

## Inke Forbrich

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### Education

PhD (Dr. rer. nat.), Landscape Ecology and Nature Conservation, University of Greifswald (Germany), Institute of Botany and Landscape Ecology, 2011. *Methane exchange of a boreal peatland – Integrated measurements and modeling on microform and ecosystem scale at the Salmisuo mire complex, Eastern Finland.*

M.Sc. (Diplom), Geography, University of Halle-Wittenberg (Germany), Institute of Geography, 2005.

### Professional Positions

Assistant Professor, Department of Environmental Sciences, University of Toledo, Toledo, OH (August 2022 – present)

Research Scientist, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA (April 2018 – August 2022)

Research Associate, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA (November 2015 – March 2018)

Postdoctoral Scientist, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA (November 2010 – October 2015)

Research Associate (Wiss. Mitarbeiter) and DBU fellow, University of Greifswald, Institute of Botany and Landscape Ecology (December 2005 - October 2010).

### Funding:

NSF – Division of Environmental Biology: “Vegetation assimilation as a source of mercury in a salt marsh ecosystem and implications for soil and tidal water exposures”, D. Obrist (PI), **I. Forbrich** (co-I). January 2021 – December 2023 (\$87,756).

DOE – Environmental System Science: “From tides to seasons: How cyclic tidal drivers and plant physiology interact to affect carbon cycling at the terrestrial-estuarine boundary”, **I. Forbrich** (PI), Z. Cardon (co-I), O’Meara, T (co-I), A. Giblin (co-I), B. Sulman (co-I). (\$999,104).

### Professional Service

- **Grant Review:** Ad hoc review for National Science Foundation (USA), NWO Division for Earth and Life Sciences (the Netherlands), Sea Grant (USA), Natural Sciences and Engineering Research Council of Canada. Panelist: NSF-Division of Environmental Biology 2020, NASA Carbon Monitoring System 2019, NASA Carbon Cycle Science 2021

- **Journal Review:** Global Biogeochemical Cycles, Agricultural and Forest Meteorology, Geophysical Research Letters, Mires and Peat, Plant and Soil, Wetlands, Ecosystems, Biogeosciences, PLOS One, Journal of Geophysical Research, Estuaries and Coast, New Phytologist, Atmospheric Environment
- **Associate Editor** AoB-Plants (since 2018)

## Publications

### *Published*

Cronin-Golomb, O., Harringmeyer, J. P., Weiser, M.W., Zhu X., Ghosh, N., Novak, A., **Forbrich, I.**, Fichot, C.G. (2022): Modeling benthic spectral solar irradiance (UV-visible) in a mesotidal estuary to inform seagrass habitat suitability. *Science of the Total Environment* 812.

Chu, H. Luo, X. Ouyang Z, Chan, W.S. Dengel, S., Biraud, S.C., Torn, M.S., Metzger, S., Kumar, J., Arain, M.A., Arkebauer, T.J., Baldocchi, D.D., Bernacchi, C., Billesbach, D., Black, T.A., Blanken, P.D., Bohrer, G., Bracho, R., Brown, S., Brunsell, N.A., Chen, J., Chen, X., Clark, K., Desai, A.R., Duman, T., Durden, D., Fares, S., **Forbrich, I.**, Gamon, J.A., Gough, C.M., Griffis, T., Helbig, M., Hollinger, D., Humphreys, E., Ikawa, H., Ju, Y., Knowles, J.F., Knox, S.H., Kobayashi, H., Kolb, T., Law, B., Lee, X., Litvak, M., Liu, H., Munger, J.W, Noormets, A., Novick, K., Oberbauer, S.F., Oechel, W., Oikawa, P., Papuga, S.A., Pendall, E., Prajapati, P., Prueger, J., Quinton, W.L., Richardson, A.D., Russell, E.S., Scott, R.L., Starr, G., Staebler, R., Stoy, P.C., Stuart-Haëntjens, E., Sonnentag, O., Sullivan, R.C., Suyker, A., Ueyama, M., Vargas, R., Wood, J.D., Zona, D. (2021): Representativeness of Eddy-Covariance flux footprints for areas surrounding AmeriFlux sites, *Agricultural and Forest Meteorology*, Volumes 301–302.

Helbig, M., Waddington, J., Alekseychik, A., Amiro, B., Aurela, M., Barr, A., Black, A., Blanken, P., Carey, S., Chen, J., Chi, J., Desai, A., Dunn, A., Euskirchen, E., Friborg, T., Flanagan, L., **Forbrich, I.**, Grelle, A., Harder, S., Heliasz, M., Humphreys, E., Ikawa, H., Iwata, H., Isabelle, P.-E., Jassal, R., Kurbatova, J., Korkiakoski, M., Kutzbach, L., Ohta, T., Lindroth, A., Löfvenius, M., Lohila, A., Maximov, T., Mammarella, I., Marsh, P., Melton, J., Moore, P., Nadeau, D., Nicholls, E., Nilsson, M.B., Peichl, M., Petrone, R., Petrov, R., Prokushkin, A., Quinton, W., Roulet, N., Reed, D., Runkle, B., Sonnentag, O., Strachan, I., Taillardat, P., Tuittila, E.-S., Tuovinen, J.-P., Turner, J., Ueyama, M., Varlagin, A., Wilmking, M., Wofsy, S., Zyrianov, V. (2020): Increasing contribution of peatlands to boreal evapotranspiration in a warming climate. *Nature Climate Change*, 10, 555–560.

Feagin, R. A., **Forbrich, I.**, Huff, T. P., Barr, J. G., Ruiz-Plancarte, J., Fuentes, J. D., Najjar, R.G., Vargas, R., Vázquez-Lule, A., Windham-Myers, L., Kroeger, K., Ward, E.J., Moore, G.W., Leclerc, M., Krauss, K.W., Stagg, C.L., Alber, M., Knox, S.H., Schaefer, K.V.R., Bianchi, T.S., Hutchings, J.A., Nahrawi, H., Noormets, A., Mitra, B., Jaimes, A., Hinson, A.L., Bergamaschi, B., King, J.S., Miao, G. (2020). Tidal wetland gross primary production across the continental United States, 2000–2019. *Global Biogeochemical Cycles*, 34, e2019GB006349.

Howard, E. M, **Forbrich, I.**, Stanley, R.H.R., Giblin, A.E., Lott, D.E., Cahill, K.L. (2018): Using Noble Gases to Compare Parameterizations of Air-Water Gas Exchange and to Constrain

Oxygen Losses by Ebullition in a Shallow Aquatic Environment. *Journal of Geophysical Research – Biogeosciences*, 123(9), 2711-2726.

**Forbrich, I.**, A. E. Giblin, C.S. Hopkinson (2018): Constraining Marsh Carbon Budgets Using Long-Term C Burial and Contemporary Atmospheric CO<sub>2</sub> Fluxes. *Journal of Geophysical Research – Biogeosciences* 123(3), 867-878.

Spivak, A., Gosselin, C., Howard, E., Mariotti, G., **Forbrich, I.**, Stanley, R., Sylva, S.P. (2017): Shallow ponds are heterogeneous habitats within a temperate salt marsh ecosystem. *Journal of Geophysical Research – Biogeosciences* 122, 1371–1384.

**Forbrich, I.** & A. E. Giblin (2015): Marsh-atmosphere CO<sub>2</sub> exchange in a New England salt marsh. *Journal of Geophysical Research – Biogeosciences* 120(9), 1825-1838.

Gažovič, M., **Forbrich, I.**, Jager, D.F., Kutzbach, L., Wille, C., Wilmking, M. (2013): Hydrology driven ecosystem respiration determines the carbon balance of a boreal peatland. *Science of the Total Environment* 463-464:675-682.

Koebisch, F., Glatzel, S., Hofmann, J., **Forbrich, I.**, Jurasinski, G. (2013): CO<sub>2</sub> exchange of a temperate fen during the conversion from moderately rewetting to flooding. *Journal of Geophysical Research – Biogeosciences* 118(2): 940-950.

**Forbrich I.**, Kutzbach L., Wille C., Becker T., Wu J., Wilmking M. (2011): Cross-evaluation of measurements of peatland methane emissions on microform and ecosystem scales using high-resolution landcover classification and source weight modelling. *Agricultural and Forest Meteorology* 151(7): 864-874.

**Forbrich I.**, Kutzbach L., Hormann A., Wilmking M. (2010): A comparison of linear and exponential regression for estimating diffusive CH<sub>4</sub> fluxes by closed-chambers in peatlands. *Soil Biology and Biochemistry* 42(3): 507-515.

Becker T., Kutzbach L., **Forbrich I.**, Schneider J., Jager D., Thees B., Wilmking M. (2008): Do we miss the hot spots? – The use of very high resolution aerial photographs to quantify carbon fluxes in peatlands. *Biogeosciences* 5: 1387-1393.

Glatzel S., **Forbrich I.**, Kruger C., Lemke S., Gerold G. (2008): Small scale controls of greenhouse gas release under elevated N deposition rates in a restoring peat bog in NW Germany. *Biogeosciences* 5: 925-935.

Beylich A.A., Schmidt K.-H., Neuvonen S., **Forbrich I.**, Schildt A. (2006): Solute fluxes in the Kidisjoki catchment, subarctic Finnish Lapland. *Geomorphologie: relief, processus, environnement* 3: 205-212.

## Advising

### Undergraduates:

Nick Beltramini, SES student 2021, *The Role of Alosa pseudoharengus in Methylmercury Bioaccumulation within Cape Cod Kettle Ponds*, Oberlin College

Marcus Mekhail, SES student 2021, *The contribution of inorganic mercury loading in Cape Cod's kettle ponds to the bioaccumulation of methylmercury in higher trophic level fish*, Colgate University

Madison Sachs, REU student 2021, *Mercury stocks in different salt marsh habitats*, University of Massachusetts - Lowell

Gyujong Yoo, *Investigation of pond metabolism in temperate salt marshes of Massachusetts*, B.S. Environmental Geology, Boston College 2018 (co-supervised with Tara Pisani Gareau)

Gyujong Yoo, REU student 2017, *Carbon dynamics in temperate salt marsh ponds*, Boston College

Jonathan Whitcomb, REU student 2014, *DIC transport in Plum Island Sound*, Clarkson University

Joy Semien, Independent research project within Semester in Environmental Sciences 2013, *Carbon storages in marshes*, Dillard University

Ana Gordon, REU student 2012, *Temporal Carbon Flux Dynamics in New England Salt Marsh Ponds*, Syracuse University

Brittany Boyke, REU student 2011, *Vegetation indices as proxies for aboveground biomass in salt marsh ecosystems*, Louisiana State University

#### Diploma students:

Ulrike Wolf, University of Gottingen, 2009

Annabell Hormann, University of Potsdam, 2008

Carolyn Schafer, University of Greifswald, 2007

Peter Schreiber, University of Dresden, 2007.

#### PhD students:

Andrew Hill, University of Delaware, on-going: Examination of vegetation driven carbon dynamics in a Tidal Salt Marsh.

#### **Invited Seminar talks**

- 'Coastal Wetlands in a Changing World: Sea-Level Rise, Sediment Supply, and Carbon Cycling Determine the Future of Salt Marsh Ecosystems', **University of Massachusetts-Lowell**, March 2021
- 'Understanding contemporary carbon cycling in tidal salt marshes – from ecosystem to continental scales', **Marine Biological Laboratory**, January 2021
- 'Using eddy covariance measurements to improve our understanding of the carbon cycle in tidal salt marshes', **University of Muenster**, August 2021

- 'Long-term ecological research in Plum Island marshes', **MIT Haystack Observatory**, April 2019
- 'Carbon cycling in a New England salt marsh', **Ohio State University**, September 2017
- 'Carbon cycling in a New England salt marsh', **Louisiana Universities Marine Consortium (LUMCON)**, February 2017
- 'Carbon cycling in a New England salt marsh', **University of Hamburg**, January 2017
- 'Carbon cycling in a New England salt marsh', **University of Connecticut**, October 2016
- 'Carbon cycling in a New England salt marsh', **Horn Point Laboratory, University of Maryland Center for Environmental Science**, June 2016
- 'Carbon cycling in a New England salt marsh', **Centre for Material and Coastal Research**, Geesthacht, Germany, January 2016.
- 'Upscaling of methane emissions in a boreal peatland – measurements and modeling.', **University of Massachusetts Lowell**, February 2012
- 'Upscaling of methane emissions in a boreal peatland – measurements and modeling.', **Marine Biological Laboratory**, February 2012

## References

Dr. Anne E. Giblin  
 Marine Biological Laboratory,  
 Senior Scientist,  
 email: [aqiblin@mbl.edu](mailto:aqiblin@mbl.edu)

Dr. Nathaniel B. Weston  
 Villanova University,  
 Associate Professor  
 email: [nathaniel.weston@villanova.edu](mailto:nathaniel.weston@villanova.edu)

Dr. Deepak Mishra  
 University of Georgia,  
 Professor  
 email: [dmishra@uga.edu](mailto:dmishra@uga.edu)

## Conference contributions

### *Oral Presentations*

**Forbrich, I.**, Weston, N., Tamborski, J.: Temporal and spatial variability in carbon fluxes— how can we best estimate the contemporary marsh NECB? CERF bi-annual meeting, November 2021

LaFond-Hudson, S., Sulman, B., O'Meara, T., **Forbrich, I.**, Cardon, Z.: Modeling impacts of salinity variation and tidal inundation on salt marsh vegetation carbon uptake and sequestration. ASLO 2021 Aquatic Sciences Meeting, June 2021.

**Forbrich, I.**, Weston, N., Alizad, K., Giblin, A.E.: Will the transition from high marsh to low marsh alter carbon sequestration, nutrient removal, or other ecosystems services? NEERS fall meeting, October 2020

Feagin, R. A., **Forbrich, I.**, Huff, T. P., Barr, J. G., Ruiz-Plancarte, J., Fuentes, J. D., Najjar, R.G., Vargas, R., Vázquez-Lule, A., Windham-Myers, L., Kroeger, K., Ward, E.J., Moore, G.W., Leclerc, M., Krauss, K.W., Stagg, C.L., Alber, M., Knox, S.H., Schaefer, K.V.R., Bianchi, T.S., Hutchings, J.A., Nahrawi, H., Noormets, A., Mitra, B., Jaimes, A., Hinson, A.L., Bergamaschi, B., King, J.S., Miao, G.: Tidal wetland gross primary production across the continental United States, 2000–2019. Ocean Science Meeting, February 2020.

**Forbrich, I.**, K. Xu, S. Metzger: Mapping tidal wetland CO<sub>2</sub> surface-atmosphere exchange with environmental response functions. CERF bi-annual meeting, November 2019

**Forbrich, I.**, A. E. Giblin, C.S. Hopkinson: Constraining Marsh Carbon Budgets Using Long-Term C Burial and Contemporary Atmospheric CO<sub>2</sub> Fluxes. NEERS spring meeting, April 2018

**Forbrich, I.**, H. Nahrawi, M. Leclerc, J. O'Donnell, D. Mishra, A. E. Giblin, M. Alber, A. D. Vázquez-Lule, R. Vargas, M. Fogarty, J. Edson: Variation in salt marsh CO<sub>2</sub> fluxes across a latitudinal gradient along the US Atlantic Coast. AGU Fall meeting, December 2017

**Forbrich, I.**, H. Nahrawi, M. Leclerc, J. O'Donnell, D. Mishra, A. E. Giblin, M. Alber, A. D. Vázquez-Lule, R. Vargas, M. Fogarty, J. Edson: Variation in salt marsh CO<sub>2</sub> fluxes across a latitudinal gradient along the US Atlantic Coast. 24th Biennial Conference of the Coastal and Estuarine Research Federation, November 2017

**Forbrich, I.** (*Invited*): Inter-annual variation in marsh CO<sub>2</sub> exchange. 2017 OCB Summer Workshop. Woods Hole, June 26-29, 2017

**Forbrich, I.**, A. E. Giblin, J.T. Morris, C.S. Hopkinson: Effects of drought on marsh CO<sub>2</sub> exchange. NEERS Fall Meeting, October 20-22, Block Island, Rhode Island. 2016

**Forbrich, I.**, A. E. Giblin: Marsh carbon cycling: Do high and low marsh respond similarly to sea level rise? 23rd Biennial Conference of the Coastal and Estuarine Research Federation, Portland, November 8-12 2015.

**Forbrich, I.**, Whitcomb, J., A. E. Giblin: Whole-System Carbon Cycling in a New England Salt Marsh: Links between Marsh Productivity and Carbon Export. SWS Annual Meeting. May 31 – June 4 2015

Kelsey, S. **Forbrich, I.**, Bond, S.K., Giblin, A.E., Hopkinson, C.S.: Using water level loggers and nutrient porewater concentrations to link contribution of marsh to estuarine water. NEERS Fall Meeting. October 16-18 2014

Whitcomb, J. and **Forbrich, I.**: Measuring dissolved inorganic carbon transport in the Plum Island Estuary. NEERS Fall Meeting. October 16-18 2014

**Forbrich, I.**; Giblin, A. E.; Ecosystem-scale NEE measurements in a New England salt marsh. 1st Joint Aquatic Sciences Meeting, Portland. May 18-23 2014.

**Forbrich I.**, Giblin A.E.: Using broad-band NDVI to track tidal submergence patterns in ecosystem-scale NEE measurements in a New England salt marsh. 2nd Conference on Atmospheric Biogeosciences, Portland. May 12-15 2014.

**Forbrich I.**, Giblin A.E.: Whole ecosystem estimates of primary production in a New England salt marsh. 22nd Biennial Conference of the Coastal and Estuarine Research Federation, San Diego. November 3-7 2013

**Forbrich I.**, Kutzbach, L., Becker, T., Gazovic, M., Wilmking, M. (*Invited*): Methane emissions in a boreal peatland and its influence on the net ecosystem carbon budget. Ecosummit, Columbus. October 1-5 2012

Becker, T., **Forbrich I.**, Schneider, J., Sievers, J., Gazovic, M., Soerensen, L.L., Kutzbach, L., Wilmking, M.: The use of high resolution aerial photography to estimate source area contributions to ecosystem fluxes. BIOEGEOMON, Northport. July 15-20 2012

**Forbrich I.**, Wania, R., Saarnio, S., Schäfer, C., Kutzbach, L., Wilmking, M.: Interannual variation of methane emissions in a boreal peatland - cross-evaluation of chamber measurements (7 years) and model results (LPJ-WHyMe). EGU General Assembly, Vienna, May 2-7 2010

**Forbrich I.**, Gazovic, M., Kutzbach, L., Wille, C., Wolf, U., Becker, T., Schreiber, P., Wilmking, M.: Upscaling methane emissions from plot- to ecosystem-scale in two boreal peatlands. EGU General Assembly, Vienna, May 2-7 2010

### ***Poster presentations***

Oikawa, P.Y., Holmquist, J.R., Megonigal, P., Russell, S., Knox, S., Najarro, M., Windham-Myers, L., Stuart-Haentjens, E.J., McNicol, G., Needelman, B., Sihi, D., **Forbrich, I.**, Tang, J., Bridgman, S.D., Lonneman, M., Wolfe, J., Fluet-Chouinard, E., Arias Ortiz, A.: United States Methane Budget from Tidal Wetlands: Developing an Open-source Database of Methane Measurements and Process-based Models. AGU fall meeting 2020.

**Forbrich, I.**, A.E. Giblin: The influence of rainfall extremes on salt marsh net carbon uptake: evidence from one dry and one wet growing season. AGU fall meeting 2019.

**Forbrich, I.**, Xu, K., Metzger, S. : Can we map CO<sub>2</sub> fluxes in tidal wetlands with environmental response functions? AGU fall meeting 2018.

Schenck, R.M., Gosselin, K., Yoo, G., **Forbrich I.**, Spivak, A.C.: Sediment respiration and sulfur cycling in salt marsh ponds. 24nd Biennial Conference of the Coastal and Estuarine Research Federation, November 2017

Kelsey, S. **Forbrich, I.**, Messerschmidt, T., Giblin, A.E., Hopkinson, C.S.: Calculating marsh porewater nutrient and DOC contributions to the surrounding estuary using water level loggers. 24nd Biennial Conference of the Coastal and Estuarine Research Federation, November 2017

**Forbrich, I.**, Nahrawi, H.B., Wang, S., Leclerc, M., Hopkinson, C.S., Giblin, A.E., Alber, M., Cai, W.-J. : Carbon cycling in salt marsh dominated estuaries along the US Atlantic coast, EGU General Assembly 2016.

Semien, J.S., **Forbrich, I.**, Giblin, A.E.: Estimating sediment carbon accumulation rates in the Plum Island Estuary (MA) salt marsh. 99<sup>th</sup> ESA Annual Meeting, Sacramento, August 10-15 2014

Koebisch, F., Glatzel, S., Hofmann, J., **Forbrich I.**, Jurasinski, G.: Conversion of a moderately rewetted fen to a shallow lake - implications for net CO<sub>2</sub> exchange. EGU General Assembly, 7-12 April 2013, Vienna, Austria.

Gordon, A.R., **Forbrich I.**, Giblin, A.E.: Temporal Carbon Flux Dynamics in New England Salt Marsh Ponds. NEERS Fall Meeting, 11-13 October, Block Island.

**Forbrich I.**, Giblin, A.E.: Ecosystem-atmosphere interactions in a New England salt marsh (PIE LTER). LTER ASM, 10-15 September 2012, Estes Park

**Forbrich I.**, Kutzbach L., Jager D., Wille C., Wu J., Becker T., Wilmking M.: A year in the carbon cycle of a boreal peatland. Peatlands in the Global Carbon Cycle, 25-30 September 2009, Prague.

**Forbrich I.**, Köhler A.-K., Wolf U., Schreiber P., Laine A., Kutzbach L., Kiely G., Wilmking M.: CH<sub>4</sub> emissions from peatlands under oceanic and continental climate. Peatlands in the Global Carbon Cycle, 25-30 September 2009, Prague.

Wolf, U., Jungkunst, H., **Forbrich I.**, Schneider, J., Schreiber, P., Wilmking, M., Kutzbach, L. 2009: Exceptionally high summer methane emissions from a boreal peatland ecosystem in the Republic of Komi, Russia. Peatlands in the Global Carbon Cycle, 25-30 September 2009, Prague.

**Forbrich I.**, Kutzbach L., Wille C., Wu J., Becker T., Wilmking M. 2009: Spatiotemporal analysis of methane emission in a boreal peatland during one growing season as measured by eddy covariance. EGU General Assembly, 19-24 April, Vienna.

Schreiber P., **Forbrich I.**, Kutzbach L., Hormann A., Wolf U., Miglovec M., Pihlatie M., Christiansen J.R., Wilmking M. 2009: A comparison of linear and exponential regression for estimating diffusive methane fluxes by closed chamber – results from laboratory and field campaigns. EGU General Assembly, 19-24 April, Vienna.

Schreiber P., Kutzbach L., **Forbrich I.**, Gazovic M., Wilmking M. 2009: Snow and ice properties and melt water dynamics control the methane flux during early spring in two boreal mires in north Eastern Europe. EGU General Assembly, 19- 24 April, Vienna.



Glatzel, S., **Forbrich I.**, Krüger, C. 2007: Drought control of methane and nitrous oxide dynamics in a restored peat bog in NW-Germany. Carbon in Peatlands: State of the Art and Future Research, 15-18 April 2007, Wageningen, the Netherlands.

Becker Th., **Forbrich I.**, Schneider J., Jager D., Thees B., Kutzbach L., Wilmking M. 2007: Do we miss the hot spot? - The use of very high resolution imagery to quantify carbon fluxes in peatlands. Carbon in Peatlands: State of the Art and Future Research, 15-18 April 2007, Wageningen, the Netherlands.

Schreiber P., **Forbrich I.**, Wilmking M., Kutzbach L. (2007): How Does Snow Melt Affect CH<sub>4</sub> Emissions? - CH<sub>4</sub> fluxes during the spring thaw period in a boreal peatland in North Karelia. Carbon in Peatlands: State of the Art and Future Research, 15-18 April 2007, Wageningen, Netherlands.