXNET site</i>	2015-2016
Deployment of re-designed soil auto-sampling chambers to assess agricultural soil COS fluxes in situ, supported by lab incubation experiments, in collaboration with Max Berkelhammer at the University of Illinois, Chicago.	
<i>Wind River, WA: Wind River Experimental Forest</i>	2015
Re-design of Li-Cor autosampling chambers for COS soil sampling, continuous surface COS fluxes in old growth forest, in collaboration with Chris Still and Bharat Rastogi of Oregon State University	
<i>Santa Cruz, CA: Wilder Ranch State Park</i>	2012-2014
Conducted monthly trace gas sampling campaigns on marine terraces in collaboration with USGS scientist Marjorie Schulz	
<i>Puerto Rico: Luquillo Experimental Forest</i>	2010
Design and construction of chemically inert chambers for reduced sulfur compound sampling, in situ rainforest soil trace gas measurements with Whendee Silver of University of California, Berkeley	
<i>Sacramento Bay Delta, CA: Sherman Island</i>	2009-2010
Conducted year-long monthly field campaign with 4 research assistants, chamber sampling halogenated compounds using isotope tracer techniques	
<i>Port Aransas, TX: Mollie Beattie Coastal Habitat Community</i>	2008-2009
Wetland sampling of sulfur and halogenated compounds with Dong-Ha Min of UT-Austin	
<i>Manhattan, KS: Konza Prairie Long Term Ecological Research Station</i>	2007
Diurnal sampling of halogenated gases using a chamber technique	
<i>Barrow, AK: Barrow Arctic Science Consortium</i>	2007
Construction and deployment of ebullition chambers, high frequency chamber sampling of methane with prototype laser, coastal permafrost erosion methane sampling with Joe von Fischer of Colorado State University	
<i>Gulf of Mexico: Mote Marine Laboratory and Aquarium</i>	2005-2006
Deep and surface water sampling, trace element sampling (e.g. Fe), in situ sample prep, boat piloting/trailing in inter-coastal waters	