Appendix A

1. Peer Reviewers' Curricula Vitae

1. Energy

1.1.1. Dr. Gregg Marland

GREGG MARLAND

Department of Geological and Environmental Sciences and Research Institute for Environment, Energy, and Economics
Appalachian State University
Boone, NC 28608-2131
828-262-6161
marlandg@appstate.edu

Professional Preparation
Virginia Polytechnic Institute (Blacksburg, VA), General Science, B.S. 1964.
Washington University (St. Louis, MO), Geology, 1964-1966.
University of Minnesota (Minneapolis, MN), Geology, Ph.D. 1972.

Appointments
Research Professor, Appalachian State University, 2011- present, Boone, NC
Distinguished R & D Staff, Oak Ridge National Laboratory, 2000-2011, Oak Ridge, TN
Staff Scientist, Oak Ridge National Laboratory, 1987-2000, Oak Ridge, TN
Senior Research Scholar, International Inst. for Applied Systems Analysis, 2007-2008
Laxenburg, Austria
Guest Professor, Mid Sweden University, 2005-2006, Östersund, Sweden
Staff Scientist, Inst. for Energy Analysis, Oak Ridge Assoc. Univ., 1975-1987, O.R., TN
Assistant Professor of Geology, Indiana State University, 1970-1975, Terre Haute, IN

Products – a sample from over 400 published papers

Marland, G., T. Buchholz, and T. Kowalczyk, 2013. Accounting for carbon dioxide emissions: the context and stakeholders matter, Journal of Industrial Ecology 17(1) 340-342.

Salk, C., M. Jonas, and G. Marland, 2013. Strict accounting with flexible implementation: the first order of business in the next climate treaty, Carbon Management 4(3): 253-256.

Shirley, K., J. Cantrell, K. Kiser, E. Marland, and G. Marland, 2014. Valuing uncertainty part II: the impact of risk charges in dealing with time issues in lifecycle analysis and GHG accounting, Carbon Management 5(1) 43-53.

Marland, G., T. L. Cherry, and H. S. Neufeld, 2014. GDP: no one metric can rule them all, Nature 507: 40.

Singer, A. M., M. Branham, M. G. Hutchins, J. Welker, D. L. Woodard, C. A. Badurek, T. Ruseva, E. Marland, and G. Marland, 2014. The role of CO_2 emissions from large point sources in emissions totals, responsibility, and policy, Environmental Science and Policy 44: 190-200.

Jonas, M., G. Marland, V. Krey, F. Wagner, and Z. Nahorski, 2014. Uncertainty in an emissions constrained world, Climatic Change 124: 459-476.

Buchholz, T., S. Prisley, G. Marland, C. Canham, and N. Sampson, 2014. Uncertainty in projecting emissions from bioenergy, Nature Climate Change 4:1045-1047.

Marland, G., T. Kowalczyk, and E. Marland, 2015. Carbon accounting: issues of scale. Journal of Industrial Ecology, Feb, 2015.

Woodard, D., M. Branham, G. Buckingham, S. Hogue, M. Hutchins, R. Gosky, G.

Marland, and E. Marland, 2015. A spatial uncertainty metric for anthropogenic CO_2 emissions. Greenhouse Gas Measurement and Management, DOI: 10.1080/20430779.2014.1000793.

Dale, V.H., K.L. Kline, G. Marland, and R.A. Miner, 2015. Ecological objectives can be achieved with wood-derived bioenergy. Frontiers in Ecology and the Environment 13: 297-299.

Jonas, M., R. Bun, Z. Nahorski, G. Marland, M. Gusti, and O. Danylo, 2019. Quantifying greenhouse gas emissions, Mitigation and Adaptation Strategies for Global Change 24:839-852.

Gilfillan, D., G. Marland, T. Boden, R. J. Andres, 2020. Global, Regional, and National Fossil-Fuel CO_2 Emissions: 1751-2017 CDIAC-FF, Research Institute for Environment, Energy, and Economics, Appalachian State University. DOI: 10.15485/1712447.

Synergistic Activities

National Research Council, Committee on Methods for Estimating Greenhouse Gas Emissions, 2008-2010

U.S. Interagency Carbon Cycle Science Working Group, co-chair, 2008-2011

IPCC (Intergovernmental Panel on Climate Change):

- 2006 Guidelines for National Emissions Inventories, lead author
- Special Report on Carbon Capture and Storage, lead author
- First Assessment Report, contributing author on Radiative Forcing of Climate
- Second Assessment Report, lead author on Energy Primer
- Third Assessment Report, lead author on Land-use Change and Forestry
- Special Report on Land Use, Land-Use Change and Forestry, lead author
- Fifth Assessment Report, contributing author on Carbon and other Biogeochemical Cycles

National Academy of Sciences: Policy Implications of Greenhouse Warming, panel member, 1990-1991

International Energy Agency/Bioenergy Agreement: U.S. team leader on Task 25 – biomass fuels and greenhouse gases, 1995-2001.

Global Carbon Project, contributor, 2015-present

Collaborators and Other Affiliations

Ciais, P., A. J. Dolman, A. Bombelli, R. Duren, A. Peregon, P. J. Rayner, C. Miller, and 51 others including G. Marland, 2014. Current systematic carbon cycle observations and needs for implementing a policy-relevant carbon observing system. Biogeosciences DOI: 10.5194/bg-11-3547/2014.

U.S. Department of Agriculture, 2014. Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory, contributing authors include G. Marland.

Le Quéré, C., and 60 others including G. Marland, 2015. Global carbon budget 2014, Earth System Science Data Discussions 7: 47-85.

Liu, Z., and 23 others including G. Marland, 2015. Reduced carbon emissions estimates from fossil fuel combustion and cement production in China. Nature 524: 335-338.

US EPA, consultant on accounting for emissions from biomass fuels, 2010-2014

4th International Workshop on Uncertainty in Greenhouse Gas Inventories, 2015, Poland, scientific committee

Others collaborators include Thomas Buchholz, Virginia Dale and Keith Kline (Oak Ridge National Laboratory), Matthias Jonas (IIASA), and Steve Prisley (NCASI).

Thesis advisees and postgraduate scholars sponsored

Robert Andres (ORNL, retired), Tris West (NW National Laboratory)

1.1.2. Dr. Kevin Gurney

Kevin Robert Gurney

School of Informatics, Computing, and Cyber Systems | Northern Arizona University
1295 S. Knoles Dr., Building 90, room 320 | Flagstaff, AZ 86011
e-mail: kevin.gurney@nau.edu

EDUCATION

Ph.D.	2004 – Ecology, Colorado State University
M.P.P	1996 – Public Policy, University of California, Berkeley
S.M.	1990 – Meteorology, Massachusetts Institute of Technology
B.A.	1986 – Environmental Physics, University of California, Berkeley

PROFESSIONAL EXPERIENCE

Professor, School of Informatics, Computing and Cyber Systems, Northern AZ Univ, Aug 2018-present
Professor, Honors Faculty, School of Life Sciences, Arizona State University, Aug 2017 – Aug 2018
Associate Professor, Honors Faculty, School of Life Sciences, Arizona State University, Aug 2010 – Aug 2017
Affiliated Faculty, School of Geographical Sciences and Urban Planning, Mar 2013 – Aug 2018
Graduate Faculty, School of Sustainability, Arizona State University, Jan 2013 – Aug 2018
Senior Sustainability Scientist, Global Institute of Sustainability, Arizona State Univ, Aug 2010 – Aug 2018
Associate Professor, Dept of Earth and Atmos Sci & Dept of Agronomy, Purdue University, Aug 2009 – Aug 2010
Assistant Professor, Dept of Earth and Atmos Sci & Dept of Agronomy, Purdue University, Aug 2005 – Aug 2009
Associate Director, Purdue Climate Change Research Center, Purdue University, Aug 2005 – Aug 2008
Research Scientist I, Department of Atmospheric Science, Colorado State University, July 1998 – Aug 2005
Staff Research Associate, Bren School of Env. Sci and Mngmnt, Univ of Ca, Santa Barbara, Apr 97 – June 98
Senior Scientist, Institute for Energy and Environmental Research, Sept 1992 – Jan 1997
Research Associate, Atmospheric and Environmental Research, Inc., Feb 1992 – Sept 1992
Research Associate, Tellus Institute, February 1990 - October 1991
Research Assistant, National Oceanic and Atmospheric Administration, Summer 1988
Research Intern, Environmental Sciences Division, Lawrence Livermore National Lab, 11/86- 9/87
Student Assistant, Atmospheric Aerosol Research Group, Lawrence Berkeley National Lab, 2/85-10/86

HONORS AND AWARDS

Fulbright U.S. Scholar award, 2019
IPCC Lead Author, 6th Assessment Report
Nominated for AGU's Macelwane Medal 2014
Sigma Xi Young Investigator's Award 2010
NSF CAREER Award 2009
Named 2007 "Air Conservationist of the Year", from the Indiana Wildlife Federation

UNIVERSITY SERVICE

Graduate Degree Program in Ecology executive committee 1999-2000
Graduate Degree Program in Ecology, Front Range Student Ecology Symposium Chairman 1999-2000
Undergraduate Programs Committee, ASU: 2013 - 2017
ASU Safety Committee: 2010 – 2013, 2017 - 2018
ASU Diversity Committee, Purdue University, Aug 2005 – Aug 2010
NAU CEIAS Promotion & Tenure Committee, November 2020 – present
NAU SICCS Graduate Recruiting Committee, September 2019 – present
NAU CEIAS COFS redesign committee, September 2019 - present

OTHER NATIONAL OR INTERNATIONAL PROFESSIONAL SERVICE

IPCC contributing author/reviewer 2nd through 6th Assessments (IPCC was organizational co-recipient of 2007 Nobel Peace Prize)

Chapter co-lead State of the Carbon Cycle Report 2, June 2016 - present

World Meteorological Organization, GURME Science Advisory Group, 2019-present

World Meteorological Organization, IG3IS Science Advisory Group, 2017-present

Integrated Greenhouse Gas Information System (IG3IS) Committee Member, 2016 - present

Carbon cycle science steering working group (CCSWG) to Carbon science interagency working group (CCIWG)

Global Carbon Program Science Steering Committee: 2008 - 2013

NOAA Global Carbon Cycle Scientific Steering Committee, 2006 - present

Carbon Management, Editorial Board, 2009 - present

MCI Task Force Committee member, 2005 – present

Carbon Balance and Management, Editorial Board member, 2006 - present

Carbon Dioxide Information Analysis Center, external advisory committee member, 2007 - present

United Nations Framework Convention on Climate Change attendee/advisor 1996-present

PROFESSIONAL SOCIETY

American Geophysical Union member since 1990

Sigma Xi member since 2000

Phi Kappa Phi lifetime member since 2004

Ecological Society of America member since 2004

PEER-REVIEWED PUBLICATIONS

2021

146. Pitt, J.R., I. Lopez-Coto, K.D. Hainy, J. Tomlin, R. Kaeser, T. Jayarathne, B.H. Stirm, C.R. Floerchinger, C.P. Loughner, r. Commane, C.K. Gately, L.R. Hutyra, **K.R. Gurney**, G.S. Roest, J. Liang, S. Gourdji, A. Karion, J.R. Whetstone, P.B. Shepson (2021) New York City Greenhouse Gas Emissions Estimated with Inverse Modelling of Aircraft Observations, *under review at Env. Sci. & Tech.*

145. Luqman, M., P.J. Rayner, **K.R. Gurney** (2021) On the rol of urbanisation in driving CO_2 emissions, *under review at Env. Sci. & Tech.*

144. **Gurney, K.R.**, S. Kilkis, K. Seto, S. Lwasa, D. Moran, K. Riahi, M. Keller, P. Rayner, M. Luqman (2021) Greenhouse Gas Emissions from Global Cities Under SSP/RCP Scenarios, 1990 to 2100, *under review at Global Environmental Change.*

143. Yadav, V., S. Ghosh, K. Mueller, A. Karion, G. Roest, S. Gourdji, I. Lopez-Coto, **K.R. Gurney**, K. Verhlust, J. Kim, M. Stock, E. DiGangi, S. Prinzivalli, C. Fain, R. Keeling, R. Weiss, R. Duren, C. Miller, J. Whetstone (2021) The impact of COVID-19 on CO_2 emissions in the Los Angeles and Washington DC/Baltimore metropolitan areas, *accepted to Geophys. Res. Lett.*

142. Laughner, J.L., J.L Neu, D.S. Schimel, P.O. Wennberg, K. Barsanti, K.W. Bowman, A. Chatterjee, B. Croes, H. Fitzmaurice, D.K. Henze, J. Kim, E.A. Kort, Z. Liu, K. Miyazaki, A.J. Turner, S. Anenberg, J. Avise, H. Cao, D. Crisp, J.A. de Gouw, A. Eldering , J.C Fyfe, D.L. Goldberg, **K.R. Gurney**, S. Hasheminassab, F.M. Hopkins, C. Ivey, D.B.A. Jones, N.S. Lovenduski, R.V. Martin, G.A. McKinley, L. Ott, B. Poulter, M. Ru, S. P. Sander, N. Swart, Y.L. Yung, Z-C. Zeng (2021) The 2020 COVID-19 pandemic and atmospheric composition: back to the future, *Earth and Space Science Open Archive,* https://doi.org/10.1002/essoar.10506081.1

141. Hainy, K.D., R. Kaeser, T. Jayarathne, J. Tomlin, J. Pitt, P.B. Shepson, B.H. Stirm, C. Floerchinger, C. Gately, M. Sargent, S. Wofsy, **K.R. Gurney**, A. Karion, I. Lopez-Coto, A. Turner (2021) Estimating Anthropogenic CO_2 Emissions from New York City Using Aircraft Measurements and Dispersion Modeling, *under review at Env. Sci. and Technol.*

140. **Gurney, K.R.**, B. Mitra, G. Roest, P. Dass, Y. Song, T. Moiz (2021) Impact and rebound of near real-time United States fossil fuel carbon dioxide emissions from COVID-19 and large differences with global estimates, *under review at PNAS*

139. Mueller, K. T. Lauvaux, **K.R. Gurney**, P. DeCola, S. Gourdji, G. Roest, J. Whetstone (2021) An Emerging GHG estimation approach can help cities achieve their limate and sustainability goals, *Environ. Res. Lett.*, https://doi.org/10.1088/1748-9326/ac0f25

138. Berelson, W.M., N. Rollins, A.J. West, G. Ban-Weiss, J. Ko, **K.R. Gurney**, and R. Cohen (2021) Atmospheric Radon, CO_2, and Methane Define a Decrease in Los Angeles CO_2 Emissions during COVID-19 Shutdown, *under review at Science Advances.*

137. Addington, O., Z-C. Zeng, T. Pongetti, R-L. Shia, **K.R. Gurney**, J. Liang, G. Roest, Y.L. Yung, S.P. Sander (2021) Estimating Nitrous Oxide (N_2O) Emissions for the Los Angeles Megacity Using Mountaintop Remote Sensing Observations, *Remote Sensing of the Environment,* 259, 112351, https://doi.org/10.1016/j.rse.2021.112351.

136. Miles, N.L., K.J. Davis, S.J. Richardson, T. Lauvaux, D.K. Martins, A.J. Deng, N. Balashov, **K.R. Gurney**, J. Liang, G. Roest, J.A. Wang, and J.C. Turnbull (2021): The influence of near-field fluxes on seasonal CO_2 enhancements: Results from the Indianapolis Flux Experiment (INFLUX). *Carbon Balance Management,* 16:4, https://doi.org/10.1186/s13021-020-00166-z.

135. **Gurney, K.R.**, J. Liang, G. Roest, Y. Song, K. Mueller, T. Lauvaux (2021) Under-reporting of greenhouse gas emissions in U.S. cities, *Nature Communications*, 12(1), 1-7, https://www.nature.com/articles/s41467-020-20871-0

2020

134. Mallia, D., L. Mitchell, L. Kunik, B. Fasoli, R. Bares, **K.R. Gurney**, D. Mendoza, J.C. Lin (2020) Constraining urban CO_2 emissions using mobile observations derived from a novel light-rail public transit platform, *Environ., Sci. & Tech.*, https://dx.doi.org/10.1021/acs.est.0c04388.

133. Song, Y., **K.R. Gurney** (2020) The relationship between on-road $FFCO_2$ emissions and socio-economic/urban form factors for global cities: significance, robustness, and implications, *Sustainability*, 12, 6028; https://doi.org/10.3390/su12156028.

132. Roest, G., **K.R. Gurney**, S.M. Miller, and J. Liang (2020) Informing urban climate planning with high resolution data: the Hestia fossil fuel CO_2 emissions for Baltimore, Maryland, *Carbon Balance and Management,* 15:22, https://doi.org/10.1186/s13021-020-00157-0.

131. **Gurney, K.R.**, Y. Song, J. Liang, G. Roest (2020) Towards accurate, policy-relevant fossil fuel CO_2 emission landscapes, *Env. Sci. & Tech*, 54, 16, 9896-9907, https://doi.org/10.1021/acs.est.0c01175.

130. Ruti, P., O. Tarasova, J. Keller, C. Carmichael, O. Hov, S. Jones, D. Terblanche, C. Anderson, A. Barros, P. Bauer, V. Bouchet, G. Brasseur, B. Brunet, P. DeCola, V. Dike, M.D. Kane, C. Gan, **K. Gurney**, S. Hamburg, W. Hazeleger, M. Jean, D. Johnston, A. Lewis, P. Li, X. Liang, V. Lucarini, A. Lynch, E. Manaenkova, J.-C. Nam, S. Ohtake, N. Pinardi, J. Polcher, E. Ritchie, A.E. Sakya, C. Saulo, A. Singhee, A. Sopaheluwakan, A. Steiner, A. Thorpe, M. Yamji (2020) Advancing Research for Seamless Earth System Prediction, *Bulletin of the American Meteorological Society,* https://doi.org/10.1175/BAMS-D-17-0302.1, January 20, 2020.

129. **Gurney, K.R.**, J. Liang, R. Patarasuk, Y. Song, J. Huang, and G. Roest (2019) Vulcan: High-Resolution Annual Fossil Fuel CO_2 Emissions in USA, 2010-2015, Version 3. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1741.

128. **Gurney, K.R.**, J. Liang, R. Patarasuk, Y. Song, J. Huang, G. Roest (2020) The Vulcan Version 3.0 High-Resolution Fossil Fuel CO_2 Emissions for the United States, *Journal of Geophysical Research: Atmospheres,* 125, 19, e2020JD032974. https://doi.org/10.1029/2020JD032974.

127. Basu S., S.J. Lehman, J.B. Miller, A.E. Andrews, C. Sweeney, **K.R. Gurney**, X. Xu, J. Southon, P. Tans (2020) Estimating US Fossil Fuel CO_2 Emissions from Measurements of ^{14}C in Atmospheric CO_2, *Proceedings of the National Academy of Sciences,* June 16, 2020 117 (24) 13300-13307; first published June 1, 2020 https://doi.org/10.1073/pnas.1919032117.

126. Ahn, D., J. Hansford, S. Howe, X. Ren, R. Salawitch, N. Zeng, M. Cohen, B. Stunder, O. Salmon, P.B. Shepson, **K.R. Gurney**, T. Oda, I. Lopez-Coto, J. Whetstone, R.R. Dickerson (2020) Fluxes of Atmospheric Greenhouse-Gases in Maryland (FLAGG-MD): Emissions of Carbon Dioxide in the Baltimore, MD-Washington, DC area, *J. Geophys. Res.*, https://doi.org/10.1029/2019JD032004.

125. Strandgren, J., D. Krutz, J. Wilzewski, C. Paproth, I. Sebastien, **K.R. Gurney**, J. Liang, A. Roiger, A. Butz (2020) Towards space-borne monitoring of localized CO_2 emissions: an instrument concept and first performance assessment, *Atmospheric Measurement Techniques*, 13, 2887-2904, https://amt.copernicus.org/articles/13/2887/2020/.

124. Lauvaux, T., **K.R. Gurney**, N.L. Miles, K.J. Davis, S.J. Richardson, A. Deng, B.J. Nathan, T. Oda, J.A. Wang, L.R. Hutyra, J.C. Turnbull (2020) Policy-relevant assessment of urban greenhouse gas emissions, *Environ. Sci. Technol.* 54, 16, 10237–10245 https://doi.org/10.1021/acs.est.0c00343

123. Park, C., Park, S.-Y., K.R. Gurney, C. Gerbig, J.P. DiGangi, Y. Choi, H.W. Lee (2020) Numerical simulation of atmospheric CO_2 concentration and flux over the Korean Peninsula using WRF-VPRM model during Korus-AQ 2016 Campaign, *PLOS ONE,* 15(1): e0228106, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0228106

2019

122. Lugman, M., P. Rayner, **K.R. Gurney** (2019) Combining measurements of Built-up area, Nighttime Light and Travel distance for detecting change in Urban Boundaries: Introducing BUNTUS Algorithm, *Remote Sensing,* 11(24), 2969; https://doi.org/10.3390/rs11242969.

121. Nathan, B., T. Lauvaux, J. Turnbull, **K.R. Gurney** (2019) Model output for determining sector-based CO_2 emissions in both pseudodata and real-data inversion analyses of Indianapolis for January-April 2015, datacommons@psu, doi:10.26208/rbrk-5q41.

120. Feng, S., T. Lauvaux, K.J. Davis, K. Keller, P. Rayner, T. Oda, **K.R. Gurney**, Y. Zhou, C. Williams, A. E. Schuh, J. Liu, I. Baker (2019), Ensemble model output of North American atmospheric CO2 simulation (full WRF-chem output), Data set. Available online from The Pennsylvania State University Data Commons, University Park, Pennsylvania, USA, doi:10.26208/7a4p-q224.

119. Kunik, L. D.V. Mallia, **K.R. Gurney**, D.L. Mendoza, T. Oda, J.C. Lin (2019) Bayesian inverse estimate of urban CO_2 emissions: results from a synthetic data simulation over Salt Lake City, UT, *Elementa: Science of the Anthropocene,* 7: 36. DOI: https://doi.org/10.1525/elementa.375.

118. Wang, Y., P. Ciais, G. Broquet, F-M. Breon, T. Oda, F. Lespinas, Y. Meijer, A. Loescher, G. Janssens-Maenhout, B. Zheng, H. Xu, S. Tao, **K.R. Gurney**, G. Roest, D. Santaren, Y. Su (2019) A global map of emission clumps for future monitoring of fossil fuel CO_2 emissions from space, *Earth Syst. Sci. Data,* 11, 1-17, https://essd.copernicus.org/articles/11/687/2019/.

117. He, L., Z-C Zeng , T. Pongetti , C. Wong , J. Liang , **K. Gurney** , S. Newman , V. Yadav , K. Verhulst , C. Miller , R. Duren , C. Frankenberg , P. Wennberg , R-L. Shia , Y. Yung (2019) Atmospheric methane emissions correlate with natural gas consumption from residential and commercial sectors in Los Angeles, *Geophys. Res. Lett.*, 46, 8563-8571, https://doi.org/10.1029/2019GL083400.

116. **Gurney, K.R.**, Liang, J, D.O. O'Keeffe, R. Patarasuk, M. Hutchins, J. Huang, P. Rao, and Y. Song (2019) Comparison of Global Downscaled Versus Bottom-Up Fossil Fuel CO_2 Emissions at the Urban Scale in Four US Urban Areas, *J. Geophys. Res.-Atmos.*, 124, 2823-2840, https://doi.org/10.1029/2018JD028859.

115. **Gurney, K.R.**, R. Patarasuk, J. Liang, D. O'Keeffe, P. Rao, Y Song (2019) The Hestia Fossil Fuel CO_2 Emissions Dataset for the Los Angeles Basin, *Earth System Science Data*, 11, 1-27, https://essd.copernicus.org/articles/11/1309/2019/.

114. Feng, S., T. Lauvaux, K. Keller, K.J. Davis, P. Rayner, T. Oda, **K.R. Gurney** (2019) A road map for improving the treatment of uncertainties in high-resolution regional carbon flux inverse estimates, *Geophys. Res. Lett*, 46. https://doi.org/10.1029/2019GL082987.

113. Cui, X., S. Newman, X. Xu, A.E. Andrews, J. Miller, S. Lehman, S. Jeong, J. Zhang, C. Priest, M. Campos-Pineda, **K.R. Gurney**, H. Graven, J. Southon, M.L. Fischer (2019), Atmospheric Observation-based Estimation of Fossil Fuel CO_2 Emissions from Regions of Central and Southern California, *Science of the Total Environment*, 664, 381-391, https://doi.org/10.1016/j.scitotenv.2019.01.081.

112. Nangini, C, A. Peregon, P. Ciais, U. Weddige, F. Vogel, J. Wang, F-M. Breon, S. Bachra, Y. Wang, **K. Gurney**, Y. Yamagata, K. Appleby, S. Telahoun, P.G., Canadell, A. Grubler, S. Dhakal, F. Creutzig (2019) A global dataset of city CO_2 emissions and ancillary data related to emission for 343 cities, *Scientific Data*, 6, Article number: 180280. https://doi.org/10.1038/sdata.2018.280.

111. Martin, C.R., N Zeng, A. Karion, K. Mueller, S. Ghosh, I. Lopez-Coto, **K.R. Gurney**, T. Oda, K. Prasad, Y. Liu, R.R. Dickerson, J. Whetstone (2019), Investigating Sources of Variability and Error in Simulations of Carbon Dioxide in an Urban Region, *Atmos. Env.*, 199, 55-69. https://doi.org/10.1016/j.atmosenv.2018.11.013.

2018

110. Hedelius, J., J. Liu, T. Oda, S. Maksyutov, C.M. Roehl, L.T. Iraci, J.R. Podolske, P.W. Hillyard, J. Liang, **K.R. Gurney**, D. Wunch, P.O. Wennberg (2018) Southern California Megacity CO_2, CH_4, and CO flux estimates using ground and space-based remote sensing and a Lagrangian model, *Atmos. Chem. and Physics,* 18, 16271-16291, https://doi.org/10.5194/acp-18-16271-2018

109. Nathan, B.J., T. Lauvaux, J. Turnbull, S.J. Richardson, N.L. Miles, **K.R. Gurney** (2018) Source Sector Attribution of CO_2 Emissions in an Urban Multi-species Bayesian Inversion System, *J.Geophys. Res.* 123(23), 13611-13621. https://doi.org/10.1029/2018JD029231

108. Liu, J., K.Bowman, D. Schimel, N. Parazoo, Z. Jiang, M. Lee, A. Bloom, D. Wunch, **K.R. Gurney**, D. Menemenlis, M. Girerach, D. Crisp, A. Eldering (2018) Responses to Comment on "Contrasting carbon cycle responses of the tropical continents to the 2015-2016 El Niño", *submitted to Science*.

107. Park, C., Park, C. Gerbig, S. Newman, R. Ahmadov; S. Feng, **K.R. Gurney**, G.R. Carmichael, S-Y. Park, H-W. Lee, M. Goulden, J. Stutz, J. Peischl, T. Ryerson (2018) CO2 transport, variability and budget over the Southern California Air Basin using high resolution WRF-VPRM model during CalNex 2010 Campaign, *Journal of Applied Meteorology and Climatology*, 57 (6), 1337-1352. https://doi.org/10.1175/JAMC-D-17-0358.1.

106. Lin, J. L. Mitchell, E. Crosman, D. Mendoza, M. Buchert, R. Bares, B. Fasoli, D. Bowling, D. Pataki, D Catharine, C. Strong, **K.R. Gurney**, R. Patarasuk, M. Baasandorj, A. Jacques, S. Hoch, J. Horel, J. Ehleringer (2018) CO2 and carbon emissions from cities: linkages to air quality, socioeconomic activity and stakeholders in the Salt Lake City urban area, *Bulletin of the American Meteorological Society*, November 2018, 2325-2339. https://doi.org/10.1175/BAMS-D-17-0037.1

105. Salmon, O.E., P.B. Shepson, X. Ren, H. He, R.R. Dickerson, B.H. Stirm, S.S. Brown, D.L. Fibiger, E.E. McDuffie, T.L.Campos, **K.R. Gurney**, J.A. Thornton (2018) Top-down Estimates of NOx and CO Emissions from Washington, D.C.-Baltimore During the WINTER Campaign, *Journal of Geophysical Research*, https://doi.org/10.1029/2018JD028539.

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Gurney, K.R. and D. O'Keeffe (2013) Crowdsourcing power plant carbon dioxide emissions data, *EOS Trans. Amer. Geophys. Union*, **94**(43), 385-386.

Over 300 public talks and poster presentations

POSTDOCTORAL SCHOLARS

Anna Kato (current)

Bhaskar Mitra (current)

Terry Song (current)

Pawlok Dass (current)

Geoffrey Roest (current)

Jianming Huang (2015-2018, research scientist, ESRI)

Preeti Rao (2013-2016, Research Scientist, University of Michigan)

Xia Zhang (2009-2014, postdoctal researcher at San Diego State University)

Igor Razlivanov (2011-2013, current position unknown)

Salvi Asefi-Najafabady (2012-2015, Faculty research associate at University of Virgina)

Risa Patarasuk (2013-2016, postdoctoral research, UC Irvine)

Yuyu Zhou (2008-2010, Assistant Professor at Iowa State University)

GRADUATE STUDENTS

Bilal Aslam (incoming Fall 2021, School of Informatics, Cyber Systems, and Computing)

Taha Moiz (current, Ph.D., School of Sustainability)

Darragh O'Keeffe (2017, M.A., School of Sustainability)

Maya Hutchins (current, Ph.D. track, Geographical Science & Urban Planning)

Ryan Anderson (2015, M.A., Sustainability)

Scott Norby-Castillo (2016, M.A., Sustainability)

Jianhua Huang (2016 Ph.D., Life Sciences)

Yang Song (2018 Ph.D., Life Sciences)

Vicky Liau (2013, M.S., co-advised with SGSUP)

Kevin Coltin (2013, M.S., co-advised with SMSS, current: Analyst, Adv. Analytics & Modeling, Deloitte)

Daniel Mendoza (2012, Ph.D., current: postdoc, Dept. Geology, Univ. of Utah)

Charlotte Castillo (2012, Ph.D., , Ross Fellowship, Fullbright scholar, current: Professor at Manila Observatory, Ateneo de Manila University)

Vandhana Chandrasekaran (2011, M.S., co-advised with Computer Sci., current: Assoc. Advisory at PwC)

Advait Godbole (2011, M.S., current: unknown)

Nalin Sahni (2010, M.S., co-advised with Civil Engineering, current: unknown)

Sarath Geethakumar (2010, M.S., co-advised with Comp. Sci., current: Senior Director, Mobile & Product Security, American Express)

Warren Eckels (2009, M.S., current: Adjunct Instructor at Ivy Tech Community College)

COURSES TAUGHT

INF 501: Research Methods in Informatics and Computing, School of Informatics, Computing, and Cyber Systems, NAU

INF 601: Research Methods in Informatics and Computing, School of Informatics, Computing, and Cyber Systems, NAU

Guest lecturer in numerous courses, School of Life Sciences, School of Sustainability, ASU

Collated all climate change related courses currently offered at ASU in order to centralize a climate change course offering – upcoming.

BIO 320: Fundamentals of Ecology (undergraduate), ASU

BIO 182: General Biology II (undergraduate), ASU

EAS 113/NRES 290/AGRY 290: Introduction to Environmental Sciences (undergraduate), Purdue University

EAS 425: Carbon neutrality at Purdue (undergraduate/graduate) , Purdue University

EAS 591T: Principals of Terrestrial Ecosystem Ecology (graduate) , Purdue University

EAS 591A: Anthropogenic Climate Change (graduate) , Purdue University

Guest lecturer, Department of Atmospheric Science, Colorado State University, 1999 – 2005

Faculty lecturer and field instructor, Cruising for Conservation, Coastal Marine Education and Research Academy (CMERA), 2016

Instructor, SPATIAL Isotopes in Biogeochemistry & Ecology course, 2013-2017

COMMITTEE SERVICE

Janet Reyna, Arizona State University, Ph.D. candidate, Advisor: Dr. Mikhail Chester

Amy Hawes, Dept of Atmospheric Sci, Colorado State University, Ph.D. candidate, Advisor: Dr. Dave Thompson

Kathy Corbin, Dept of Atmospheric Sci, Colorado State University, Ph.D. Candidate, Advisor: Dr. Scott Denning

Ryan Sriver, Dept of Earth and Atmospheric Sciences, Purdue University, Advisor: Dr. Matt Huber

Megan Walker, Dept of Earth and Atmospheric Sciences, Purdue University, Advisor: Dr. Noah Diffenbaugh

Jinyun Tang, Dept of Earth and Atmospheric Sciences, Purdue University, Advisor: Dr. Qianlai Zhuang

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h-index: 50 (Google Scholar, 3/29/2021).

1.1.3. Mr. Michael E. Van Brunt

Michael E. Van Brunt, P.E.

(862) 485-4160 ▪ mvanbrunt@covanta.com

Environmental engineer and sustainability professional with an industrial and consulting background and significant experience in sustainability reporting and leadership; environmental management systems; environmental regulation and compliance; and climate and energy policy. Experienced working with a diverse set of internal and public stakeholders on complex environmental and sustainability issues.

PROFESSIONAL EXPERIENCE

COVANTA 5/08 - Present

Sr. Director, Sustainability

Responsible for the corporate sustainability program, including annual reporting, goals development and tracking and development of technical resources on climate change, greenhouse gases (GHGs), air emissions and sustainability. Engage diverse investor, media, client, customer, community, NGO, regulatory and elected stakeholders on climate, energy and environmental performance and policies. Lead waste management lifecycle assessment (LCA) services for municipal, commercial and internal customers. Review new technology for performance and viability, including carbon capture and storage and alternative waste treatment processes. Provide regulatory, technical and engineering support, including on GHG reporting and measurement, criteria and air toxics emissions inventories, dioxin fingerprinting, and waste management and other compliance plans. Assist business development with response to RFPs and other business opportunities.

- Advanced sustainability reporting in collaboration with investor relations, Covanta Environmental Solutions (CES), and sustainability team leading to external recognition, including an Ecovadis bronze award and a significant increase in Covanta's CDP report score above global benchmarks
- Built and delivered technical case resulting in lower landfill gas collection efficiency defaults in U.S. EPA lifecycle models to better position case for Waste-to-Energy (WTE)
- Secured GHG allowances for California facilities with government affairs team
- Led Covanta's advocacy efforts as part of an international team to successfully preserve WTE participation in European energy capacity markets
- Developed first carbon offset projects for WTE facilities under the verified carbon standard
- Coordinated academic research partnerships culminating in published studies on industry economic impact, lifecycle GHG benefits and accurate characterization of WTE dioxin and mercury emissions
- Collaborated with CES team to develop calculation process for annual Sustainable Future Awards issued to over 100 customers annually
- Led interaction with 22 academic research teams resulting in Covanta participation in 8 out of 9 funded proposals totaling $8M in research for the industry through the Advanced Research Projects Agency - Energy

FIRST ENVIRONMENT 6/01 – 4/08

Associate

Provided consulting services to clients in the areas of climate change, GHG emissions, environmental site assessments, and environmental management systems. Directed site investigation and remediation projects under state brownfield redevelopment programs, regularly interfacing with clients and regulators. Developed expert witness testimony and reports for litigation of historical environmental contamination. Assisted manufacturing, commercial, and government clients with regulatory compliance including multimedia compliance auditing, trend analysis, risk-based audit plans, root cause analysis, hazardous waste management, spill prevention & response, stormwater, and air permits. Mentored junior staff and engineers.

- Directed $3 million soil and groundwater remediation of chlorinated organics leading to successful closure of soil remediation by NJDEP
- Managed multiyear project to design and implement an ISO 14001 environmental management system for Westchester County's Department of Environmental Facilities
- Led comprehensive rewrite of operating procedures and checklists for 7 wastewater treatment plants
- Performed first U.S. verification of NO_x emission reductions under the Ontario Emissions Trading Registry

INTERNATIONAL PAPER 7/97 – 7/00

Senior Project Engineer / Shift Manager

Supervised 24-person crew responsible for converting, packaging, and shipping 2,700 tons of paper a week. Managed capital projects in on-site 100 MW power plant. Performed and evaluated product trials to improve quality, reduce costs, or reduce variability. Provided on-site technical support to key printing press customers.

- Designed and managed emergency tank repair for 0.5-million-gallon chemical tank during mill-wide shutdown
- Coordinated development of key operating procedures for papermill alkaline chemistry conversion

EDUCATION

Cornell University, Ithaca, NY Bachelors of Science in Agricultural & Biological Engineering	5/97
Cornell University, Ithaca, NY Masters of Engineering in Biological & Environmental Engineering	8/01

PROFESSIONAL QUALIFICATIONS & ORGANIZATIONS

Licensed Professional Engineer, State of New Jersey	
Board Member, National Recycling Coalition	10/14 – 10/17
Research Council Member, Environmental Research & Education Foundation	11/17 - Present

SELECTED PRESENTATIONS & PUBLICATIONS

Field Testing of Municipal Waste Combustor Ash for Heat Generation Potential, *Global Waste Management Symposium*, Palm Springs, CA (2020)

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Wintergreen, J., M. Van Brunt, Delaney, T. "Greenhouse Gas Inventories and Wastewater Treatment Plants" *Proceedings of the Water Environment Federation WEFTEC 2007.*

Heeren, J., M. Van Brunt (2002) Design for Environment and the ISO Standards" *Proceedings of the Air & Waste Management Association's 95th Annual Conference and Exhibition*, June 21-27, 2002

Van Brunt, M. (2001) *Spreadsheet Implementation of Compost Kinetics* [Master's Thesis, Cornell University]

STANDARDS & PROTOCOL DEVELOPMENT

UL Standards Technical Panel, Standards Committee for Sustainability of Plastic Packaging	2018 - Present
UL Standards Technical Panel, Standard for Waste Minimization Reporting and Assessment of Zero Waste Operations	2014 – 2018
ICLEI Community GHG Protocol Solid Waste and Material Consumption Technical Advisory Committee; Lead: Trans-Boundary Solid Waste Subcommittee	2010 – 2014
The Climate Registry Electric Power Sector Technical Workgroup	2008 – 2009
WBCSD & WRI GHG Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard, Technical Working Group	2009 – 2011

1.1.4. Mr. Jeffrey Rutherford

Jeffrey S. Rutherford

137 Running Farm Ln , Apt. 110
Stanford, CA 94305
jruthe@stanford.edu
+1 650 732 6412

RESEARCH INTERESTS

Life-cycle assessment; Methane emissions; Energy systems transitions; Climate change

ACADEMIC TRAINING

PhD (in progress) in Energy Resources Engineering, 09/2017 – present
Stanford University, Stanford

- GPA = 3.71 (Cumulative)
- Major Professor: Dr. Adam Brandt

M.S. in Oceanography and Coastal Science, 08/2015 – 04/2017
Louisiana State University, Baton Rouge

- GPA = 4.01 (Cumulative, 4.3 scale)
- Major Professors: Dr. John Day and Dean Chris D'Elia

B.S. in Mechanical Engineering (Co-op option), 09/2010 –06/2015
University of Alberta, Edmonton

- GPA = 3.89 (Cumulative, 3.76 in final two semesters)
- Graduated with distinction

International Summer School "On the Cutting Edge of the Sustainable Energy Supply", 21/05/2013 - 21/06/2013
Technical University of Freiberg, Germany

- Interdisciplinary course in technological elements in sustainable energy

AWARDS AND SCHOLAR-SHIPS

- Stanford VPGE Preparing Future Professors Fellow, 2020
- 2nd Place at the 9th Annual Graduate Student Symposium, Louisiana State University College of the Coast and Environment, Baton Rouge LA USA
- Louise McKinney Post-Secondary Scholarship, 2014, 2013 (top 1.5% - 2% of class)
- University of Alberta Academic Excellence, 2012, 2010
- Jason Lang Scholarship, 2013, 2012, 2011
- Talisman Engineering Undergraduate Scholarship, 2011

RESEARCH EXPERIENCE

Graduate Research Assistant, 09/2017 – present
Stanford University, Department of Energy Resources Engineering

- Development of a bottom-up methane emissions estimation tool, validated with top-down assessments and compared with existing methane inventories.

- Using life cycle assessment modelling tools to evaluate climate and energy intensity of energy projects

Graduate Research Assistant, 08/2015 – 04/2017
Louisiana State University, College of Oceanography and Coastal Sciences

- Using geomorphic modelling and ecosystem goods and service valuation to evaluate coastal restoration projects

Undergraduate Research Project, 01/2015 – 05/2015
University of Alberta, Chair of Energy and Environmental Systems Engineering

- Investigated energy intensity of Alberta bitumen refining

Research Assistant, 06/2013 – 08/2013
Technical University of Freiberg (Germany), Chair of Gas and Heat Technology

- Modelled performance of solar parabolic dish collector

TEACHING EXPERIENCE

Graduate Teaching Mentor, 09/2020 – 07/2021
Stanford University, Department of Energy Resources Engineering

- Mentoring teaching assistants and hosting training workshops

Teaching Fellow, 01/2020 – 04/2020
Stanford University, Department of Energy Resources Engineering

- ENERGY 293B – Fundamentals of Renewable Energy Processes: Co-teaching with Dr. Tony Kovscek and Dr. Roland Horne

Teaching Assistant, 09/2019 –12/2019
Stanford University, Department of Energy Resources Engineering

- ENERGY 171/271 – Energy Infrastructure, Technology, and Economics: Coordinated a mock "lease-sale exercise" and met and advised with students on a class project

Teaching Assistant, 08/2015 –05/2016
Louisiana State University, College of Oceanography and Coastal Sciences

- OCS 1005 - Introduction to Oceanography: Led review sessions and managed homework assignments

Guitar Teacher, 09/2010 – 06/2011
ADW Music, St. Albert

- Taught beginner guitar to six students, both children and adults

INDUSTRY EXPERIENCE

Renewable Energy Consultant, 01/2014 –08/2014
SgurrEnergy, Vancouver

- Independently completed 'Energy Yield and Site Suitability Assessment' reports for wind energy projects

Intern Plant Maintenance Engineer, 01/2013 – 05/2013
Agrium Wholesale, Redwater

- Managed "root cause failure analysis" of old equipment
- Managed the design and installation of a strainer for a damaged heat exchanger

Fabrication and Drafting Planner, 01/2012 – 04/2012
Kiewit Energy Canada Corp., Edmonton

- Managed organization of materials for pipe spool fabrication while serving as a key contact on material issues

TALKS

American Geophysical Union Fall Meeting 2020, December 14, 2020
Virtual

- Closing the gap: Investigating the persistent underestimation of methane inventories

MIT A+B Applied Energy Symposium, August 13, 2020
Virtual

- Closing the gap: Investigating the persistent underestimation of methane inventories

Precourt Student Energy Lectures, August 12, 2019
Stanford, CA

- Assessing Climate Impacts of Natural Gas Supply Chains

Stanford Energy Week, January 25, 2019
Stanford, CA

- Communications in Climate and Energy Workshop (co-hosted with Chris Nelder of the Energy Transition Show)
- Workshop designed with survey-based audience participation

School of Coast and Environment Symposium, April 19, 2017
Baton Rouge, LA

- Quantifying Benefits of Large-Scale River Diversions Through an Ecosystem Service Valuation of the Maurepas Swamp

Gulf of Mexico Graduate Student Symposium, March 17, 2017
Baton Rouge, LA

- An Ecosystem Service Valuation for a Large, Intermittent River Diversion into the Maurepas Swamp

Sea Grant Coastal Connections Competition, October 27, 2016
Baton Rouge, LA

- Ecosystem Service Valuation – It's Time for Natural Scientists to Join the "Dark Side"

PUBLICATIONS

Refereed articles:

Rutherford, J.S., Sherwin, E.D., Ravikumar, A.P., Heath, G.A., Englander, J., Cooley, D., Lyon, D., Omara, M., Langfitt, Q., Brandt, A.R., *In press*. Closing the methane gap

in US oil and natural gas production emissions inventories. Nature Communications.

Masnadi, M. S., Perrier, P. R., Wang, J., **Rutherford, J.**, Brandt, A. R, 2020. Statistical proxy modeling for life cycle assessment and energetic analysis. Energy: 194.

Talaei, A., Oni, A.O., Ahiduzzaman, M., Roychaudhuri, P.S., **Rutherford, J.S.**, and Kumar, A., 2019. Assessment of the impacts of process-level energy efficiency improvement on greenhouse gas mitigation potential in the petroleum refining sector. Energy: 116243.

Rutherford, J.S., Day, J.W., D'Elia, C.F., Wiegman, A.R., Willson, C.S., Caffey, R.H., Shaffer, G.P., Lane, R.R. and Batker, D., 2018. Evaluating trade-offs of a large, infrequent sediment diversion for restoration of a forested wetland in the Mississippi delta. Estuarine, Coastal and Shelf Science 203: 80-89.

Day, J.W., D'Elia, C.F., Wiegman, A.R., **Rutherford, J.S.**, Hall, C.A., Lane, R.R. and Dismukes, D.E., 2018. The Energy Pillars of Society: Perverse Interactions of Human Resource Use, the Economy, and Environmental Degradation. BioPhysical Economics and Resource Quality 3(1): 2.

Wiegman, A.R., Day, J.W., D'Elia, C.F., **Rutherford, J.S.**, Morris, J.T., Roy, E.D., Lane, R.R., Dismukes, D.E. and Snyder, B.F., 2017. Modeling impacts of sea-level rise, oil price, and management strategy on the costs of sustaining Mississippi delta marshes with hydraulic dredging. Science of The Total Environment 618: 1547-1559.

Day, J.W., Lane, R.R., D'Elia, C.F., Wiegman, A.R., **Rutherford, J.S.**, Shaffer, G.P., Brantley, C.G., Kemp, G.P., 2016. Large infrequently operated river diversions for Mississippi delta restoration. Estuarine, Coastal and Shelf Science 183, 292 - 303.

Edited book chapters:

Rutherford, J.S., Wiegman, A.R., Day, J.W., Lane, R.R., 2018. Energy and climate: global trends and their implications for delta restoration. In: Day, J.W. (Ed.), Mississippi Delta Restoration. Springer, Cham.

Wiegman, A.R., **Rutherford, J.S.**, Day, J.W., 2018. The Costs and Sustainability of Ongoing Efforts to Restore and Protect Louisiana's Coast. In: Day, J.W. (Ed.), Mississippi Delta Restoration. Springer, Cham.

Conference papers:

Meehan, N., El-Houjeiri, H., **Rutherford, J.S.**, 2018. Comparing Carbon Intensity of Unconventional and Asia Pacific Oil Production. In: SPE Asia Pacific Oil and Gas Conference and Exhibition. Society of Petroleum Engineers.

Meehan, N., El-Houjeiri, H., **Rutherford, J.S.**, 2018. Carbon Intensity: Comparing Carbon Impacts of Middle East and US Shale Oils. In: SPE Kingdom of Saudi Arabia Annual Technical Symposium and Exhibition. Society of Petroleum Engineers.

Acknowledged contributions to publications:

Heinberg, R., Fridley, D. and Heinberg, 2016. Our Renewable Future. Island Press/Center for Resource Economics. **(for research)**

Magazine/blog articles:

Rutherford, J.S., 2019. Oil and gas companies in energy transition - Part 1: An introduction. Stanford Energy Journal, Oct 27. Available online: sej.stanford.edu/oil-and-gas-companies-energy-transition-part-1-introduction.

Shaikh, O, and **Rutherford, J.S.**, 2019. Buildings consume a lot of energy. What can we do about it?. Stanford Energy Journal, May 29. Available online: sej.stanford.edu/buildings-consume-lot-energy-what-can-we-do-about-it.

Rutherford, J.S., 2019. Cleantech Challenge Highlights the Value of Interdisciplinary Work in Energy and Climate. Stanford Energy Journal, Apr 15. Available online: sej.stanford.edu/cleantech-challenge-highlights-value-interdisciplinary-work-energy-and-climate.

Rutherford, J.S., 2019. Understanding perspectives on energy and climate: Results of Stanford Energy Week workshop. Stanford Energy Journal, Apr 1. Available online: sej.stanford.edu/understanding-perspectives-energy-and-climate-results-stanford-energy-week-workshop.

Rutherford, J.S., and Puljic, G., 2018. Stanford hosts world leaders to chart our energy future. Stanford Energy Journal, Nov 5. Available online: sej.stanford.edu/stanford-hosts-world-leaders-chart-our-energy-future.

Rutherford, J.S., and Von Wald, G., 2018. Stanford's Natural Gas Initiative Charts Course of Natural Gas in a Future Decarbonized Energy System. Stanford Energy Journal, Oct 26. Available online: sej.stanford.edu/stanford-s-natural-gas-initiative-charts-course-natural-gas-future-decarbonized-energy-system.

Rutherford, J.S., 2018. Review of "Energy and Civilization" by Vaclav Smil. Stanford Energy Journal, Aug 10. Available online: sej.stanford.edu/review-energy-and-civilization-vaclav-smil.

Rutherford, J.S., Von Wald, G., and Orta Aleman, D., 2018. Stanford's Divestment Dilemma: Seeking Pathways for Decarbonization. Stanford Energy Journal, Apr 23. Available online: sej.stanford.edu/stanford-s-divestment-dilemma-seeking-pathways-decarbonization.

Rutherford, J.S., 2018. American Chemical Society national meeting showcases new research on energy and the economy. Stanford Energy Journal, Apr 23. Available online: sej.stanford.edu/american-chemical-society-national-meeting-showcases-new-research-energy-and-economy.

Rutherford, J.S., 2018. The Alberta Oil Sands: Between a Rock and a Hard Place. Stanford Energy Journal, Jan 12. Available online: sej.stanford.edu/alberta-oil-sands-between-rock-and-hard-place.

UNIVERSITY SERVICE

Editor in Chief of the Stanford Energy Journal, Stanford Energy Club, 03/2018 –04/2020
Stanford University, Stanford

- Managed the "Stanford Energy Journal", the Stanford Energy Club's student-run online publication and a team of student journalists
- Organized energy-related seminars, workshops, and field-trips

VP Industry and Careers, Energy Club, 09/2014 –06/2015
University of Alberta, Edmonton

- Organized energy-related seminars and field trips (e.g., trip to the Strathcona Energy Centre with guest lecture from FVB Energy)

1.1.5. Mr. Raymond Pilcher

Raymond C. Pilcher

EXPERTISE:

- Forty years of experience leading emissions reductions projects, clean energy development, and national CMM resource assessments.
- Internationally recognized expert in energy resource assessment, resource development and utilization. Experience comprises exploration and development of energy resources ranging from grass roots evaluation of resource potential to negotiating international contracts with ministry-level officials in many countries outside of the United States.
- Contributed to IPCC coal mine emissions inventory standards, co-authored two contributions to UNFCCC CMM methodology, ACM0008, authored emissions reduction protocols for AES's internal carbon trading program.
- Program Manager of four five-year contracts with U.S. EPA's Coalbed Methane Outreach Program (CMOP) to provide technical support for reducing methane emissions from coal mining worldwide.
- Chair of the UNECE Group of Experts on Coal Mine Methane, and Vice-Chair of the Bureau of the Committee on Sustainable Energy under which the GoE convenes. One of two principal authors of the revised UNECE Publication "Best Practice Guidance for the Effective Methane Drainage and Use in Coal Mines". Contributing author and editor for "Best Practice Guidance for Effective Methane Recovery and Use from Abandoned Coal Mines"
- Certified Professional Geologist (Texas license 1608).

EXPERIENCE:
Raven Ridge Resources, Incorporated: President – 1988 to present

Relevant experience:

- Consultant to the World Bank focused on developing global coal mine closure standards and mined lands repurposing and the economics of methane emissions mitigation.
- Led a team working under contract with the US Trade and Development Agency (USTDA) to undertake a Definitional Mission ("DM") to evaluate and develop recommendations for gas sector opportunities related to import, distribution and use of LNG in Turkey and to inform its decision-making relative to funding requests from the private sector.
- Contributing author and editor for "Best Practice Guidance for Effective Methane Recovery and Use from Abandoned Coal Mines", published in 2020 by UNECE.
- Participated in a ground-breaking study conducted by Raven Ridge Resources for Canada's Oil Sands Innovation Alliance. The study was the first to identify possible geologic sources of methane emissions from the Athabascan Oil Sands in Alberta.
- Led the investigation and technical due diligence on 17 abandoned UK coal mines to determine longevity of abandoned mine methane production and the magnitude of the remaining gas reserves. The client purchased the asset for approximately $ 160 million USD.
- Authored and delivered a one day invited lecture in Taiyuan, Shanxi Province China on the transition of the coal industry. The lecture focused on increased energy efficiency, reduction of GHGs through the use or destruction of coal mine methane and inclusion of renewable energy sources in the operation of mines and delivery of product to market.

- Authored and presented lectures on the origin of coal associated gases and estimation of CBM and CMM resources to students and faculty of the Mongolian University of Science and Technology, the Ministry of Mining and the Society of Economic Geologists of Mongolia.
- Authored and presented lectures in Kazakhstan and India as part of UNECE workshops to train mining professionals and government policy and decision makers on best practices for effective methane drainage and use in coal mines.
- Co-author of UNECE Publication "Best Practice Guidance for the Effective Methane Drainage and Use in Coal Mines" Second Edition December 2016.
- Contributed technical expertise to a feasibility study of the potential for CBM and natural gas extraction in Córdoba conducted by Raven Ridge on behalf of a Colombian client.
- Managed and contributed to a research project in Mongolia that culminated in the publication of "Coal Mine Methane (CMM) Research Assessment and Emissions Inventory Development in Mongolia". This document is the seminal publication on the CMM/CBM resource potential of Mongolia. The project included capacity building and technology transfer.
- Managed and contributed to the publication "Legal and Regulatory Status of CMM Ownership in Key Countries: Considerations for Decision Makers" and a sister publication "Legal and Regulatory Status of CMM Ownership in Key Countries: An Overview Provided for Decision Makers in Mongolia". These publications have been used in Mongolia and Colombia to develop policy related to ownership and management of coal and gas resources.
- Managed and contributed technical expertise for 11 techno-economic feasibility and pre-feasibility studies conducted in coal basins in China, Viet Nam and Mongolia, Eastern Europe and the former Soviet Union. Raven Ridge developed technical approaches to capture and use of methane in complex geological and mining conditions. Studies involved reservoir and economic modeling.
- Managed and contributed to the publication "China's Energy Markets: Anhui, Chongqing, Henan, Inner Mongolia, and Guizhou Provinces"; and delivered a presentation summarizing the findings at an international forum.
- Led and participated in a review of detailed technical data and information to produce a second opinion for a multinational European oil and gas producer on the advisability of further investment as a non-operating entity in a major CBM in play in Asia.
- Managed reservoir characterization and modeling project in Raton Basin where Raven Ridge provided New Elk Coal Company, a coal mine operator an analysis of CBM production from wells drilled through the mine's coal resources. Study forecasted the productive life and value of the wells penetrating minable coal seams and determined the safety issues that might arise from each well penetrating the coal with the mine's extraction plan.
- Project Manager in a partnership which explored for CBM in the Texas Gulf Coast region covering 3500 square miles containing more than 500,000 net acres of gas leases. The project was financed, and one prospect was successfully drilled.
- Technical Advisor on a Site Survey for the APEC Coal Mine Gas Project, People's Republic of China, for J-Coal. The site was selected for a $US 20 million demonstration of coal mine gas recovery in China. Estimated reserves and evaluated technical feasibility of methane recovery.
- Technical Advisor and principal member of the team that wrote the document specifically describing the scope, work plan and budget of the activities that are being developed under a $US 9.6 million GEF Project in China, which has a goal of mitigation of methane emissions from coal mining.
- Managed preparation of reserves estimates and assessment of the potential for development of coalbed methane on three coal lease blocks in northern Turkey. Final report estimated coalbed methane resources and identified the most prospective targets for drilling.

- Development of Coalbed Methane Programs for CBM Energy. Assisted in estimating reserves and recoverable resources and developing an exploration program and modeled economic performance of a proposed $US 350 million coalbed methane project in Ukraine. Conducted research on the potential for similar programs in Bulgaria and Romania. Drilled a frontier CBM well in the Dobroudja Basin, Bulgaria.
- RRR provided an expert to a United Nations Development Programme mission to India for the purpose of developing a "project brief". This document described a plan for a coalbed methane demonstration project that calls for developing a gas recovery program at two underground coal mines. The recovered gas would fuel an internal combustion power generation station and a compressed natural gas vehicle refueling station. The Global Environmental Facility (GEF) accepted the program as a funding candidate. As a result, Pilcher led a second mission to prepare a Project Document that detailed the activities and proposed a budget. GEF approved the project and funded it for a total of $US19.2 million. Project implementation began in 1998.
- Led the development for a series of workshops that promote best practices for methane recovery in coal mines in China, Ukraine, and Kazakhstan.

EDUCATION AND TRAINING:

- University of Texas at Austin, Bachelor of Science Geology, 1975
- Colorado School of Mines, Managing Risks and Strategic Decisions in Petroleum Exploration, 1998 & 2005
- Columbia Graduate School of Business, Global Leadership Program, 1996
- Colorado School of Mines, Economic Evaluation and Investment Decision Methods, 1993 & 1998

2. Industrial Processes and Product Use

1.2.1. Dr. Jerry Marks

Jerry Marks, Ph.D.

Consultant

EXPERIENCE OVERVIEW

Jerry is active in greenhouse gas measurement (GGM) and inventory. In that capacity, he has been a major contributor to the international aluminum industry's understanding of GHG emissions and their relationship to climate change. Jerry has authored numerous technical publications and reports in this area.

As independent consultant and owner of J. Marks & Associates, he has worked with the London-based International Aluminium Institute (IAI), the US EPA, the Canadian Aluminum Association, Environment Canada and numerous individual global metal producers. Some of his main activities have been:

- analysis of GHG performance data from IAI member companies
- development of standard protocols for GHG measurements for the US EPA
- measurements of GHG emissions at operating facilities of global aluminum producers

Jerry has worked with Chinese primary aluminum producers at Chinese smelters to measure GHG emissions under the sponsorship of the Asia-Pacific Partnership for Clean Development and Climate, and for the International Aluminium Institute.

He served as coordinator for the metals chapter of the 2006 revised IPCC Good Practices for Greenhouse Gas Inventories, and was recognized as a contributor to the scientific reports for which the Intergovernmental Panel on Climate Change (IPCC) was co-awarded the 2007 Nobel Prize. More recently he drafted the 2019 update to the Good Practices for Measuring PFCs for primary aluminum producers and, with an industry workgroup, was co-author to the final 2019 updated PFC measurement methodology.

PROJECT EXPERIENCE

International Measurements of Industrial Greenhouse Gas Emissions

Consultant, J Mark & Associates LLC (2000–Present). As independent consultant and owner of J Marks & Associates, Dr. Marks has worked with the London-based International Aluminium Institute (IAI), the U.S. EPA, the Canadian Aluminum Association, Environment Canada, and numerous individual global metal producers. Some of his main activities have been: Analysis of GHG performance data from IAI member companies; development of standard protocols for GHG measurements for the U.S. EPA; and measurements of GHG emissions at operating facilities of global aluminum producers. Recently he worked with Chinese primary aluminum producers to measure GHG emissions under the sponsorship of the Asia-Pacific Partnership for Clean Development and Climate.

Consultant, U.S. EPA Programs on PFC Emissions from Primary Aluminum Industry, U.S. EPA. Dr. Marks has the primary responsibility for the preparation and revision of the PFC Measurements Good Practices Protocol. He has made PFC measurements at numerous U.S. and international primary aluminum production facilities.

Consultant, U.S. EPA Programs on SF_6 Emissions from Magnesium Industry, U.S. EPA. Dr. Marks developed a template for evaluation of SF_6 emissions from magnesium die casting.

Analysis and Testing

Manager, Analysis & Testing Services, Alcoa Inc. (1986–2000). While employed at Alcoa Inc., Dr. Marks was responsible for the technical management, budget, and personnel development for the Analysis & Testing Services Section of the Alcoa Technical Center. Technical Divisions included Analytical Chemistry, Structural and Microscopy Analysis, and Corrosion Testing.

SELECTED PUBLICATIONS AND PRESENTATIONS

S. Gaboury, A. Gosselin, P. Tremblay and J. Marks, Comparing Different Measuring Approaches to Characterize All PFC Emissions, Light Metals 2014, pp 523 – 527.

D.S. Wong and J. Marks (2013). Continuous PFC Emissions Measured on Individual 400kA Cells. In B.A. Sadler (Ed.) Light Metals 2013 (pp 865–870). Hoboken, NJ, USA: John Wiley & Sons, Inc.

W. Li, Q. Zhao, J. Yang, S. Qiu, X. Chen, J. Marks and C. Bayliss (2013). On Continuous PFC Emission Unrelated to Anode Effects. In (G. Bearne, M. Dupuis and G. Tarcy (Eds), Essential Readings in Light Metals: Aluminum Reduction Technology, Volume 2. Hoboken, NJ, USA:, John Wiley & Sons, Inc.

P. Coursol, P. Coulombe, S. Gosselin, D. Lavoie, J.-M. Simard, J. Marks and S. Fardeau. (2011). *Impact of operations at low anode-cathode distance on energy consumption and greenhouse gas emissions at Aluminerie Alouette.* The Journal of The Minerals, Metals & Materials Society, 63(8), pp 109–115.

J. Marks (2006). *Methods for Calculating PFC Emissions from Primary Aluminum Production.* Light Metals 2006, pp 185–188.

R. Chase, R. Gibson and J. Marks (2005). *PFC Emissions Performance for the Global Primary Aluminum Industry.* Light Metals 2005, pp 279–282.

W. Bjerke, R. Chase, R. Gibson and J. Marks (2004). *International Aluminium Institute Anode Effect Survey Results.* Light Metals 2004, pp 367–372.

A.K. Gupta, C. Vijayakumar and J. Marks (2004). *PFC Emissions at Dubal Potlines.* Light Metals 2004, pp 373–379.

J. Marks (2003). *Global aluminium industry environmental progress—A life cycle approach.* Proceedings of International Conference on Aluminium, Volume 1, pp 163–170, New Delhi, India, April, 2003.

J. Marks, R. Kantamaneni, D. Pape and S.D. Rand (2003). *Protocol for Measurement of Tetrafluoromethane and Hexafluoroethane from Primary Aluminum Production.* Light Metals 2003, pp 221–226.

J. Marks (2002). *Global Aluminium Industry Environmental Progress—A Life Cycle Approach*. Aluminium of Siberia Conference Proceedings, Krasnoyarsk, Siberia, September 10, 2002.

J. Marks (2002). *Emissions of Perfluorocarbons (PFCs) from the Aluminium Industry—A Decade of Progress.* UNFCCC Subsidiary Body for Technical Advice 16th Meeting, Bonn, Germany, June 12, 2002.

J. Marks (2002). *International Aluminium Institute Initiative to Reduce PFC Emissions.* The Earth Technologies Forum, Washington, DC, March 26, 2002.

J. Marks, M. Atkinson, R Chase, S.D. Rand (2002). Technology and Economics of Reducing PFC Emissions from Aluminium Production. In J. van Ham, A.P.M. Baede, R. Gjuicherit and J.G.F.M. Williams-Jacobse (Eds), Non-CO_2 Greenhouse Gases: Scientific Understanding, Control Options and Policy Aspects (pp 403–408). Rotterdam, Netherlands: Millpress.

J. Marks (2001). *Aluminium—Sustainable Material for the Future.* Arab Aluminium Conference, Dubai, UAE, November 13, 2001.

J. Marks, P. DeWaal, W. Bjerke and R. Chase (2001). *Measurement of PFC Emissions in Commercial Aluminium Reduction Cells.* Aluminium of Siberia Conference 2001, Krasyonarsk, Siberia, September, 2001.

EMPLOYMENT HISTORY

J Marks & Associates LLC	Owner	2000–Present
Alcoa Inc. Alcoa Technical Center	Manager, Analysis & Testing Services	1986–2000
United Technologies	Pratt Whitney Materials Research Laboratory	1969–1986

1.2.2. Mr. E. Lee Bray

E. LEE BRAY
E-mail: lbray@usgs.gov
Phone: (847) 404-5357 (cell)

EDUCATION

University of Illinois at Chicago
Master of Business Administration (2002). Graduated with honors.

Brigham Young University
Master of Science in Geology (1999); Bachelor of Science in Geology (1995).

Ricks College
Attended in fall 1989 and then summer and fall of 1992 before transferring to BYU.

EXPERIENCE

January 2007 to present
US Geological Survey–National Minerals Information Center
Mineral Commodity Specialist

• Mineral Commodity Specialist for aluminum, alumina, bauxite, and magnesium. From 2013 to 2020 also covered magnesium compounds, and in 2020 helped to train the new specialist for magnesium compounds. Also was co-specialist for thorium (2009-2010) and back-up for the specialists covering other commodities. Fills in for supervisor when requested.
• Participated in Section 232 investigation of the impact of aluminum imports on national security. Continues providing updates for adjustments to the tariff on aluminum imports.
• Participated creation of critical minerals list and identifying critical minerals required for health care.
• Co-authored Open File Report 2010-1256 (The Global Flow of Aluminum from 2006 Through 2025).
• Resolved issues involving unreported scrap aluminum consumption by smelters in the U.S. using data reported to USGS, trade data, and from shipment information provided by industry associations to more accurately account for secondary aluminum production.
• Advocated for solutions to publish data in a timely manner.
• Participated in planning a forum on revisions to mineral assessment methodology, helping to determine attendees, speakers, and topics for the forum.
• Collects and interprets data on production of mineral commodities, presenting the findings in monthly, quarterly, and annual publications that are available to the public and to specific users in other agencies. Completes projects in a timely manner.
• Provides information on mineral commodities to other agencies involved with issues related to trade policy and the use of mineral commodities in national defense.
• Stays abreast of events affecting the production and consumption of mineral resources.
• Interacts with representatives of companies and trade associations to obtain data.
• Conducts peer reviews of reports written by other Mineral Commodity Specialists.
• Makes presentations at industry meetings.

September 1999 to December 2006
Illinois State Geological Survey–Environmental Site Assessments Section
Associate Geologist I
• Evaluated environmental hazards near proposed transportation infrastructure projects.
• Acquired reputation as productive project manager, often relied upon for projects with short deadlines, were politically important, large, or in complex urban areas.
• Continually exceeded production expectations by 30% to 60% annually.
• Involved in obtaining renewal of contract and developing new contract proposals.
• Extensive experience dealing with the public, especially property owners affected by eminent domain proceedings along proposed construction routes.
• Responsible for training new project managers and overseeing field technicians.

May 1996 to September 1997 (Summers)
Broken Hill Proprietary Co. Ltd., Robinson Mine, Ruth, NV
Geological Assistant
• Responsible for interpreting previous drilling records to identify faults and alteration boundaries for updating the geologic model of the mine.
• Created a computerized database of geologic information from logs of more than 8,500 drill holes. The project was expected to require two geologists working two summers, but was completed in one summer for about 25% of the projected cost.

April 1995 to September 1995
Barrick Gold Corp., Mercur Mine, Mercur, UT
Geological Intern
• Field geologist working with drilling crew.

September 1998 to May 1999
Utah Valley State College, Math and Science Department
Adjunct Professor
• Taught introductory geology classes and lab for general education requirement.

September 1995 to August 1999 (excluding summers listed above)
Brigham Young University, Geology Department
Teaching Assistant, Lab Coordinator, and Research Assistant
• Taught and coordinated labs for several geology classes, including supervising other teaching assistants.
• Prepared samples for laboratory analysis of elemental composition and isotopic ratios.
• Assisted students and professor doing studies on sources of pottery material for the BYU Anthropology Department.

1.2.3. Mr. Jonathan De'Ath

Jonathan D. De'Ath

Falls Church, VA 22042. Cell (703) 402-8447

jon.d.da@gmail.com, Linkedin

SUMMARY

Environmental, health and safety affairs specialist experienced in regulatory and legislative issues under environmental statutes including the Clean Air Act, Clean Water Act, and Toxic Substance Control Act. Also experienced with rulemaking, standards, and regulations issued by the U.S. Mine Safety and Health Administration (MSHA). Skilled in greenhouse gas accounting methodology, and applying quantitative analyses and sound scientific principles to support rulemaking and policy advocacy objectives. Also experienced as an environmental scientist working on U.S. EPA multi-media remediation projects.

Scientific expertise is in environmental measurement and monitoring, and multi-media, multi-pathway human health risk assessment, including air dispersion modeling to assess risk from exposure to hazardous air pollutants. Competent project and program manager overseeing large, complex projects.

PROFESSIONAL WORK EXPERIENCE

National Lime Association (NLA) (*www.lime.org*), Arlington, VA. February 2011 – Present.

The NLA is the trade association representing companies who quarry and mine limestone, and manufacture lime (Calcium Oxide) and hydrated lime (Calcium Hydroxide). A vital component of the U.S. economy, the lime industry produces over 19 million tons annually valued at about $2.2 billion. Major markets are steelmaking, flue gas desulfurization, wastewater treatment, mining, construction, and environmental/soil stabilization.

Director Environmental/Scientific Affairs

- Principal liaison for the NLA Environmental Committee and select subcommittees. Support the NLA Board of Directors by implementing directives and executing special projects.
- Conduct research on federal and state policy, programs, and legislation on key issues related to air quality, climate, environment, energy, and mine safety, and evaluate potential impacts on the lime industry; develop appropriate strategies to address issues, and advocate NLA positions to regulators and legislators.
- Responsible for ensuring that rules or regulations proposed by EPA are fair and practical, and do not impose an unreasonable burden or cost on the industry by balancing technical, economic, and political viability.
- Ensure effective communication with NLA members on the status of relevant science and regulatory policy initiatives.
- Collect, analyze, and disseminate electronic information to support the needs of the industry as appropriate.
- Assist drafting comments on regulatory or legislative actions, policies, and other matter of interest.
- Review, analysis, and interpretation of government air emissions inventory databases (NEI, TRI, U.S. greenhouse gas (GHG) inventory etc.) for the lime industry. Conduct annual industry-wide analysis of lime industry process and energy-related GHG emissions, energy use, energy trends, energy intensity, emissions intensity, and recycling practices.
- Quarterly analysis and reporting on MSHA lime industry accident and injury data and statistics.
- Represent the NLA at meetings and conferences.

- Draft and edit bi-monthly newsletter material and manage web content material.

Significant Accomplishments

- Successfully navigated the lime industry though EPA CAA Residual Risk and Technology Review rule making.
- Managed industry-wide research effort to collect and analyze data on hazardous air pollutant emissions, including mercury mass balances, particulate matter, organics, and acid gas emissions; and performing air emission control technology evaluations.
- Managed and directed industry-wide human health risk assessment from exposure to hazardous air pollutants.
- Created centralized, MS Access NLA member databases for process and engineering data, analysis of government emissions inventories, stack test data, and accident and injury data.

Plexus Scientific Corporation *(www.plexsci.com)*, **Alexandria, VA. Sediment Remediation Specialist. April 2010 – February 2011.**

Remedial Investigation at a 110-acre marsh and 2.2-mile creek at Aberdeen Proving Ground Edgewood Area, Edgewood, MD. Developed remedial options for treatment of contaminated sediment.

BMT Designers and Planners, Inc. (*www.danp.com*), **Arlington, VA (formerly BMT Entech Inc.,) Project Manager/Senior Consultant. July 1996 – January 2010.**

Environmental remediation project manager for U.S. Department of Agriculture CERCLA and RCRA projects, including initial site assessments, RI/FS's, long-term monitoring, soil removal actions, engineering evaluation/cost assessments, and remedial design. Prepared proposals, managed and directed staff, and interfaced directly with clients, subcontractors, federal, and state agencies.

Environmental Risk Assessor

Technical lead for development of human health risk assessments in support of CERCLA investigations. Prepared baseline human health risk assessment for numerous sites (former landfill sites, chemical disposal sites etc.,) with contaminated soils, groundwater, surface water, and sediment. Developed baseline ecological risk assessments, ecological preliminary remediation goals, and risk-based site-specific ecological cleanup goals at CERCLA sites.

Environmental Chemist

Corporate QA Officer and Project Chemist: Responsible for procurement and subcontracting qualified analytical laboratories; specification, implementation, and oversight of laboratory and field quality assurance programs; and contract administration. Primary point of contact for all technical and administrative issues relating to laboratory and field activities.

Experienced performing field work including environmental sampling (media including soil, sediment, groundwater, and surface water), on-site gas chromatography analysis, and monitoring well installation. Thirteen years' experience validating environmental analytical data.

EDUCATION

B.S. Honors, Chemistry with Chemical Technology, Brighton University (Sussex, England)

COMPUTER SKILLS

MS Office (Excel (advanced), MS Access (advanced), Word, PowerPoint)

1.2.4. Dr. Pallav Purohit

CURRICULUM VITAE

Pallav PUROHIT, Ph. D.
Senior Research Scholar
International Institute for Applied Systems Analysis (IIASA)
Energy, Climate, and Environment (ECE) Program
Pollution Management (PM) Research Group
Schlosplatz 1, A – 2361 Laxenburg, Austria
Tel: +43 22 36807 – 336
Fax: +43 22 36807 - 533
Mob: +43-69910969601
Email: purohit@iiasa.ac.at; pallav1976@yahoo.co.in
Web: http://www.iiasa.ac.at

PERSONAL DATA

Date of Birth	14/01/1976
Nationality	Indian
Gender	Male
Civil status	Married, two children

RESEARCH INTERESTS

	Fluorinated Greenhouse Gas (F-gas) Emissions, Air Pollution and Health, Climate Change (Mitigation), Integrated Assessment Modeling, Short Lived Climate Forcers (SLCFs), Energy Economics, Policy & Planning, Renewable Energy Systems/Technologies

EMPLOYMENT

Jan 2021 onwards	• **Senior Research Scholar**, Pollution Management (PM) Research Group, Energy, Climate, and Environment (ECE) Program, International Institute for Applied Systems Analysis (IIASA), Laxenburg (AUSTRIA)
Sep 2007-Jun 2021	• **Research Scholar**, Air Quality & Greenhouse Gases (AIR) Program, International Institute for Applied Systems Analysis (IIASA), Laxenburg (AUSTRIA)
Sep 2005-Aug 2007	• **es Postdoctoral Research Fellow**, Research Program on International Climate Policy, Hamburg Institute of International Economics (HWWI), Hamburg (GERMANY)
Jan 2005-Aug 2005	• **Senior Lecturer**, College of Engineering, University of Petroleum & Energy Studies (UPES), New Delhi (INDIA)
Apr 2004-Dec 2005	• **Consultant**, Integrated Research and Action for Development (IRADe), New Delhi (INDIA)
Jan 2002-Mar 2004	• **Senior Research Fellow**, Centre for Energy Studies, Indian Institute of Technology (IIT) Delhi, India, Senior Research Fellowship of the Council for Scientific and Industrial Research (CSIR), Govt. of India, New Delhi (INDIA)
Jan 1999-Dec 2001	• **Senior Research Fellow**, Centre for Energy Studies, Indian Institute of Technology (IIT) Delhi, India, Senior Research Fellowship of the Indian Council for Agricultural Research (ICAR), Govt. of India, New Delhi (INDIA)

AFFILIATED POSITIONS AND RESEARCH STAYS

Sep 2019 onwards	• **Visiting Faculty**, Department of Built Environment & Energy Technology, Linnaeus University (LNU), Sweden.
Mar. 2016 onwards	• **Advisor** on ***Energy, Air Pollution and Climate Change***, Social Development for Communities (SDC) Foundation, Dehradun, India (http://sdcuk.in/)
Aug. 2015	• **Visiting Fellow**, at the Council on Energy, Environment and Water (CEEW), New Delhi, India.
Apr. 2010	• **Visiting Fellow** under the ***Governance of Clean Development (GCD) project*** (Sponsored by: Economic & Social Research Council, UK) at the School of International Development, University of East Anglia (UEA), Norwich, UK.
Mar. – Aug. 2007	• **Visiting Faculty** (Summer Semester 2007), Institute of Political Science, University of Zurich, Switzerland.
Apr. – Jun. 2005	• **Research Manager** in the ***Project Udaan - Developing Revised* Benchmarks *& Certification Process for Model Locations.*** (Sponsored by: Bharat Petroleum Corporation Limited), Indian School of Petroleum, New Delhi, India.

EDUCATION

2005	**Degree: Ph.D. (Energy Policy & Planning)** University: Indian Institute of Technology (IIT) Delhi, India Thesis title: ***Techno-Economics of Renewable Energy Utilization in Indian Agriculture Sector***
1998	**Degree: M. Sc. (Physics – Nuclear Engineering & Particle Physics)** University: H.N.B. Garhwal University Srinagar, India Thesis title: *Quark Structure of Matter*
1996	**Degree: B. Sc. (Physics, Chemistry, Mathematics)** University: H.N.B. Garhwal University Srinagar, India.

TEACHING EXPERIENCE (Courses taught)

S. No.	Course	Level	Institution
1.	International Climate Policy: policy levels, stakeholders and outcomes	PG	Institute of Political Science, University of Zurich, Switzerland
2.	Energy Economics	PG	College of Engineering, University of Petroleum & Energy Studies, New Delhi, India
3.	Energy Management	PG	
4.	Renewable Energy Resources	PG	
5.	Environmental Technology for Sustainable Development.	PG	Linnaeus University Summer Academy 2019, Sweden.
6.	Evaluation and Design of Energy Policies	PG	Department of Built Environment & Energy Technology, Linnaeus University, Sweden.

SUPERVISION (Ph. D. and MS/MBA students)

1. D. Düring. 2021. *Optimizing the management of ambient particulate matter pollution in Gauteng, South Africa.* North-West University (NWU), South Africa (under the Young Scientists Summer Program (YSSP) of IIASA, Laxenburg, Austria).
2. H.D. Jiang. 2019. *Modelling and Application Research on Influential Factors of Carbon Abatement Cost in China.* Center for Energy & Environment Policy Research, School of Management and Economics, Beijing Institute of Technology, China (under the China Scholarship Council (CSC) Scholar at IIASA, Laxenburg, Austria).
3. X. Wang. 2019. *Assessing Energy Efficiency Co-Benefits for Air Pollution and Greenhouse Gas Abatement in China's Building Sector.* School of Economics and Management, Beihang University, Beijing (under the Young Scientists Summer Program (YSSP) of IIASA, Laxenburg, Austria).
4. Z. Zhai. 2015. *HFC Emissions and Mitigation Strategies for China Using GAINS Model.* College of Environmental Sciences and Engineering, Peking University, Beijing (under the Young Scientists Summer Program (YSSP) of IIASA, Laxenburg, Austria).
5. K.A. Mir 2014. *Air Quality Improvement & Greenhouse Gas Mitigation in Pakistan: An Integrated Approach.* Master's Dissertation, National University of Singapore (NUS), Singapore.
6. N. Lam. 2013. *Assessing health and environmental impacts of measures that supplant kerosene use in developing country households: Lighting.* School of Public Health, University of California, Berkeley (under the YSSP of IIASA, Laxenburg, Austria).
7. S.K. Gupta. 2012. *Assessing the performance of Renewable Energy Certificate (REC) market in India.* Department of Industrial and Management Engineering (IME), Indian Institute of Technology (IIT) Kanpur (under the DFID-funded *Support to Improve Climate Research and Information Services in South Asia* (SICRISA) Program at the Institute of Development Studies (IDS), UK).
8. H.H. Dholakia. 2012. *Study of burden of disease as a result of air pollution across different income groups in selected cities in India.* Public Systems Group, Indian Institute of Management (IIM), Ahmedabad (under the YSSP of IIASA, Laxenburg, Austria).
9. T. Munir. 2008. *Assessment of air pollution and greenhouse gas mitigation strategies in Pakistan using the GAINS model.* Global Change Impact Studies Centre (GCISC) Islamabad (under the YSSP of IIASA).
10. J.J. Martto. 2005. *Monetizing environmental benefit of natural gas projects through carbon trading.* MBA Dissertation, University of Petroleum & Energy Studies, Dehradun, India.
11. H.V. Rai. 2005. *Assessment of environmental benefit of wind energy projects under clean development mechanism.* MBA Dissertation, University of Petroleum & Energy Studies, Dehradun, India.

CAPACITY BUILDING (Select)

- Trainer/Program Coordinator. *Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) India Virtual Workshop.* IIASA-GIZ-EU workshop on *Low Carbon Modelling - Strategic Partnerships for the Implementation of the Paris Agreement,* 12-16th April 2021 (See: http://gains.iiasa.ac.at/SPIPA/).
- Trainer/Program Co-coordinator. *Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) – India.* TIFAC-IIASA-NEERI workshop on *Economic Development and Atmospheric Pollution* at National Environmental Engineering Research Institute (NEERI), Nagpur, India, 6-10th Feb 2012.
- Trainer/Program Co-coordinator. *Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) – India.* TIFAC-IIASA-CEPT workshop on *Climate Change, Regional Air Pollution and Greenhouse Gas Mitigation* at CEPT University, Ahmadabad, 27-28th Jan 2011.
- Trainer/Program Co-coordinator. International Training Program on "*Renewable Energy: Techno-economic, Financial and Socio-environmental Issues*". Sponsored by: Ministry of Non-conventional Energy Sources, Govt. of India, New Delhi, 7-17th Dec 2004.

PROFESSIONAL AND REVIEW ACTIVITIES

Grant Reviews

- External reviewer (research proposals) for the National Centre of Science & Technology Evaluation (NCSTE), Ministry of Education & Science, Astana, Republic of Kazakhstan (*2011 onwards*).
- External reviewer (research proposals) for the King Fahd University of Petroleum & Minerals (KFUPM), Dhahran, Saudi Arabia.

Journal Reviews

1) Energy, 2) Applied Energy, 3) Energy Policy, 4) Solar Energy, 5) Energy & Buildings, 6) International Journal of Global Energy Issues, 7) International Journal of Environmental Research & Public Health, 8) Energies, 9) Sustainability, 10) Mitigation & Adaptation Strategies for Global Change, 11) International Journal of Sustainable Energy, 12) Journal of Cleaner Production, 13) The Open Fuels & Energy Science Journal, 14) The Open Renewable Energy Journal, 15) Desalination, 16) International Journal of Energy Sector Management, 17) Journal of Renewable & Sustainable Energy, 18) Environmental Progress & Sustainable Energy, 19) International Journal of Green Energy, 20) Energy Strategy Reviews, 21) SESI Journal, 22) Greenhouse Gas Measurement & Management, 23) Energy for Sustainable Development, 24) Economic & Political Weekly, 25) Journal of Integrative Environmental Sciences, 26) Environmental Engineering & Management Journal, 27) Environment, Development & Sustainability, 28) Climate Policy, 29) International Journal of Electrical Power & Energy Systems, 30) Applied Economics, 31) Atmospheric Environment, 32) International Journal of Climate Change Strategies & Management, 33) Journal of Renewable Energy, 34) Sustainable Energy Technologies & Assessments, 35) Journal of the Air & Waste Management Association, 36) Environmental Research Letters, 37) Current Science, 38) International Journal of Global Warming; 39) World Development, 40) Nature Sustainability, 41) Environmental Progress & Sustainable Energy, 42) Nature Energy, 43) International Journal of Global Environmental Issues, 44) Energy, Sustainability and Society, 45) Journal of Environmental Management, 46) Nature Communications, 47) Renewable & Sustainable Energy Reviews, 48) Environmental Research, 49) Communications Earth & Environment, 50) Atmospheric Pollution Research, 51) Energy and Climate Change, 52) Environmental Science & Technology, 53) Chemosphere.

SCIENTIFIC RECOGNITION

1. Key contributor and reviewer to the *REN21Global Status Report 2021* by REN21 Secretariat, Paris, June 2021.
2. Key contributor and reviewer to the *Air Quality and Climate Policy Integration in India: Frameworks to deliver co-benefits* by International Energy Agency (IEA), Paris, May 2021.
3. Key contributor to the *Net Zero by 2050 - A Roadmap for the Global Energy Sector* by International Energy Agency (IEA), Paris, May 2021.
4. Key contributor and reviewer to the *Renewables in Cities 2021: Global Status Report* by REN21 Secretariat, Paris, March 2021.
5. Key contributor to the *India Energy Outlook 2021: World Energy Outlook Special Report* by International Energy Agency (IEA), Paris, February 2021.
6. Key contributor to the *World Energy Outlook 2020* by International Energy Agency (IEA), Paris, October 2020.
7. Key contributor to the UNEP/IEA report on *Cooling Emissions and Policy Synthesis Report: Benefits of cooling efficiency and the Kigali Amendment*. July 2020.
8. Lead Country Contributor (India) and reviewer to *REN21Global Status Report 2020* by REN21 Secretariat, Paris, June 2020.
9. Key contributor to the *World Energy Outlook 2019* by International Energy Agency (IEA), Paris, November 2019.

10. Key contributor to Africa Energy Outlook 2019: World Energy Outlook Special Report by International Energy Agency (IEA), Paris, November 2019.
11. Key contributor to the *Renewables in Cities 2019: Global Status Report* by REN21 Secretariat, Paris, November 2019.
12. Key contributor to Cooling on the Move: The future of air conditioning in vehicles by International Energy Agency (IEA), Paris, September 2019.
13. Lead Country Contributor (India) to *REN21 Global Status Report 2019* by REN21 Secretariat, Paris, June 2019.
14. Key contributor to The Future of Cooling in China Delivering on action plans for sustainable air conditioning by International Energy Agency (IEA), Paris, June 2019.
15. Lead Author, Air Pollution in Asia and the Pacific: Science-based Solutions. Summary Report of the United Nations Environment Programme (UNEP) and Climate and Clean Air Coalition (CCAC), January 2019.
16. External Reviewer for USEPA Report on *Global Non-CO_2 Greenhouse Gas Emissions Projections & Marginal Abatement Cost Analysis*, U.S. Environmental Protection Agency (EPA), Office of Atmospheric Programs/Climate Change Division, Washington, D.C.
17. Lead Author, *Chapter 6: Meeting Future Energy Needs in the Hindu Kush Himalaya*, In: The Hindu Kush Himalaya Assessment - Mountains, Climate Change, Sustainability and People, Springer-Nature, Switzerland, 2019.
18. Contributing Author, *Chapter 2: Mitigation pathways compatible with 1.5°C in the context of sustainable development*. In: Special Report on Global Warming of 1.5°C (SR15), Intergovernmental Panel on Climate Change (IPCC), Geneva, October 2018.
19. Key contributor to the *World Energy Outlook 2018* by International Energy Agency (IEA), Paris, November 2018.
20. Lead Country Contributor (India) to *REN21 Global Status Report 2018* by REN21 Secretariat, Paris.
21. Lead Author, Chapter 2: Drivers, Regional Emissions and Measurements. In: *Integrated Assessment of Short-Lived Climate Pollutants in Latin America and the Caribbean*. Report of the Climate and Clean Air Coalition (CCAC), United Nations Environment Program (UNEP), Paris, 2018, ISBN: 978-92-807-3549-9.
22. Lead Author, Chapter 4: SLCP measures, the potential reduction in emissions, and benefits for near-term climate and air quality. In: *Integrated Assessment of Short-Lived Climate Pollutants in Latin America and the Caribbean*. Report of the Climate and Clean Air Coalition (CCAC), United Nations Environment Program (UNEP), Paris, 2018, ISBN: 978-92-807-3549-9.
23. Lead Country Contributor (India) to *REN21 Global Status Report 2017* by REN21 Secretariat, Paris.
24. Key contributor to the *World Energy Outlook 2016 Special Report on Energy and Air Pollution* by International Energy Agency (IEA), Paris.
25. Lead Sectoral Contributor (Distributed Renewable Energy for Energy Access) to *REN21 Global Status Report 2016* by REN21 Secretariat, Paris.
26. Lead Country Contributor (India) to *REN21 Global Status Report 2015* by REN21 Secretariat, Paris.
27. Key contributor to the IEA's *World Energy Outlook 2015 Special Report on India Energy Outlook* by International Energy Agency (IEA), Paris.
28. Contributor and Reviewer for *Southern African Development Community (SADC) Renewable Energy and Energy Efficiency Status Report 2015* published by REN21.
29. Lead Author, Chapter 6: Concentrating Solar Power. In: *Green Energy Choices: The benefits, risks, and trade-offs of low-carbon technologies for electricity production*. Report of the International Resource Panel, United Nations Environment Program (UNEP), Paris, 2016, ISBN: 978-92-807-3490-4.
30. Lead Author, UNEP report on *Biofuel Roadmap for India* by UNEP/DTU, Copenhagen, November 2015.
31. Lead Author, UNEP report on *Second generation biofuel potential in India: Sustainability and cost considerations* by UNEP/RISOE, Copenhagen, June 2014.
32. Consultant, Work Bank, *Diesel Power Generation: Inventories and Black Carbon Emissions in Nigeria*, 2014.
33. Consultant, Work Bank, *Diesel Power Generation: Inventories and Black Carbon Emissions in Kathmandu Valley*, Nepal, 2014.
34. Contributing author, Chapter 17: Energy Pathways for Sustainable Development. In: *Global Energy Assessment: Towards Sustainable Future*. International Institute for Applied Systems Analysis and Cambridge University Press, June 2012.
35. Consultant, United Nations Framework Convention on Climate Change (UNFCCC), *Additionality Testing of CDM Projects*, 2007.

MEMBERSHIP OF PROFESSIONAL SOCIETIES/EDITORSHIP, etc.

1. Associate Editor (*Apr 2010 onwards*), *International Journal of Global Energy Issues (IJGEI)* published by Inderscience.
2. Associate Editor, Handbook of Climate Change Management, Springer Nature, ISBN 978-3-030-57280-8.
3. Guest Editor, Special Issue on Cool it - How to address global cooling needs in a warming world? for the *Mitigation and Adaptation Strategies for Global Change* (IF: 3.23) published by Springer.
4. Guest Editor, Special Issue on *Atmospheric Pollution* of the *Sustainability* Journal (IF: 2.6) published by MDPI Switzerland.
5. Guest Editor, Special Issue on *Modern Bioenergy for Sustainable Development* of the *Sustainability* Journal (IF: 2.6) published by MDPI Switzerland.
6. Member, Editorial Board of *Sustainability* Journal (IF: 2.6) published by MDPI Switzerland.
7. Member, Editorial Board of *Journal of Atmospheric Science Research* published by Bilingual Publishing.
8. Member, Editorial Board of *Progress in Energy & Fuels* published by PiscoMed Publishing Pvt. Ltd.
9. Member, Editorial Board of *The Global Environmental Engineers* published by Avanti Publishers.
10. Member, Editorial Board of *International Journal of Renewable and Environmental Sciences* published by Bret Research Journals.
11. Member, Editorial Board of *Current Environmental Engineering* Journal published by Bentham Science Publishers.
12. Member, Editorial Board of *Journal of Renewable Energy* published by Hindawi.
13. Member, Editorial Board of *Innovative Energy & Research* published by the OMICS International.
14. Member, Editorial Board of *Global Journal of Researches in Engineering* published by Global Journals.
15. Member (former), Editorial Board of *Journal of Environment & Agricultural Studies* published by Al-Kindi Center for Research and Development (KCRD)
16. Member (former), Editorial Board of *American Journal of Electrical Power & Energy Systems* published by SciencePG.
17. Member (former), Editorial Board of *The Open Renewable Energy Journal* published by BENTHAM OPEN
18. Member, Scientific Advisory Committee, 3rd World Sustainability Forum (WSF-3), Basel, Switzerland 1-30 November 2013.
19. Member, Scientific Advisory Committee, 2nd World Sustainability Forum (WSF-2), Basel, Switzerland 1-30 November 2012.
20. Member, International Steering Committee, World Renewable Energy Congress (WREC-X), Glasgow, UK 19-25 July 2008.
21. Distant Mentor for the project - Support to Improve Climate Research and Information Systems in South Asia (SICRISA). Institute of Development Studies (IDS), UK.
22. Life member, Solar Energy Society of India (SESI)
23. Member South Asian Network for Development & Environmental Economics
24. Member International Energy Foundation (IEF)
25. Founding Member: ClimateNet e.V. Hamburg

AWARD/FELLOWSHIP

1. Outstanding Paper Awards – 2008 by Emerald Group Publishing Limited.
2. Marquis WHO's Who in Science & Engineering (10th Anniversary Edition) 2007-08.
3. e8 Postdoctoral Scholarship on Sustainable Energy Development (2004-05), e8 Network Secretariat (now Global Sustainable Electricity Partnership: GSEP).
4. Research Associate of the Council of Scientific & Industrial Research (CSIR), Govt. of India.
5. Senior Research Fellowship of the Council of Scientific & Industrial Research (CSIR), Govt. of India.

PROFICIENCY IN COMPUTERS

OS:	DOS, WINDOWS
Languages:	GAMS (General Algebraic Modeling Software), FORTRAN 77/95, SQL
Packages:	MS OFFICE, SIGMA PLOT, TORA, RETScreen, CURXPT, EVIEWS, System Advisor Model

LANGUAGES

Language	Reading	Speak	Writing
Hindi*	1	1	1
English	1	1	1
German	2	2	2

*(1: Excellent; 2, Intermediate, 3: Basic; (*Mother Tongue, Basic level knowledge of Sanskrit, Urdu, etc.)*

Annexure - I

RESEARCH PUBLICATIONS

(h-index – 39; i10-index: 89; Citations: 5576)

A. Books

1. Khatiwada, D., Purohit, P. (Eds.) 2021. ***Modern Bioenergy for Sustainable Development***. MDPI Switzerland, ISBN 978-3-0365-0469-8.

B. Journal Articles (peer-reviewed)

2. Peng, W., Kim, S.E., Purohit, P., Urpelainen, J., Wagner, F. 2021. Incorporating political feasibility concerns into India's clean air policies for addressing air quality and climate objectives. ***One Earth***, Vol. 4, No. 7, pp. 1-12, https://doi.org/10.1016/j.oneear.2021.07.004.
3. Hamilton, I., Kennard, H., McGushin, A., Hoglind-Isaksson, L., Kiesewetter, G., Lott, M., Milner, J., Purohit, P., Rafaj, P., Sharma, R., Springmann, M., Woodcock, J., Watts, N. 2021. Responding to climate change for health: the public health implications of the Paris Agreement. ***The Lancet Planetary Health***, Vol. 5, No. 2, pp. e74-e83, https://doi.org/10.1016/S2542-5196(20)30249-7
4. David, L. M., Barth, M., Höglund-Isaksson, L., Purohit, P., Velders, G. J. M., Glaser, S., and Ravishankara, A. R. 2021. Trifluoroacetic acid deposition from emissions of HFO-1234yf in India, China and the Middle East. ***Atmospheric Chemistry & Physics*** https://doi.org/10.5194/acp-2021-222.
5. Mir, K.A., Park, C., Purohit, P., Kim, S. 2021. Comparative analysis of greenhouse gas emission inventory for Pakistan: Part II agriculture, forestry and other land use and waste. ***Advances in Climate Change Research***, Vol 12, No. 1, pp. 132-144, https://doi.org/10.1016/j.accre.2021.01.003
6. Khatiwada, D., Purohit, P. 2021. Special Issue on Assessing the Modern Bioenergy Potential and Strategies for Sustainable Development: Transformations through Nexus, Policy, and Innovations. ***Sustainability***, Vol. 13, No. 1, 374 (1-5); https://doi.org/10.3390/su13010374
7. Jiang, H., Purohit, P., Dong, K., Liu, L.-J., Liang, Q.-M. 2021.The cost-benefit comparisons of China's and India's NDCs based on carbon marginal abatement cost curves. ***Energy Economics*** (*Under review*).
8. Mir, K.A., Purohit, P., Cail, S., Kim, S. 2021. Co-benefits of addressing climate change and air pollution simultaneously in Pakistan. ***Environmental Science & Policy*** (*Under review*).
9. Jiang, H., Purohit, P., Liu, L.-J., Liang, Q.-M. 2021. Marginal abatement cost of carbon with air-quality co-benefits: A multi-provincial analysis of China. ***China Economic Review*** (*Under review*).
10. Amjath-Babu, T.S., Aggarwal, P., Vitale, J., Purohit, P., Shah, T. 2021. Centralized versus decentralized solar electricity for groundwater pumping to farmers facing climatic risks: Implications on crop choice, profitability and resource degradation. ***International Journal of Water Resources Development*** (*Under review*).
11. Purohit, P., Borgford-Parnell, N., Klimont, Z., Höglund-Isaksson, L. 2021. Accelerating HFC phase-down under the Kigali amendment to the Montreal protocol (*In preparation*).
12. Wang, X., Purohit, P. 2021. Transitioning to low-GWP alternatives of hydrofluorocarbons with enhanced energy efficiency in commercial air conditioning sector of China (*In preparation*).
13. Klimont, Z., Hoglund, L., Heyes, C., Rafaj, P., Schoepp, W., Cofala, J., Borken-Kleefeld, J., Purohit, P., Kupiainen, K., Winiwarter, W., Amann, M., Zhao, B., Wang, S.X., Bertok, I., Sander, R. 2021. Global scenarios of air pollutants and methane: 1990-2050 (*In preparation*).
14. Klimont, Z., Heyes, C., Rafaj, P., Schoepp, W., Purohit, P., Cofala, J., Hoglund-Isaksson, L., Wagner, F. 2021. Global scenarios of anthropogenic emissions of air pollutants: ECLIPSE (*In preparation*).
15. Khatiwada, D., Purohit, P., Ackom, E., Nerini, F.F., Bailis, R., Zerriffi, H. 2021. Powering the SDGs through Bioelectricity from Biomass Residues in Least Developed Countries (*In preparation*).
16. Purohit, P., Höglund-Isaksson, L., Dulac, J., Shah, N., Wei, M., Rafaj, P., and Schöpp, W. 2020. Electricity savings and greenhouse gas emission reductions from global phase-down of hydrofluorocarbons. ***Atmospheric Chemistry & Physics***, Vol. 20, No. 19, pp. 11305–11327, https://doi.org/10.5194/acp-2020-193.
17. Peng, W., Dai, H., Guo, H., Purohit, P., Urpelainen, J., Wagner, F., Wu, Y., Zhang, H. 2020. The central role of policy enforcement in achieving health, air quality and climate benefits from India's clean electricity transition. ***Environmental Science & Technology***, Vol 54, No. 19, pp. 11720-11731, https://doi.org/10.1021/acs.est.0c01622.
18. Wang, X., Purohit, P., Höglund-Isaksson, L., Zhang, S., Fang, H. 2020. Co-benefits of energy efficient air conditioners in the residential building sector of China. ***Environmental Science & Technology***, Vol. 54, No. 19, pp. 11720-11731, http://dx.doi.org/10.1021/acs.est.0c01622.

19. Amann, M., Kiesewetter, G., Schoepp, W., Klimont, Z., Winiwarter, W., Cofala, J., Rafaj, P., Hoglund-Isaksson, L., Gomez-Sabriana, A., Heyes, C., Purohit, P., Borken-Kleefeld, J., Wagner, F., Sander, R., Fagerli, H., Nyiri, A., Cozzi, L., Pavarini, C. 2020. Reducing global air pollution: The scope for further policy interventions. ***Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences***, Vol. 378, No. 2183, pp. 20190331, http://dx.doi.org/10.1098/rsta.2019.0331
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190. Purohit, P., Höglund-Isaksson, L., Bertok, I., Chaturvedi, V., Sharma, M. 2016. ***Scenario analysis for HFC emissions in India: Mitigation potential and costs***. Submitted to the ClimateWorks Foundation, 29th Feb 2016.

191. Höglund Isaksson L, Winiwarter W, Purohit P, and Gomez-Sanabria A. 2016. ***Non-CO2 greenhouse gas emissions in the EU-28 from 2005 to 2050: GAINS model methodology***. IIASA Report submitted to the European Commission.

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193. Purohit, P., Fischer, G. 2013. ***Second generation biofuel potential in India: Sustainability and cost considerations***. Submitted to the UNEP Risø Centre, Roskilde, Denmark.

194. Höglund-Isaksson, L., Winiwarter, W., Purohit, P. 2013. ***Non-CO2 greenhouse gas emissions, mitigation potentials and costs in the EU-28 from 2005 to 2050: Part I: GAINS model methodology. GAINS methodology report*** submitted to the European Commission, 8th November 2013.

195. Höglund-Isaksson, L., Winiwarter, W., Purohit, P. 2013. ***Non-CO_2 greenhouse gas emissions, mitigation potentials and costs in the EU-28 from 2005 to 2050: Part II: GAINS model results***. Final Technical Report submitted to the European Commission, 21st Feb 2014.

196. Klimont, Z., K. Kupiainen, Ch. Heyes, J. Cofala, P. Rafaj, L. Höglund-Isaksson, J. Borken, W. Schöpp, W. Winiwarter, P. Purohit, I. Bertok, R. Sander. 2013. ***ECLIPSE V4a: Global emission data set developed with the GAINS model for the period 2005 to 2050: Key features and principal data sources***, International Institute for Applied Systems Analysis (IIASA), Schlossplatz 1, 2361 Laxenburg, Austria, 2013.

197. Höglund-Isaksson, L., Winiwarter, W., Purohit, P. 2013. ***EU Low Carbon Roadmap 2050: Methodology for estimation of non-CO2 greenhouse gas emissions, mitigation potentials and costs***. Interim report to the European Commission, DG Climate Action (Sub-Contract no. 071303/2011/600928/SER/CLIMA.A4).

198. Amann, M., Borken-Kleefeld, J., Cofala, J., Heyes, C., Klimont, Z., Rafaj, P., Purohit, P., Schöpp, W., Winiwarter, W. 2012. ***Future emissions of air pollutants in Europe – Current legislation baseline and the scope for future reductions***. TSAP Report 1, Service contract on "Monitoring and Assessment of Sectorial Implementation Actions" Framework Contract (ENV.C.3/SER/2011/0009).

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202. Höglund-Isaksson, L., Purohit, P. 2011. ***Estimation of future F-gas emissions and mitigation potentials in the GAINS model***. Technical Note prepared for DG-CLIMA, European Commission, Brussels.

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206. Heyes, C., Höglund-Isaksson, L., Purohit, P., Rafaj, P., Schöpp, W., Winiwarter, W., Amann, M. (2010). ***Model application for post-2012 regime: global policies and EU-27 action***. Final report Submitted to Entec UK Ltd., London.

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211. Michaelowa, A., Purohit, P. 2006. ***Additionality Testing of CDM Projects***. Final Technical Report (FTR) submitted to the United Nations Framework Convention on Climate Change (UNFCCC), Bonn.

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Annexure - II

RESEARCH PROJECTS/FUNDING (Select)

1) System for Protection of Health, Essential Resources and Environment from Persistent Mobile Chemicals. Joint research proposal *submitted* under Horizon 2020 - Research and Innovation Framework Programme (Euro 530,625).
2) Research on Low-carbon Technology Innovation and Transformation in Transport Sector. Joint research proposal *submitted* under the Austria/China Scientific & Technological Cooperation (WTZ) Programme to the OeAD (Österreichische Austauschdienst)-GmbH (Euro 45,000).
3) Low Carbon Modelling - Strategic Partnerships for the Implementation of the Paris Agreement. Sponsored by Deutsche Gesellschaft fuer International Zusammenarbeit (GIZ) GmbH (April 2020 – Dec 2021) (Euro 86,576*).
4) Advancing the Clean Air, Health and Climate Integration Agenda in the Association of Southeast Asian Nations (ASEAN) Region. Sponsored by Climate and Clean Air Coalition (CCAC), Paris (Nov 2019 – June 2021).
5) Supporting Air Quality Management Planning in Johannesburg, South Africa – Cost Effectiveness/Air Quality Management Planning (CE-AQMP). Sponsored by Procurement, Pollution Management & Environmental Health (PMEH) Pilot, The World Bank (Sep 2020 – Oct 2021).
6) Clean Air Project in India. Sponsored by Swiss Agency for Development Cooperation (SDC), Switzerland (Nov 2019 – Oct 2023).
7) The World's Roadmap to Net Zero by 2050. Sponsored by Organization for Economic Co-operation and Development (OECD) Paris (Mar 2021 – May 2021).
8) EUClimit (Phase-V): Assessment of EU Climate Policies in an EU mid-century perspective. Sponsored by EU Commission, DG CLIMA (climate action), Brussels at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Dec 2019 – Nov 2021).
9) Technical Assistance to the Air Quality Management Modelling project in the Indo-Gangetic Plain. Sponsored by the World Bank at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Sep 2020 – Jun 2021).
10) World Bank Flagship Study on South Asia. Sponsored by the World Bank at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (SEP 2019 – Dec 2020).
11) *Backup Generator (BUGS) Impact Study*. Sub-contracted by Schatz Energy Research Center (SERC), Humboldt State University, California (USD 4,900*).
12) EUClimit (Phase-IV): Assessment of EU Climate Policies in an EU mid-century perspective. Sponsored by EU Commission, DG CLIMA (climate action), Brussels at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Nov 2017 – Nov 2019).
13) *Analyzing Cross-sectoral learnings and linkages for the faster penetration of clean energy technologies in South Asia and Sub-Saharan Africa*. Sponsored by: Formas - The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Euro 50,000*) at IIASA, Laxenburg, Austria (*forthcoming*).
14) Development of global HFC emission scenarios to 2100 using Shared Socio-economic Pathways. Sponsored by: ClimateWorks Foundation (USD 80,000*) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Oct 2018 – Mar 2019).
15) Pathways to achieving National Ambient Air Quality Standards in India. Sponsored by: ClimateWorks Foundation (USD 88,468*) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Sep 2017 – Dec 2018).
16) EUClimit (Phase-III): Modelling of EU climate policies. Sponsored by EU Commission, DG CLIMA (climate action), Brussels at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Jan 2016 – Dec 2016).
17) Hydrofluorocarbon (HFC) phase-down scenarios for Asia. Sponsored by: Climate & Clean Air Coalition (CCAC), United Nations Environment Programme (USD 60,000*) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Jun – Nov 2017).
18) Co-benefits of Hydrofluorocarbons (HFC) phase-down under the Montreal Protocol. Sponsored by: ClimateWorks Foundation (USD 50,000*) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Dec 2016 to May 2017).
19) Exploring long-term mitigation potential of SLCP emissions. Sponsored by: ClimateWorks Foundation at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Apr 2016 to Mar 2017).
20) IEA's World Energy Outlook (WEO) 2016 special report on Energy and Air Pollution. Sponsored by: International Energy Agency (IEA), Paris.
21) IEA's World Energy Outlook (WEO) special report on Implications of energy trajectories from the World Energy Outlook 2015 for India's air pollution. Sponsored by: International Energy Agency (IEA), Paris.

22) Regional Assessment of Short-Lived Climate Pollutants in Latin America and the Caribbean. Sponsored by: UNEP Regional Office for Latin America and the Caribbean, Panama City (Nov 2014 to Oct 2015).
23) EUClimit (Phase-II): Modelling of EU climate policies. Sponsored by EU Commission, Brussels at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Jul 2014 – May 2016).
24) Biofuel roadmap for India (*consultancy*). Sponsored by: UNEP DTU Partnership (USD 7,000*), Copenhagen, Denmark (May – August 2015).
25) India's HFC emission scenarios: Mitigation potential and costs (Joint project by Council on Energy, Environment and Water (CEEW), New Delhi, India and International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria), Sponsored by: ClimateWorks Foundation (USD 48,753*), Washington DC (Sep 2014 –December 2015).
26) Second generation biofuel potential in India: Sustainability and cost considerations (*consultancy*). Sponsored by: UNEP Risø Centre (USD 7,000*), Roskilde, Denmark (May-August 2014).
27) Development and Application of GAINS-City Model for Indian Cities (Joint project by National Environmental Engineering Research Institute (NEERI), Nagpur, India and International Institute for Applied Systems Analysis (IIASA), Austria), Sponsored by: Technology Information, Forecasting and Assessment Council (USD 75,000), Govt. of India, New Delhi (Sep 2013 to Aug 2016).
28) Diesel Generator Emissions Inventory and Black Carbon Emissions Estimates. Sponsored by: The World Bank (USD 3,000*) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Jun - Aug 2013).
29) Climate Works: Phase–II: *To identify and implement the GHG mitigation potential for China and India in the IIASA-GAINS model.* Sponsored by: ClimateWorks Foundation at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Oct 2012 – May 2013).
30) Evaluating the Climate and Air Quality Impacts of Short-Lived Pollutants (ECLIPSE). Project No. 282688. European Commission (7th Framework).
31) Pan-European Gas-Aerosols-Climate Interaction Study (PEGASOS). Project No. 265148. European Commission (7th Framework).
32) Assessment of Hemispheric Air Pollution on EU Air Policy. Contract No. 07.0307/2011/605671/SER/C3. European Commission (7th Framework).
33) Mitigation of Climate Change: *Continued model capacity to support international policy objectives.* Sponsored by: European Commission via. Entec UK Ltd. at International Institute for Applied Systems Analysis (IIASA), Austria (Jan 2011 – Mar 2012).
34) EUClimit (Phase-I): Development and application of EU economy-wide climate mitigation modelling capacity (all greenhouse gas emissions and removals). Sponsored by EU Commission, DG CLIMA (climate action), Brussels at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Sep 2011 – Jan 2014).
35) Model Based Assessment of EU energy and climate change policies for post-2012 regime. Sponsored by: European Commission via. National Technical University of Athens, Greece at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Apr 2010 – Dec 2011).
36) Model Application for Post 2012 Regime: *global policies and EU-27 action.* Sponsored by: European Commission, DG Environment via Entec UK Ltd. at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Sep 2008 – July 2011).
37) Global Energy Assessment Initiative. Sponsored by: Swedish Environmental Research Institute Ltd. (IVL) at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Aug 2008 – June 2009).
38) Comparison of GHG Mitigation Efforts for Annex 1 Parties. Sponsored by: International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (Apr – Dec 2008).
39) Climate Works: Phase–I: *To identify and implement the GHG mitigation potential for Annex-I countries in the IIASA-GAINS model.* Sponsored by: ClimateWorks Foundation at International Institute for Applied Systems Analysis (IIASA), Austria (2009).
40) Toyota Asian Ozone Project. Sponsored by: Toyota Motor Corporation (TMC) Japan at International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria.
41) Policy Pathways to Human Development and Implications on GHG emissions. Sponsored by: International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria.
42) GAINS (Greenhouse Gas and Air Pollution Interactions and Synergies) Asia. Sponsored by: DG Research, European Commission, Brussels (2005-2008).
43) Additionality Testing of CDM Projects. Sponsored by: United Nations Framework Convention on Climate Change (UNFCCC), Bonn at the Hamburg Institute of International Economics (HWWI), Hamburg, Germany (Jun 2006 – Aug 2006).
44) Carbon dioxide emissions mitigation potential through renewable energy technologies in India. Sponsored by e7 Network Secretariat (USD 50,000*), Montreal, Canada.

45) Project Udaan - Developing revised benchmarks and certification process for model locations. (*Sponsored by*: Bharat Petroleum Corporation Ltd.) at Indian School of Petroleum (ISP), New Delhi (Apr 2005 – Jun 2005).

46) Fuelling India's Growth: Past Trends and Scenarios. (*A joint collaborative project of IRADe, New Delhi and PricewaterhouseCoopers Ltd., New Delhi*) sponsored by: Petroleum Federation of India (PetroFed), New Delhi) at Integrated Research and Action for Development (IRADe), New Delhi, India.

47) GHG Reduction Potential, Sectoral Baselines and Opportunities for CDM Projects. (Sponsored by: Ministry of Environment and Forest, Govt. of India, New Delhi) at Integrated Research and Action for Development (IRADe), New Delhi, India.

48) Impact of fuel Scarcity and Pollution on Rural Poor: A Comparative Analysis of Vulnerable Groups in Himachal Pradesh (Sponsored by: South Asia Network of Economic Research Institutes (SANEI), New Delhi) at Integrated Research and Action for Development (IRADe), New Delhi, India.

49) Round robin testing of box type solar cookers and flat plate solar collectors in India. Sponsored by: Ministry of Non-conventional Energy Sources (MNES), Govt. of India, New Delhi at Centre for Energy Studies, Indian Institute of Technology (IIT) Delhi, India.

50) Using renewable energy technologies in the agriculture sector of India: Modeling for potential assessment, financial, economic and environmental evaluation, and energy end use matching. Sponsored by: Indian Council of Agricultural Research (ICAR), Ministry of Agriculture, Govt. of India, New Delhi (Jan 1999 – Dec 2001).

**Research funding as principal investigator is provided in bracket.*

Annexure – III

CONFERENCES/WORKSHOPS/INVITED LECTURES (Select)

1) Kigali Workstream discussion on *Accelerating the Kigali Amendment*, organized by the Climate and Clean Air Coalition (CCAC), 6 May 2021.
2) *Co-benefits of the Kigali Amendment*, organized by the Technology and Economic Assessment Panel (TEAP) of the UNEP, 5 May 2021.
3) *HFC consumption trends in Article 5 countries*, organized by the Climate and Clean Air Coalition (CCAC), 4 May 2021.
4) Online presentation on the *Co-benefits of global HFC phase-down under the Kigali amendment to the Montreal Protocol*, ECE Program, IIASA, Laxenburg, Austria, 3 May 2021
5) Online presentation on SPIPA GAINS Workshop on *Understanding data in GAINS and exchange with the model – Residential and Commercial Sector.* 15 April 2021
6) Online presentation on the *Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) Model: Residential Sector* at the 1st Technical Advisory Committee meeting of the CSIR-NWU-GAINS project on cost-effective air quality management in the cities of Johannesburg, Ekurhuleni, and Tshwane (A World Bank funded project), 25 March 2021.
7) *Clean Air Project (CAP) India brainstorming session for identification of pilot project*, organized by The Energy and resources Institute (TERI),16 February 2021.
8) *Applications of GAINS model for integrated policy design and impact evaluation.*16th Refresher Course on "Spatiality and Sustainability for an Inclusive Future", organized by the UGC-Human Resource Development Centre, Jamia Millia Islamia (Central University), New Delhi, 9 November 2020.
9) *Air quality management and clean air technologies* Panel discussion on Air Pollution Management, Vaishwik Bharatiya Vaigyanik (Vaibhav) Summit, 15 October 2020 (online event).
10) *Air pollution management in India: Issues, challenges, and the way forward.* Panel discussion on Air Pollution Management through Monitoring and Modelling and Health Benefit assessment, Vaishwik Bharatiya Vaigyanik (Vaibhav) Summit, 12 October 2020 (online event).
11) *Co-benefits of the global HFC phase-down.* Catalyzing 2030 Mitigation Ambition – HFCs, Climate and Clean Air Coalition (CCAC) Science Policy Dialogue, 28 September 2020 (online event).
12) *Co-benefits of the global HFC phase-down under Kigali amendment to the Montreal Protocol.* Sustainable Recovery in Building Sector – Energy Efficient Cooling and Renewable Energy, The 6th IEA-Tsinghua Joint Workshop, 28 September 2020 (online event).
13) *Applications of GAINS model for integrated policy design and impact evaluation.* Clean Air Project (CAP) India webinar series on Air Quality Management, Organized by The Energy and Resources Institute (TERI), New Delhi ,1st May 2020.
14) *Mitigation Pathways towards Clean Air in India.* International Conference on Material Science and Applications (ICMSAA), H.N.B. Garhwal University Srinagar, India, 25-27 Nov 2019.
15) *Pathways to Achieve National Ambient Air Quality Standards in India.* 36th International Energy Workshop, Organized by International Energy Agency (IEA), Paris, 3-5th June 2019.
16) *Pathways towards clean air in India. European Geosciences Union (EGU) General Assembly 2019*, Vienna, 07 – 12th April 2019.
17) *Temperature, environmental, and development impacts - benefits of HFC phasedown with enhanced cooling efficiency.* Meeting of Steering Committee Members and Lead Authors - UN Environment assessment of development and climate benefits Report on "Kigali Efficient and Climate Friendly Cooling" UNEP/DTU Partnership, Copenhagen, 25th June 2018.
18) CEEW-IIASA roundtable on '*Pathways to achieving India's ambient air quality standards*' at IHC, New Delhi, 23rd March 2018.
19) *Managing future air quality in Delhi.* Workshop organized by the Technology Information Forecasting & Assessment Council, (TIFAC), Government of India, New Delhi 26th October 2017.
20) *Market mechanisms as a means to effectively implement India's climate mitigation objectives.* Workshop organized by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India and the German Federal

Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) jointly with German Development Cooperation (GIZ), India Habitat Centre, New Delhi, 27th June 2017.

21) *Vienna Energy Forum 2017* organized by UNIDO, IIASA, SE4All, Austrian Development Agency, Ministry of Europe, Integration and Foreign and Affairs (BMEIA), Vienna, 11-12th May 2017.

22) Co-benefits of managing future air quality in Delhi. Technology Information, Forecasting and Assessment Council (TIFAC) side-event on *Climate Change and Health in Indian Cities: Modelling the Impacts of Heat and Air Pollution and Potential Co-benefits from Mitigation and Adaptation* at India Pavilion, 22nd Conference of the Parties (COP 22) to the UN Framework Convention on Climate Change (UNFCCC), Marrakech, Morocco, 12th November 2016.

23) Economy-wide cost of HFC phase-down in India. CEEW-IIASA side event at the 36th Meeting of the Open-ended Working Group (OEWG) of the Parties to the Montreal Protocol, Vienna, 20th July 2016.

24) Vienna Energy Forum 2015 organized by UNIDO, IIASA, and Ministry of Europe, Integration and Foreign and Affairs (BMEIA), Vienna, 18-30th June 2015.

25) Long-term HFC Emissions and Alternative Policy Scenarios. CEEW-IIASA workshop at India International Centre (IIC), New Delhi, 23rd February 2015.

26) Task Force on Hemispheric Transport of Air Pollution (HTAP/TFIAM Workshop on Global Air Pollutant Emission Scenarios. International institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, 11-13th February 2015.

27) Black carbon emissions from kerosene lighting and diesel generator sets in the GAINS model. GAINS Workshop on Toyota Ozone Project activities, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, 23rd October 2013.

28) Invited lecture on Carbon finance potential of renewable energy technologies in India. Centre for Energy Studies, Indian Institute of Technology (IIT) Delhi, 25th July 2013.

29) Vienna Energy Forum 2013 organized by UNIDO, IIASA and Ministry of Europe, Integration and Foreign and Affairs (BMEIA), Vienna, 28-30th May 2013.

30) Impact of current policies on future air quality and health outcomes in Delhi, India. European Geosciences Union (EGU) General Assembly 2013, Vienna, 07 – 12th April 2013.

31) 4th Member State Consultation Meeting on the 2012 EU Baseline Scenario. Development and Application of EU Economy-wide Climate Mitigation Modeling Capacity Project, Climate Change Committee Working Group II, European Commission, Brussels, 6-7th February 2013.

32) GAINS Seminar on - Applications of the GAINS model for integrated policy design. Pakistan Institute of Engineering & Applied Sciences (PIEAS), Islamabad, 6th November 2012.

33) IIASA's 40th Anniversary Conference - Worlds Within Reach: From Science to Policy. Organized by the International Institute for Applied Systems Analysis (IIASA), at the Hofburg Imperial Palace Vienna, 24-26th October 2012.

34) HTAP Workshop on Global Emissions Scenarios to 2030. *Organized by the Task Forces on Hemispheric Transport of Air Pollutants (HTAP) and Integrated Assessment Modelling (TFIAM) of the Convention on Long-range Transboundary Air Pollution (LRTAP)*, in cooperation with the US-Environmental Protection Agency (US-EPA) at IIASA, 8-10th October 2012.

35) Opportunities for integrated policy design - applications of the GAINS India Tool. Centre for Energy Studies, Indian Institute of Technology Delhi, 24th February 2012.

36) Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) – India. *TIFAC-IIASA-NEERI workshop on Economic Development and Atmospheric Pollution* at the National Environmental Engineering Research Institute (NEERI) Nagpur, India, 6-10th February 2012.

37) CDMability of off-grid electrification projects. *Workshop on Off-grid electrification: Experience, Approaches and Issues* at Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP), University of Dundee, Scotland, 6th July 2011.

38) *Vienna Energy Forum 2011: Energy for all - Time for action*, organized by UNIDO, IIASA and Ministry of European and International Affairs, 21-23rd June 2011 Vienna, Austria.

39) Expert Group workshop on *Environmental Sustainability Benchmarking of Clean Energy Technologies*, organized by International Resource Panel (IRP), United Nations Environment Program (UNEP), 1st to 2nd June 2011, Helsinki, Finland.

40) *Greenhouse Gas and Air Pollution Interactions and Synergies Mitigation (GAINS) – India: Opportunities for Renewables* at Ministry of New and Renewable Energy (MNRE), Govt. of India, New Delhi, 31st January 2011.

41) *Greenhouse Gas and Air Pollution Interactions and Synergies Mitigation (GAINS) – India.* TIFAC-IIASA-CEPT workshop on Climate Change, Regional Air Pollution and Greenhouse Gas Mitigation at CEPT University, Ahmadabad, 27-28th January 2011.

42) *Renewable Energy in India - Opportunities and Challenges.* Department of Geography, University of Cambridge, UK, 27th April 2010.

43) *EC4MACS. European Consortium for Modelling of Air Pollution and Climate Strategies.* International Institute for Applied Systems Analysis (IIASA), Austria, 23-24th March 2010.

44) *International Energy Conference 2009 - Towards an Integrated Energy Agenda Beyond 2020: Securing Sustainable Policies and Investments,* Vienna, Austria, 22-24th June 2009.

45) *Workshop on Comparison of GHG mitigation potentials and costs in Annex I countries.* International Institute for Applied Systems Analysis (IIASA), Austria, 28-29th May 2009.

46) *Workshop on Household Energy: Household Energy Database.* Joint ACCENT/UC Berkeley workshop held at the International Institute for Applied Systems Analysis (IIASA), Laxenburg, 20-21st May 2009.

47) *EC4MACS. European Consortium for Modeling of Air Pollution and Climate Strategies.* International Institute for Applied Systems Analysis (IIASA), Austria, 23-24th March 2009.

48) *Flexible Mechanisms under the UNFCCC.* Greenhouse Gas Initiative (GGI), International Institute for Applied Systems Analysis (IIASA), Austria, 24th September 2008.

49) *World Renewable Energy Congress (WREC-X)* organized by the World Renewable Energy Network, Scottish Exhibition & Conference Centre, Glasgow - Scotland, UK 19-25th July 2008.

50) *7th International Conference on Sustainable Energy Technologies (SET2008),* Seoul, South Korea 24-27th August 2008.

51) *EC4MACS. European Consortium for Modelling of Air Pollution and Climate Strategies.* International Institute for Applied Systems Analysis (IIASA), Austria, 2-3rd April 2008.

52) *ACCENT Workshop on Remote Sensing and Inventories of Anthropogenic Emissions: The best of two worlds* at International Institute for Applied Systems Analysis (IIASA), Austria, 4-5th Dec 2007.

53) *IIASA's 35th Anniversary Conference - Global Development: Science and Policies for the Future.* Organized by the International Institute for Applied Systems Analysis (IIASA), at the Hofburg Imperial Palace, Vienna, 14-16th Nov 2007.

54) *CDM potential of renewable energy technologies in India.* Greenhouse Gas Initiative (GGI), International Institute for Applied Systems Analysis (IIASA), Austria, 17th November 2007.

55) *Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) - Asia Model.* Asia-Europe Scientific Cooperation Day, Vienna, 24th October 2007.

56) *CO_2 emissions mitigation potential through renewable energy technologies in India* at Energy Systems Engineering, Indian Institute of Technology Bombay, Mumbai, India, 2nd July 2007.

57) *Scenario design for climate change policy and technology cooperation: The role of China and India.* Judge Business School, University of Cambridge, UK, 30th April 2007.

58) *World Renewable Energy Congress (WREC-IX)* organized by the World Renewable Energy Network at the University of Florence, Italy 19-25 August 2006.

59) *2006 Solar Cookers and Food Processing International Conference* (Solar Cookers International (SCI)), organized by the Terra Foundation, Granada, Spain, 12-16 July 2006.

60) *11th International Energy Conference & Exhibition: ENERGEX 2006,* organized by SINTEF Energy Research and the International Energy Foundation (IEF) Stavanger, 12-15 June 2006.

61) 24th sessions of the *Subsidiary Body for Scientific and Technological Advice (SBSTA)* and the *Subsidiary Body for Implementation (SBI)* of the United Nations Framework Convention on Climate Change (UNFCCC), 18-26th May 2006 Bonn, Germany.

62) *Carbon EXPO 2006* organized by the World Bank and the International Emissions Trading Association (IETA), Koelnmesse, May 10 – 12 in Cologne, Germany.

63) *United Nations Climate Change Conference (UNFCCC): 11th Conference of Parties (COP-11),* Nov 28 - Dec 09, 2005, Montreal, Canada.

64) *International Conference on Climate or Development* organized by the Hamburg Institute of International Economics (H WWI), 28-29 October 2005, Hamburg, Germany.

65) One-week Software Training Program for the Process Industry on ASPENTECH at the University of Petroleum and Energy Studies, Dehradun, India.

66) Consultation workshop on *Impact of fuel scarcity and pollution on rural poor: A comparative analysis of vulnerable groups in Himachal Pradesh* organized by the Integrated Research and Action for Development (IRADe), New Delhi.

67) National Training Program on *All India Energy Efficiency Capacity Building Program* (Feb 14–15, 2005) sponsored by the World Bank, IRG systems Pvt. Ltd. and Indian Renewable Energy Development Agency at PHD Chamber of Commerce and Industry, New Delhi.

68) One day Training Session on *Capacity Building, Environment, Trade and Sustainable Development* (24th Nov 2004) sponsored by the United Nations Environment Program (UNEP), New Delhi.

69) 6th Annual Conference of the *South Asia Network of Economic Research Institutes (SANEI)* at Indian Council for Research on International Economic Relations (ICRIER), New Delhi.

70) India Country-level Development Marketplace (IDM) 2004 on *Improved Rural Services - Access and Quality in Rural Water Supply and Sanitation, Health, Education, Roads, Finance and Electricity*, organized by the World Bank, New Delhi.

71) Training Seminar on *RETScreen International Renewable Energy Project Analysis Software* sponsored by the United Nations Environment Program (UNEP) and Natural Resources Canada (NRCan) at IIT Delhi, New Delhi, 18th May 2004.

72) Workshop on *Energy Policy Reforms and Agriculture in India: A General Equilibrium Exploration* organized by Integrated Research and Action for Development (IRADe) and Stanford University, New Delhi, 20th April 2004.

73) National Training Program on "*Economics of Renewable Energy Systems*" sponsored by the Ministry of Non-Conventional Energy Sources (MNES) at IIT Delhi, New Delhi, 20-24th Jan 2003.

74) Regional Workshop on *Household Energy, Indoor Air Pollution and Health*. organized by the World Bank and Tata Energy Research Institute (TERI), New Delhi, 9-10th May 2002.

75) *National Conference on Advances in Contemporary Physics & Energy 2001*. Indian Institute of Technology (IIT) Delhi, New Delhi, 8-9th Feb 2002.

76) *24th National Renewable Energy Convention (NREC) 2000*, Department of Energy System Engineering, IIT Bombay, Mumbai, 30th Nov–2nd Dec 2000.

Annexure – IV

MEDIA NEWS/BLOGS POSTS

1. https://iiasa.ac.at/web/home/resources/publications/options/s21_Clean_air_needs_more_than_climate_policy1.html
2. https://citizenmatters.in/varanasi-air-quality-typical-of-cities-of-indo-gangetic-plain-22763
3. https://iiasa.ac.at/web/home/about/news/201118-urban-air-pollution-management.html
4. https://blog.iiasa.ac.at/2020/11/10/exploring-co-benefits-of-green-cooling-in-china/
5. https://india.mongabay.com/2020/10/even-with-coal-strict-air-pollution-control-can-prevent-early-deaths/
6. https://iiasa.ac.at/web/home/about/news/201006-climate-friendly-cooling.html
7. CCAC Science Policy Dialogue https://www.youtube.com/watch?v=Num9d2iiW5Q
8. https://india.mongabay.com/2019/12/can-kolkata-clean-its-air-by-2030-step-up-on-advanced-technology-clean-fuels-study-suggests/
9. https://iiasa.ac.at/web/home/resources/publications/options/options19w.pdf
10. https://timesofindia.indiatimes.com/city/ahmedabad/gujarat-pumps-2500-mt-of-pollutants-into-air-annually/articleshow/72063869.cms
11. http://citizenmatters.in/mumbai-delhi-air-pollution-particulate-matter-aqi-environment-12940
12. https://india.mongabay.com/2019/05/crackdown-on-dirty-household-fuels-can-save-lives/
13. https://www.eurekalert.org/pub_releases/2019-03/iifa-aqt032819.php
14. https://phys.org/news/2019-03-air-quality-problem-india-pollution.html
15. https://www.business-standard.com/article/pti-stories/india-s-pollution-control-policies-unlikely-to-improve-air-quality-study-119033100181_1.html
16. https://swachhindia.ndtv.com/poor-air-quality-to-remain-a-problem-in-india-despite-pollution-control-policies-study-32932/
17. https://www.enn.com/articles/57378-poor-air-quality-to-remain-a-problem-in-india-despite-pollution-control-policies
18. https://www.hindustantimes.com/world-news/over-674-million-indians-to-inhale-toxic-air-despite-policies-to-curb-pollution-study/story-c5kklGKV5JvUbIhGpP2mnO.html
19. https://www.aninews.in/news/health/poor-air-quality-to-remain-a-problem-in-india-despite-pollution-control-policies20190331143320/
20. https://www.deccanchronicle.com/lifestyle/environment/010419/pollution-control-policies-fail-to-improve-air-quality-in-india.html
21. https://energy.economictimes.indiatimes.com/news/coal/670-million-indians-to-breathe-poor-quality-air-in-2030-study/68631523
22. https://www.dailypioneer.com/2019/trending-news/india-s-pollution-control-policies-unlikely-to-improve-air-quality--study.html
23. https://economictimes.indiatimes.com/news/politics-and-nation/indias-pollution-control-policies-unlikely-to-improve-air-quality-study/articleshow/68654604.cms
24. https://www.technologynetworks.com/applied-sciences/news/pollution-policies-not-alleviating-poor-air-quality-in-india-317550
25. https://www.greencarcongress.com/2019/04/20190401-india.html
26. https://medibulletin.com/despite-clean-air-plan-674-mn-indians-could-breathe-polluted-air-in-2030/
27. https://www.eurekalert.org/pub_releases/2018-10/iifa-ict100918.php
28. https://swarajyamag.com/economy/aspects-of-the-biofuels-policy-that-need-refining
29. https://www.eastasiaforum.org/2014/08/20/increase-in-coal-tax-will-scale-up-indian-renewables/
30. https://www.swatantraawaz.com/headline/8052.htm
31. https://m.jagran.com/uttarakhand/pauri-garhwal-workshop-in-physics-19783039.html
32. https://dainikjayantnews.com/sangoshathi-mein-shodharthi-prastut-karenge-120-shodh-patar/
33. https://www.livehindustan.com/uttarakhand/srinagar/story-international-level-materials-scientists-will-gather-in-garhwal-university-2864233.html

1.2.5. Ms. Alissa Benchimol

Alissa Benchimol
Greenhouse Gas Management Institute
Program Officer

Profile | Alissa joined GHGMI in 2021 as Program Officer focusing develops capacity-building training materials, drafts technical reports, and provides project management and technical support to multiple MRV projects. Alissa's professional experience has been focused on the water-energy-GHG nexus. Prior to working at GHGMI, Alissa worked as a Sustainability Specialist at The Climate Registry, leading the implementation of the Water-Energy Nexus Registry for California, developing and delivering GHG training, and developing verification guidance for water-related data and performance metrics.

Technical Expertise | Alissa is an experienced in GHG accounting and registry management, project manager and program developer across a wide variety of project types. Alissa also has large experience with software management, testing, and enhancement. She is also experienced in working with diverse project stakeholders and delivering technical presentations.

EDUCATION

2015-2017	**Saint Louis University** M.S. in Sustainability	Saint Louis, MO
2011-2014	**Lindenwood University** B.A in Business Administration	Saint Charles, MO
2007-2009	**Federal Center for Technological Education of Rio de Janeiro** Technical Degree in Meteorology and Climatology	Rio de Janeiro, Brazil

EXPERIENCE

2021 – PRESENT **Greenhouse Gas Management Institute**
Program Officer

- Program support to Initiative of Climate Action Transparency (ICAT)'s projects. Managing the monitoring, evaluation, learning and uptake (MELU) reporting for seven countries.
- Designing and implementing the learning management system (LMS) for the training delivery as part of Fiji's ICAT project.
- Training development for GHG accounting principles and curriculum review.
- Software and data management systems reviewer and evaluator.
- Develop activity data templates in excel for the IPPU sector

2018 – 2020 **The Climate Registry** Los Angeles, CA
Sustainability Specialist

- Managed the development, implementation, and maintenance of the Water-Energy Nexus Registry in California
- Lead the research and development of new GHG and water reporting and verification resources, training modules, and procedures
- Oversaw statewide outreach, recruiting, and marketing initiatives
- Provided policy interpretation, explain calculation methodologies, and advise organizations in the development of their carbon and water footprint reporting
- Led the design of the user interface and new calculation features for water and emissions data in the online GHG calculation and reporting platform

2018 **DigDeep Water** Los Angeles, CA

American Projects Fellow

- Conducted research on water access projects in regions without reliable access to water in the Navajo reservation
- Worked on the development of project reports for donors and sponsors of the Navajo Water Project
- Created and implemented a new database for all ongoing and future projects
- Conducted research on the feasibility and impact of future project sites

2015 – 2017 **Saint Louis University** St. Louis, MO

Graduate Assistant

- Supported the management of over 150 student organizations, including budget and finance management
- Developed and provided training material and workshops for over 300 students in leadership roles and their advisors based on data analysis from surveys
- Planned and executed Fall and Winter Activity Fairs, two major events on campus that attract over 2,000 people. Partnered with the Sustainability Department to implement zero waste practices.

Graduate Research

- Graduate research focused on social-technical approaches to maximize formal access to electricity in low-income settlements through human rights lenses.

Languages

English, Portuguese

Civic Engagement

- Board of Directors, Let There Be Light International (since 2021)
- Volunteer Energy Poverty Consultant, Let There Be Light International (2018-2020)

1.2.6. Dr. Olia Glade

Olia Glade
Greenhouse Gas Management Institute (GHGMI)
Director of MRV Systems

Profile

Dr. Glade has joined GHGMI in June 2019 to become a Director for Monitoring, Reporting and Verification (MRV) Systems, bringing the expertise in natural science, education, greenhouse gas reporting and review under the UNFCCC and Kyoto Protocol, and designing GHG data management systems to the Institute.

For the past seven years she has been New Zealand's GHG inventory focal point at the UNFCCC and led New Zealand's National Greenhouse Gas Program and being New Zealand's national inventory compiler. She also led the project to include Tokelau in New Zealand's national system.

Being a New Zealand-nominated review expert, she served as an energy sector expert and later, as an expert-generalist and a Lead Reviewer for GHG inventories, National Communications and Biennial Reports at the UNFCCC. As a Lead Reviewer, she participated in several projects focused on the review process improvement, presented at the Lead Reviewers meetings in Bonn and wrote a fundamental QA/QC and Verification paper.

Apart from GHG accounting, national inventory systems and data management systems, Dr Glade's technical expertise includes Chemistry and Crystallography (PhD, over 100 research papers in peer-reviewed scientific journals and conference presentations), molecular biology and bioorganic chemistry (MSc), and teaching (Grad. Diploma). She has an extensive experience working at the government agencies (Ministry for the Environment, Tertiary Education Commission, New Zealand's Qualifications Authority), universities (Moscow State University, University of Canterbury, Victoria University of Wellington and New Zealand's International Campus) as well as the biggest New Zealand's on-line academic service provider at the time (The Open Polytechnic of New Zealand).

Her other interests include performing arts, reading and traveling.

Education

2017	**UNFCCC/ GHGMI**	
	• Certified UNFCCC expert, review of national Communications and Biennial Reports (inventories and inventory systems, Modelling and projections)	
2017	**UNFCCC/ GHGMI**	
	• Certified UNFCCC expert review of Biennial Update reports (non-Annex Parties)	
2014	**UNFCCC/ GHGMI**	
	• UNFCCC Lead Reviewer for National Greenhouse Gas inventories	
2014	**UNFCCC/ GHGMI**	
	• Certified UNFCCC expert- Generalist (National systems, Registry)	
2014	**UNFCCC/ GHGMI**	
	• Certified UNFCCC review expert in Industrial processes and product use sector	
	• Certified UNFCCC review expert in Energy sector	
2004 – 2005	**Victoria University**	Wellington, NZ
	Wellington College of Education	
	Graduate Diploma in Teaching	
	• Mathematics, Chemistry, Physics, Informational Technology	
2003	**Microsoft Professional**	

- Active Directory Management, Active Directory Design

2001 **Certificate in Micro computing Technology, NZQA**

2001 **Professional Excellence Program** Wellington, NZ
Spherion Technology

1997 **Victoria University** Wellington, NZ
Professional training program in European Languages and Music

1993 – 1994 **University of Canterbury** Canterbury, NZ
Department of Chemistry
- Post-Doctoral/ Visiting Lecturer

1992 **Moscow State University** Moscow, Russia
Moscow Academy of Sciences
PhD in Chemistry and Crystallography
- Post- graduate course in Computer Science (including algorithm design)

1985 **Moscow State University** Moscow, Russia
Russian Academy of Sciences
B.Sc. Hons Chemistry (Theoretical Chemistry, Physical Chemistry, Genetic Engineering)

Experience

2019 - **Greenhouse Gas Management Institute**
Director, MRV Systems, Faculty
- Manages projects and provides for successful implementation of international MRV capacity building projects associated with developing national GHG inventory systems and inventory data management systems with multiple partner and stakeholder organizations, managing relationships across numerous international government ministries and organizations and overseeing project staff activities.
- Leads and supports projects through the preparation of training materials/courses, workshops and webinars, as well as MRV and capacity building tools.
- Instructs IPCC Guidelines online courses and deliver training workshops on IPCC Guidelines and other carbon management topics.
- Serves and an expert (generalist, national systems) and a Lead Reviewer for the international GHG reporting reviews under the UNFCCC and the Paris Agreement

2011 - 2019 **Ministry for the Environment** New Zealand
Senior Climate Change Analyst, National GHG Inventory Program Manager
- Managed New Zealand's inter-agency National GHG inventory program
- Developed and maintained relationships with the Ministry's stakeholders (national and international) in GHG reporting space
- Improved and maintained national GHG inventory system
- Coached and the national inventory experts, facilitating their professional growth
- Successfully produced and published New Zealand's annual GHG inventory reports in 2012 – 2019
- Was a contributing author of the New Zealand's National Communications and Biennial Reports in 2013, 2015, 2017 and 2019
- Assisted in design and implementation of the national GHG reporting system in Tokelau (New Zealand's independent overseas territory) as a project manager and a technical consultant
- Managed the projects on design and building information systems and tools on GHG analysis for policy purposes and international climate change negotiations

- Supported New Zealand's Ministers for Climate Change and Environment through briefing notes, ministerial and parliamentary questions, and responding to public requests regards climate change and greenhouse gases

2013 – 2018 **UNFCCC**

UNFCCC Expert Reviewer for GHG Inventories, National Communications and Biennial Reports

- Participated in the UNFCCC expert review teams as the energy sector expert and national systems expert and later, as a Lead Reviewer
- Led UNFCCC expert teams for reviewing GHG inventories (Annex I Parties), National Communications and Biennial Reports
- Co-authored 16 assessment review reports for greenhouse gas inventory, National Communications, and biennial reports for Annex I Parties
- Contributed to several projects run by the UNFCCC secretariat to implement the decisions of the Lead Reviewers' meetings aiming to improve efficiency and consistency of the international inventory review process
- Presented at the Lead Reviewers meeting at the UNFCCC
- Wrote a fundamental paper on Quality Assurance, Quality Control and Verification for the UNFCCC secretariat
- Contributed to English-Russian translation of the pilot edition of the IPCC Guidelines

2008 - 2011 **New Zealand's Tertiary Education Commission and New Zealand's Qualification Authority**

Senior Analyst and Senior Researcher

- Led and coordinated New Zealand's tertiary education research and analysis projects
- Designed and built information systems and tools for tertiary education
- Presented at the international forums on education

2004 – 2008 **New Zealand International Campus**

Leading Lecturer

- Read undergraduate courses on systems analysis, project management, software design, and mathematics for University of Central Queensland and University of Ballarat, Australia at their international campus in New Zealand
- Led research program at the campus (as a Head of the Research Committee)
- Provided consulting, technical and personal supervision for students and academic staff

2002 – 2012 **The Open Polytechnic of New Zealand, School of Information Technology and Humanities**

Adjunct Faculty and Acting Lecturer

- Designed undergraduate courses on database management systems, systems analysis and design
- Read undergraduate courses on project management, systems analysis, database management systems and programming
- Most of these services were provided while working in remote access mode/virtual environment

2000 – 2004 **Kip McGrath Educational Centre**

Senior Teacher

- Taught Mathematics, Chemistry, Physics, and Biology at senior school level (years 10-13)
- Provided coaching and consulting services to students and developed course materials

1994 – 2000 **Victoria University of Wellington, Department of Chemistry**

Lecturer

- Designed and read undergraduate and graduate courses on chemistry and material science
- Performed intensive research work and managed research projects
- Published and presented research papers nationally and internationally
- Provided laboratory supervision
- Supervised student's research work
- Provided consulting services for internal and external stakeholders

1998 **Wellington Polytechnic Conservatory of Music**
Lecturer

- Designed and read undergraduate course, course materials and exams on Russian phonetics for opera singers

1993 – 1994 **University of Canterbury, Department of Chemistry**
Visiting Lecturer

- Performed research work on chemistry, crystallography; managed research projects
- Published and presented research papers nationally and internationally
- Provided laboratory supervision
- Supervised students' research work
- Provided consulting services for internal and external stakeholders

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Qualifications

Program & Project Management

- New Zealand's focal point for the GHG inventory at the UNFCCC and New Zealand's national inventory compiler 2013 - 2019
- Lead Reviewer for GHG inventories, National Communications and Biennial Reports
- Experienced program manager: managed national greenhouse case inventory program from 2013 onwards. This included planning, management and coordination multiple projects and sub-programs between different government agencies, companies and teams
- Experienced project manager: taught project management for MBA students and within undergraduate programs; coached new project managers through all phases of the project cycle with a high rate of success; managed and co-managed multiple projects within last 6 years covering technical reporting for greenhouse gas inventory, software development, and international relations; applied agile management techniques for successful work in changing environment and comprehensive task prioritizing to enable smooth project flow and to successfully balance multiple projects; hired and managed personnel
- Team planning work; led and contributed to several work planning workshops for the climate change analysis team at the Ministry for the Environment; as a Lead Reviewer, did planning for the review weeks at the UNFCCC
- Comprehensive planning for the national GHG inventory program (including financial and resource planning)
- Financial planning for several projects: greenhouse gas program support, greenhouse gas inventory, information systems
- Contract management
- Cross-government agency coordination for the GHG inventory; coordination of efforts between different organizational units
- Managed national and international stakeholders to ensure high quality and timely delivery of the national GHG inventory program and supported inventory use by various organizations.

GHG Inventories, National Inventory Systems

- Hands-on experience in planning and producing annual New Zealand's GHG national inventory from 2012 as a deputy compiler and the national inventory compiler in 2013 - 2019
- New Zealand's inventory system management, maintenance and improvement
- Cross-sectoral analyses for the national GHG emissions and authored the relevant chapters of the GHG inventory from 2012 onwards
- Specialist on the national inventory systems: organized several bilateral meetings between New Zealand and other Annex I Parties (Australia, Austria, Germany, Denmark and France) to discuss and review respective national GHG inventory systems through learning and knowledge exchange; as a review generalist expert, reviewed national systems of several Annex I Parties

UNFCCC Reporting and Review

- Lead Reviewer of the GHG inventories with working knowledge of the UNFCCC inventory reporting guidelines and review guidelines; led the first centralized UNFCCC review event under the 2006 guidelines under the UNFCCC and the Kyoto Protocol in the second commitment period
- Participated in the international GHG inventory reviews in 2013 and 2014 as the Energy sector expert
- Participated in the international GHG inventory reviews from 2015 onwards as Generalist and a Lead Reviewer
- Participated in the review of 7th National Communications and 3rd Biennial Report as a GHG projections expert and a Lead Reviewer
- Among other selected Lead Reviewers, participated in the projects run by the UNFCCC secretariat to implement decisions of the Lead Reviewers meetings in 2017 and 2018

3. Agriculture

1.3.1. Dr. Hoyoung Kwon

HOYOUNG KWON

Principal Environmental Scientist
Systems Assessment Center, Energy Systems Division
Argonne National Laboratory
Phone : (630) 252-6519 ; E-mail : hkwon@anl.gov

9700 South Cass Avenue, Bldg. 362
Lemont, IL 60439
USA

AREAS OF INTEREST

Develop process-based modeling frameworks as a practical means for sustainable land management practices:

Assess environmental effects of agricultural production for food, feed, and biofuels

- Soil organic carbon (SOC) sequestration, greenhouse gas (GHG) mitigation, land use and management change, and land degradation

Process and analyze multi-scale spatiotemporal databases

- National agricultural statistics and remote sensing data of soil, climate, and land cover

Update current modeling of agro-ecosystem processes with latest research findings

- Soil organic matter dynamics, nutrient cycling, crop growth, and hydrology

PROFESSIONAL EXPERIENCE

PRINCIPAL ENVIRONMENTAL SCIENTIST (MAY 2018 – PRESENT)

Systems Assessment Center, Energy Systems Division, Argonne National Laboratory, Lemont, IL

SOC modeling for life-cycle analysis (LCA) of biofuels

- Develop a database of regional variations in land management practices and their impact on SOC changes and associated GHG emissions for biofuel feedstocks. Update Carbon Calculator for Land Use Change from Biofuels Production module, which employ SOC modeling based on a parameterized version of the process-based CENTURY model, with the data and findings derived from the database.

Development of LCA frameworks for sustainable feedstock production

- Conduct farm-level LCA by employing the Greenhouse gases, Regulated Emissions, and Energy use in Technologies® (GREET) LCA model for bioenergy and bioproduct pathways and explore its potential to support farm-level certification of sustainable farming practices for biofuel production. Provide a scientific foundation for rewarding sustainably produced low-carbon feedstocks through the California's Low-Carbon Fuel Standard and other market mechanisms.

RESEARCH FELLOW (MAR 2013 – MAY 2018)

Environment and Production Technology Division, International Food Policy Research Institute, Washington, DC

Quantitative foresight modelling to inform the Consultative Group for International Agricultural Research program portfolio

- Quantified GHG emissions derived from productivity changes in crop and livestock production systems and foregone C sequestration due to land use conversion occurring in forests associated with 12 scenarios of the International Model for Policy Analysis of Agricultural Commodities and Trade model runs.

Global adoption of climate-smart agriculture (CSA)

- Investigated how adoption on a global scale of a series of CSA-compatible practices and technologies might affect global prices, world production, GHG emissions, and trade flows.

Ex ante evaluation of Africa Research in sustainable intensification for next generation

- Constructed a fully developed, calibrated integrated, modelling framework that support Africa RISING partners in answering research questions on the potential impacts of adopting sustainable intensification technologies and practices, systemically as compared to the model-estimated counterfactual.

Global estimates of the impacts of grassland degradation on livestock productivity

- Developed a modeling framework where global statistics databases and remote sensing data/analyses coupled with empirical/statistical modeling are designed to quantify the global cost of grassland degradation.

POSTDOCTORAL RESEARCH ASSOCIATE (JAN 2011 – MAR 2013)
Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana-Champaign, IL

- Estimated soil emissions factors associated with direct and indirect land-use change resulting from cellulosic feedstock production in the U.S. Modeled crop yields, SOC sequestration rates, and GHG emissions associated with farming practices by utilizing process-based simulation models, global statistics databases, and remote sensing data.

VISITING SCHOLAR (SEP 2010 – DEC 2010)
Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana-Champaign, IL

- Analyzed surface water quality data of a watershed in South Carolina monitored by the U.S. Geological Survey.

POSTDOCTORAL RESEARCH ASSOCIATE (NOV 2006 – JUL 2010)
Soil and Water Science Department, University of Florida, Gainesville, FL

- Constructed an on-farm decision making simulation tool by incorporating hydrology, crop growth, and soil nutrient processes of mineral and organic soils in South Florida.

EDUCATION

DOCTOR OF PHILOSOPHY (AUG 2001 – DEC 2006)
Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana-Champaign, IL

- *Concentration*: Soil C and N process modeling
- *Dissertation*: An approach to using labile soil nitrogen measurements for calibration of the DSSAT/CENTURY agroecosystem model for site-specific nitrogen fertilizer management in Illinois, USA

MASTER OF ENVIRONMENTAL MANAGEMENT (AUG 1999 – MAY 2001)
Nicholas School of the Environment, Duke University, Durham, NC

- *Concentration*: Wetland ecology and management
- *Master's project*: An environmental impact assessment of the Saemangeum Tidal Flats development project in South Korea: a reanalysis

BACHELOR OF SCIENCE (MAR 1992 – FEB 1999)
Korea University, Seoul, Republic of Korea

- *Major*: Agricultural biology
- *Senior thesis*: Isolation of bacterial antagonists to plant-pathogenic soil fungi

COMPUTATIONAL SKILLS

Agro-ecosystem models (DSSAT, CENTURY, DNDC, and RULSE2); LCA model (GREET); Statistical software (SAS); Geographic information system (ArcGIS); Microsoft office application; Programming language (FORTRAN)

Peer-Reviewed Journal Publications (Selected)

Kwon, H., Liu, X., & Wang, M. Greenhouse Gas Mitigation Strategies and Opportunities for Agriculture. Agronomy Journal (Accepted)

Liu, X., **Kwon, H.**, & Wang, M. (2021). Varied farm-level carbon intensities of corn feedstock help reduce corn ethanol greenhouse gas emissions. Environmental Research Letters. https://doi.org/10.1088/1748-9326/ac018f.

Xia, Y., **Kwon, H.**, & Wander, M. (2021). Developing County-level Data of Nitrogen Fertilizer and Manure Inputs for Corn Production in the United States. Journal of Cleaner Production. Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2021.126957.

Liu, X., **Kwon, H.**, Northrup, D., & Wang, M. (2020). Shifting Agricultural Practices to Produce Sustainable, Low Carbon Intensity Feedstocks for Biofuel Production. Environmental Research Letters doi: 10.1088/1748-9326/ab794e.

De Pinto, A., Cenacchi, N., **Kwon, H.**, Koo, J., & Dunston, S. (2020). Climate Smart Agriculture and Global Food-crop Production. PLoS ONE, https://doi.org/10.1371/journal.pone.0231764.

De Pinto, A., Cenacchi, N., Robertson, R., **Kwon, H.**, Thomas, T., Koo, J., Begeladze, S., & Kumar, C. (2020). The Role of Crop Production in the Forest Landscape Restoration Approach – Assessing the Potential Benefits of Meeting the Bonn Challenge. Frontiers in Sustainable Food Systems, https://doi.org/10.3389/fsufs.2020.00061.

Xu, H., Sieverding, H., **Kwon, H.**, Clay, D., Stewart, C., Johnson, J.M.F., Qin, Z., Karlen, D.L., & Wang, M. (2019). A Global Meta-analysis of Soil Organic Carbon Response to Corn Stover Removal. Global Change Biology Bioenergy 11:1215-1233.

Qin, Z., Canter, C.E., Dunn, J., Mueller, S., **Kwon, H.**, Han, J., Wander, M., Wang, M. (2018). Land Management Change Greatly Impacts Biofuels' Greenhouse Gas Emissions. Global Change Bioenergy 10: 370-381.

Ugarte, C.M., **Kwon, H.**, & Wander, M.M. (2018) Conservation Management and Ecosystem Services in Midwest Agricultural Systems. Journal of Soil and Water Conservation 73 (4) 422-433.

Kwon, H., Ugarte, C.M., Ogle, S.M., Williams, S.A., & Wander, M.M. (2017). Use of Inverse Modeling to Evaluate CENTURY-predictions for Soil Carbon Sequestration in US Rain-fed Corn Production Systems. PLoS ONE 12: e0172861.

Reports (Selected)

Kwon, H., Liu X., Dunn, J., Mueller, S., Wander, M., & Wang, M. (2020). Carbon Calculator for Land Use and Lange Management Change from Biofuels Production (CCLUB) – Users' Manual and Technical Documentation. Energy Systems Division, Argonne National Laboratory. ANL/ESD/12-5 Rev. 6.

De Pinto, A., **Kwon, H.**, Cenacchi, N., & Dunston, S. (2017). The Effects of Widespread Adoption of Climate-Smart Agriculture in Africa South of the Sahara under Changing Climate Regimes. ReSAKSS Annual Trends and Outlook Report. https://doi. org/10.2499/9780896292949_03.

Oral Presentations (Selected)

Kwon, H., Hawkins, T.R., Hunter, R., & Zaimes, G. (2021). Life-cycle Analysis of Off-shore Macroalgae Production. MARINER Annual Review, Virtual.

Xia, Y., Xu, H., Wander, M.M., & **Kwon, H.** (2019). Spatial Crop-soil Data to Parametrize Modeling of N_2O Emissions from Corn Production for Biofuel. American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America International Annual Meeting, San Antonio, TX.

Lee, U., & **Kwon, H.** (2019). Biofuels and Land Use Change GHGs. GREET® Introduction Workshop, Lemont, IL.

Kwon, H. (2019). Land Management Change Impacts Biofuels' Greenhouse Gas Emission. Soil Health and Water Quality Meeting, St. Paul, MN.

Kwon, H. (2018) GREET Life Cycle Analysis and Soil Organic Carbon Modeling for Ethanol. Agricultural Data Meeting, University of Illinois, Chicago, IL.

4. Land Use, Land-Use Change, and Forestry

1.4.1. Dr. April Leytem

CURRICULUM VITAE

April B. Leytem
Research Soil Chemist
USDA-ARS Northwest Irrigation and Soils Research Laboratory
Kimberly, ID

EDUCATION

University	Degree	Year	Major
North Carolina State University	Ph.D.	1999	Soil Science
North Carolina State University	M.A.	1993	Natural Resources
Brandeis University	B.A.	1991	Economics

POSITION AND EMPLOYMENT HISTORY

1995-1999, Research Assistant, North Carolina State University
1999-2001, Post Doctoral Research Associate, University of Delaware
2001-present, Research Soil Chemist, USDA-ARS, Kimberly, ID

HONORS

2003 USDA Secretary's Honor Award (group award for P Site Index Team)
2003 ARS Technology Transfer Award (group award for P Site Index Team)
2005 Soil and Water Conservation Society Best Research Paper for "Removing soluble P in irrigation return flows with alum additions"
2008 Early Career Scientist of the Year Award for the Pacific West Area
2010 ARS Postdoctoral Research Associate Award Program recipient
2011 Global Research Alliance Borlaug Fellowship Program recipient
2015 Global Research Alliance Borlaug Fellowship Program recipient
2015 Journal of Environmental Quality Outstanding Associate Editor
2016 ASABE Superior Paper Award for "Process-based modeling of ammonia and nitrous oxide emissions from open-lot beef and dairy facilities.
2020 Journal of Soil and Water Conservation Editor's Choice Award for "Managing crop nutrients to achieve water quality goals"
2020 ASABE Outstanding Reviewer Award

RELEVANT PUBLICATIONS

Leytem, A.B., Bjorneberg, D.L., Sheffield, R.E., and de Haro Marti, M.E. Case study: On-farm evaluation of liquid dairy manure application methods to reduce ammonia losses. Prof. Anim. Sci. 25:93-98. 2009.

Griffiths, P.R., Shao, L., and **Leytem, A.B.** Completely automated open-path FT-IR spectrometry. Anal. Bioanal. Chem. 393:45-50. 2009.

Dungan, R.S. and **Leytem, A.B.** Qualitative and quantitative methodologies for determination of airborne microorganisms at concentrated animal-feeding operations. World J. Microbiol. Biotechnol. 25:1505-1518. 2009.

Dungan, R.S. and **Leytem, A.B.** Airborne endotoxin concentrations at a large open-lot dairy in southern Idaho. J. Environ. Qual. 38:1919-1923. 2009.

Dungan, R.S. and **Leytem, A.B.** The effect of extraction, storage, and analysis techniques on the measurement of airborne endotoxin from a large dairy. Aerobiol. 25:265-273. 2009.

Bjorneberg, D.L., **Leytem, A.B.**, Westermann, D.T., Griffiths, P.R., Shao, L., and Pollard, M.J. Measurement of atmospheric ammonia, methane, and nitrous oxide at a concentrated dairy production facility in southern Idaho using open-path FTIR spectrometry. Trans. ASABE. 52:1749-1756. 2009

Leytem, A.B, Dungan, R.S., and Bjorneberg, D.L. Case Study: Seasonal and spatial distribution of ambient ammonia concentrations measured at a large open-lot dairy. Prof. Anim. Sci. 25:786-793. 2009

Dungan, R.S., **Leytem, A.B.**, Bjorneberg, D.B. Year-long assessment of airborne endotoxin at a concentrated dairy operation. Aerobiol. 26:141-148. 2010.

Dungan, R.S., **Leytem, A.B.**, Verwey, S.A., and Bjorneberg, D.L. Assessment of bioaerosols at a concentrated dairy operation. Aerobiologia. 26:171-184. 2010.

Shao, L., Griffiths, P.R., and **Leytem, A.B.** Advances in data processing for open-path fourier transform infrared spectrometry of greenhouse gases. Analy. Chem. 82:8027-8033. 2010.

Dungan, R.S. and **Leytem, A.B**. Ambient endotoxin concentrations and assessment of offsite transport at open-lot and open-freestall daries. J. Environ. Qual. 40:462-467. 2011

Leytem, A.B., Dungan, R.S., Bjorneberg, D.L., and Koehn, A.C. Emissions of ammonia, methane, carbon dioxide, and nitrous oxide from dairy cattle housing and manure management systems. J. Environ. Qual. 40:1383-1394.2011.

Shao, L., Liu, B., Griffiths, P.R. and **Leytem, A.B.** Using multiple calibration sets to improve the quantitative accuracy of partial least squares (PLS) regression on open-path fourier transform infrared (OP/FT-IR) spectra of ammonia over wide concentration ranges. Appl. Spectrosc. 65:820-824. 2011.

Dungan, R.S., **Leytem, A.B**. and Bjorneberg, D.L. Concentrations of airborne endotoxin and microorganisms at a 10,000 cow open-freestall dairy. J. Anim. Sci. 89:3300-3309. 2011.

Dungan, R.S. and **Leytem, A.B**. Ambient endotoxin concentrations and assessment of offsite transport at open-lot and open-freestall daries. J. Environ. Qual. 40:462-467. 2011

Cavigelli, M.A., Del Grosso, S.J., Liebig, M.A., Snyder, C.S., Fixen, P.E., Venterea, R.T., **Leytem, A.B.**, McLain, J.E., and Watts, D.B. US agricultural nitrous oxide emissions: Context, status, and trends. Front. Ecol. Environ. 10:537-546. 2012.

Shao, L., Wang, W., Griffiths, P.R., and **Leytem, A.B**. Increasing the quantitative credibility of open-path Fourier transform infrared (FT-IR) spectroscopic data, with focus on several properties of the background spectrum. Appl. Spectrosc. 67:335-341. 2013.

Leytem, A.B., Dungan, R.S., Bjorneberg, D.L., and Koehn, A.C. Greenhouse gas and ammonia emissions from an open-freestall dairy in southern Idaho. J. Environ. Qual. 42:10-20. 2013.

A.C. Koehn, **Leytem, A.B.**, and Bjorneberg, D.L. Comparison of atmospheric stability methods for calculating ammonia and methane emission rates with WindTrax. Transactions ASABE. 56:763-768. 2013.

Leytem, A.B., and R.S. Dungan. Livestock GRACEnet: A workgroup dedicated to evaluating and mitigating emissions from livestock production. J. Environ. Qual. 43:1101-1110. 2014.

Bonifacio, H.F., C.A. Rotz, **A.B. Leytem**, H.M. Waldrip. Process based modeling of ammonia and nitrous oxide from open lot beef and dairy production systems. Trans. ASABE. 58:827-846. 2015.

Rotz, C.A. and **A.B. Leytem**. Reactive nitrogen emissions from agricultural operations. EM Magazine. Air & Waste Management Association. September Issue. Pages 12-17. 2015

Cardoso, A.S., A. Berndt, **A. Leytem**, B.J.R. Alves, I.N.O. de Carvalho, L.H. de Barros Soares, S. Urquiaga, and R.M. Boddey. Impact of the intensification of beef production in Brazil on greenhouse gas emissions and land use. Agricultural Systems. 143:86-96. 2016

Niu, M., J.A.D.R.N. Appuhamy, **A.B. Leytem**, R.S. Dungan, E. Kebreab. Dietary crude protein and forage amendments to minimize enteric methane emissions and nitrogen excretion from dairy cows simultaneously. Animal Prod. Sci. 56:312-321. 2016.

Bougouin, A., **A.B. Leytem**, J. Dijkstra, R.S. Dungan, and E. Kebreab. Nutritional and environmental effects on ammonia emissions from dairy cattle housing: A meta analysis. J. Environ. Qual. 45:1123-1132. 2016.

Dungan, R.S., **A.B. Leytem**, D.D. Tarkalson, J.A. Ippolito, and D.L. Bjorneberg. Greenhouse gas emissions from an irrigated cropping system as influenced by nitrogen source and timing. Soil Sci. Soc. Am. J. 2017. 81:537-545.

Niu, M., J.A.D.R.N. Appuhamy, R.S. Dungan, E. Kebreab, and **A.B. Leytem**. Effects of diet and manure storage method on nutrient dynamics during storage and plant nutrient uptake. Agric. Ecosys. Environ. 2017. 250:51-58.

Leytem, A.B., D.L. Bjorneberg, A.C. Koehn, L.E. Moraes, E. Kebreab, and R.S. Dungan. Methane emissions from dairy lagoons in the western US. J. Dairy Sci. 2017. 100:6785-6803.

Leytem, A.B., D.L. Bjorneberg, C.A. Rotz, L.E. Moraes, E. Kebreab, and R.S. Dungan. Ammonia emissions from dairy lagoons in the western US. Trans. ASABE 2018. In press

Cole, N.A., D.B. Parker, R.W. Todd, **A.B. Leytem**, R.S. Dungan, K.E. Hales, S.L. Ivey, and J. Jennings. Use of new technologies to evaluate the environmental footprint of feedlot systems. 2018. Translational Animal Sci. 2018.2:89-100.

Arndt, C., **A.B. Leytem**, A.N. Hristov, D. Zavala-Araiza, J.P. Catviela, S. Conley, C. Daube, I. Faloona, II and S.C. Herndon. Short-term methane emissions from 2 dairy farms in California estimated by different measurement techniques and US Environmental Protection Agency inventory methodology: A case study J. Dairy Sci. 2018. 101:11461-11479.

Leytem, A.B., A.D. Moore, R.S. Dungan. Greenhouse gas emissions from an irrigated crop rotation utilizing dairy manure. Soil Sci. Soc. Am. J. 2019. 83:137-152.

Khalil, T, **Leytem, A.**, Carlson, B., Stockle, C., Frear, C., Ma, J., Uslar-Balle, N., Dungan, R., Nelson, R., Higgins, S. Dairy-CropSyst: Gaseous emissions and nutrient fate modeling tool. *Computers Electronics Ag.* 2019;162:962-978.

Beltran, I., van der Weerden, T.J., Alfaro, M.A., Amon, B., de Klein, C.A.M., Grace, P., Hafner, S., Hassouna, M. Hutchings, N., Krol, D.J., **Leytem, A.B.**, Noble, A., Salazar, F., Thorman, R.E., and Velthof, G.L. DataMan: A global database of nitrous oxide and ammonia emission factors for excreta deposited by livestock and land-applied manure. J. Environ. Qual. 2021. http://dx.doi.org/10.1002/jeq2.20186

VanDerWeerden, T.J., A. Noble, C.A.M. De Klein, N. Hutchings, R.E. Thorman, M.A. Alfaro, B. Amon, I. Beltran, P. Grace, M. Hassouna, D.J. Krol, **A.B. Leytem**, F. Salazar, G.L. Velthof. Ammonia and nitrous oxide emission factors for excreta deposited by livestock and land-applied manure. 2021. J. Environ. Qual.

OTHER RELEVANT PUBLICATIONS

Powers, W., Auvermann, B., Cole, A., Gooch, C., Grant, R., Hatfield, J., Hunt, P., Johnson, K., **Leytem, A.**, Liao, W., Powell, M. Quantifying greenhouse gas sources and sinks in animal production systems. In: Quantifying greenhouse gas fluxes in agriculture and forestry: Methods for entity-scale inventory. Office of the Chief Economist, U.S. Department of Agriculture, Technical Bulletin Number 1939. Washing ton DC. 606 pages. July 2014. Eve, M., D. Pape, M. Flugge, R. Steele, D. Man, M. Riley-Gilbert, and S. Biggar, Editors.

Rotz, C.A. and **Leytem, A.B.** Reactive nitrogen emissions from agricultural operations. EM Magazine. Air & Waste Management Association. 2015. September Issue. Pages 12-17

White, J.W.C., Allen D., Amar, P.K., Bogner, J., Bruhwiler, L., Cooley, D., Frankenberg, C., George, F., Hanle, L., Hristov, A.N., Kebreab, E., Leytem, A.B., Mastalerz, M., and Wofsy, S. Improving Characterization of Anthropogenic Methane Emissions

in the United States. National Academy of Sciences Engineering Medicine. National Academies Press 2018. 234pp. https://doi.org/10.17226/24987.

Puchalski, M.A., J.T. Walker, G.M. Beachley, M.A. Zondio, K.B. Benedict, R.H. Grant, B.A Schichtel, C.M. Rogers, **A.B. Leytem**, J. Rice, K. Morris, J.J. Schauer, and R. Wang. Need for improved monitoring of spatial and temporal trends of reduced nitrogen. EM Magazine. Air & Waste Management Association. July Issue. Pages 1-7, 2019

Leytem, A.B., S. Archibeque, N.A. Cole, S. Gunter, A. Hristov, K. Johnson, E. Kebreab, R. Kohn, W. Liao, C. Toureene, J. Tricarico, 2021. Chapter 5: Quantifying Greenhouse Gas Sources and Sinks in Animal Production Systems. In *Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory*. Technical Bulletin Number xxxx, Office of the Chief Economist, U.S. Department of Agriculture, Washington. DC. XXX pages. Date, 202X.,

1.4.2. Ms. Emily McGlynn

Emily McGlynn

2201 Sandcastle Way, Sacramento, CA 95833
efmcglynn@ucdavis.edu ▪ 202 487 8136

Experience

PhD Candidate ▪ Agricultural and Resource Economics, University of California, Davis ▪ 2017 – present
PhD Candidate in top global department for resource economics, supported by National Science Foundation Graduate Research Fellowship. Research focuses on wood product market impacts on forest management and net carbon sequestration, conservation policy for carbon sequestration and avoided GHG emissions, and land use, land use change, forestry, and agriculture GHG accounting.

Deputy Associate Director for Energy and Climate Change ▪ White House Council on Environmental Quality, Washington DC ▪ 2016
Lead co-author of the U.S. Mid-Century Strategy for Deep Decarbonization, an analysis invited by the UN Paris Agreement that describes technologies and investments required to reduce U.S. GHG emissions by 80 percent by 2050. Developed and oversaw original interagency modeling and analysis. Supported policy strategy on conservation finance, biogenic emissions accounting, and public lands management.

Director of Strategy and Policy ▪ The Earth Partners, Washington DC ▪ 2014–2015
Managed commercial relationships with counterparties and government officials in five major export and U.S. markets for bioenergy and land restoration infrastructure projects. Successfully integrated "conservation biomass" concept into UK, Dutch, and Belgian renewable energy policy. Ensured sustainability compliance with Roundtable for Sustainable Biomaterials, Sustainable Biomass Partnership, and Sustainable Forests Initiative. Originated and directed all consulting projects, managing bioenergy, ecosystem restoration, and climate policy initiatives with government, NGOs, private sector partners, and universities.

Senior Advisor ▪ U.S. Department of State, Washington DC ▪ 2011 – 2013
Managed international government programs related to climate change, including U.S.-China climate change cooperation. Led U.S. government interagency and international teams on Secretary Clinton's priority program the Climate and Clean Air Coalition. Supported Special Envoy for Climate Change Todd Stern on all domestic policy analysis and in UN climate negotiations.

Transatlantic Fellow ▪ Technische Universitaet, Ecologic Institute, Berlin, Germany ▪ 2009 – 2011
Researcher in Economics of Climate Change Department under IPCC Co-Chair Ottmar Edenhofer. Co-author on major transportation and emissions trading report and *Energy Policy* article. At Ecologic Institute, led research and reports with EU-wide research consortium on EU environmental policy and carbon trading markets

Education

Bachelor of Arts, Biology, Economics ▪ Bryn Mawr College, Bryn Mawr, PA ▪ 2009 ▪ GPA: 3.9, Summa cum laude, Valedictorian

Honors and Awards

Berkeley/Sloan Summer School in Environmental and Energy Economics	2020
STEM Solutions Policy Award, UC Sacramento Center ($1,000)	2019
John Muir Institute for Environment Graduate Fellowship ($5,000)	2019
Graduate Student Association Travel Award, Davis, CA ($500)	2019
Henry A. Jastro Graduate Research Scholarship Award, Davis, CA ($2,975)	2019, 2020
National Science Foundation Graduate Research Fellowship, Washington DC ($100,800)	2018
Outstanding Oral Presentation, Arctic Frontiers Conference, Tromsø, Norway	2011
Transatlantic Renewable Energy Fellowship, Berlin, Germany (€4,050)	2009
Gertrude Slaughter Fellow, Bryn Mawr College Valedictorian ($3,000)	2009
Harry S. Truman Scholarship, Washington D.C. ($30,000)	2008
Gail Ann Schweiter Prize for Music and Science, Bryn Mawr, PA ($500)	2008
Annie's Environmental Studies Scholarship, Napa, CA ($1,000)	2007
Alumnae Regional Scholarship, Bryn Mawr, PA ($3,600)	2006
Daria Cheremeteff Fund Recipient, Bryn Mawr, PA ($3,600)	2006

Publications

Journal Articles

McGlynn, E., Favero, A., Olvera, B.A. (in prep) DICELAND: Exploring the economics of forests carbon sequestration and surface albedo in global climate policy.

McGlynn, E., Harper, K., Li, S., Berger, M. (in prep) Assessing Uncertainty and Bias in the U.S. Land Use, Land Use Change, and Forestry Greenhouse Gas Inventory.

Fargione, J., Bassett, S., Boucher, T., Bridgham, S., Conant, R., Cook-Patton, S., Ellis, P., Falcucci, A., Fourqurean, J., Gopalakrishna, T., …, **McGlynn, E.**, et al. (2018) Natural climate solutions for the United States. Science Advances, 4(11).

Bodnar, P., Ott, C., Edwards, R., Hoch, S., **McGlynn, E.**, Wagner, G. (2018) Underwriting 1.5°C: competitive approaches to financing accelerated climate change mitigation. Climate Policy, 18, 368–382, doi:10.1080/14693062.2017.1389687.

Creutzig, F., **McGlynn, E.**, Minx, J., Edenhofer, O. (2011) "Climate policies for road transport revisited: Evaluation of the current framework" Energy Policy, 39(5):2396-2406

Cavalieri, S., **McGlynn, E.**, Stoessel, S., et al. (2011) "The EU's Arctic Footprint." Journal of Nordregion. Vol 11, 27.

Cavalieri, S., **McGlynn, E.**, Stoessel, S., et al. (2011) "Spurensuche: Der kologische Fussabdruck der EU in der Arktis." Osteuropa, Vol. 2-3, 211-223.

McGlynn, E. (2009) "Advocating Native Bee Pollination Services on US Farms." WRDC Rural Connections: Food Security in the Western US, 4(1):33-36.

McGlynn, E. (2008) "Filling Up on Hot Air: The Road to a Hydrogen Economy." Lead Domestic Article for Virginia Policy Review, University of Virginia, Vol. 2, Issue 1.

Reports and other publications

McGlynn, E. (in press) It's time to put land carbon on the Biden climate agenda. Mission Zero, Center on Global Energy Policy, Columbia University.

McGlynn, E., Chitkara, A. (2018) Negative Emissions and Land-Based Carbon Sequestration: Implications for Climate and Energy Scenarios. Rocky Mountain Institute. http://www.rmi.org/insight/negative-emissionscarbon-sequestration

[*McGlynn, E. served as co-lead author*] United States White House (2016) U.S. Mid-Century Strategy for Deep Decarbonization. Washington, DC.

McGlynn, E., Galik, C., Myers, J., DeMeester, J. (2016) "Building Carbon in America's Farms, Forests, and Grasslands: A Policy Roadmap for Climate-Smart Landscapes." Forest Trends report, supported by MacArthur Foundation. 99 pp.

McGlynn, E., Bucholz, T., Gunn, J., Saah, D., Kittler, B. (2015) "Low-risk Bioenergy Can Be a Critical Climate Solution." Ecosystem Marketplace. Available online: http://www.ecosystemmarketplace.com/articles/opinion-low-risk-bioenergy-can-be-a-critical-climate-solution/

McGlynn, E. (2015) "Bioenergy can support climate, food, land restoration – If done right." Ecosystem Marketplace. Available online: http://www.ecosystemmarketplace.com/articles/em-op-ed-em-bioenergy-can-support-climate-food-land-restoration-if-done-right/

McGlynn, E., Chen, X., Zhang, Y., Zuo, Y., Berg, J. (2014) "Biomass co-firing at existing coal plants: A new opportunity for U.S.-China cooperation?" Rocky Mountain Institute publication. Available online: http://theearthpartners.com/wp-content/uploads/2015/10/Updated-RMI-TEP-US-China-biomass-co-firing-10-19-2014-FINAL-FOR-CEQ.pdf. 87 pp.

McGlynn, E. (2012) "Energy Policy" in Encyclopedia of Energy. Edited by Pierce, M., 1st ed. (Also authored articles "Carbon tax" and "Energy markets, transportation")

McGlynn, E. (2012) "Economics, Cost of Affecting Climate Change" in Encyclopedia of Global Warming and Climate Change. Edited by Philander, S., Golson, J., 2nd ed. (Also authored articles "Arctic and Arctic Ocean", "Carbon, black", and "Department of State, U.S.")

Cavalieri, S., **McGlynn, E.**, Stoessel, S., Stuke, F., Bruckner, M., Polzin, C., Koivurova, T., Sellheim, N., Stepien, A., Hossain, K., Duyck, S., Nilsson, A. (2010) "Arctic Footprint and Policy Assessment." Ecologic Institute, Berlin. European Commission, DG Environment. 243 pp.

Creutzig, F., Flachsland, C., **McGlynn, E.**, Minx, J., Brunner, S., Edenhofer, O. (2010) "CITIES: Car industry, road transport and an international emission trading scheme. A report commissioned by BMW. 99 pp.

McGlynn, E., Williams, N., Winfree, R. (2009) "Native Bee Benefits: How to Increase Native Bee Pollination on Your Farm in Several Simple Steps." NE Sustainable Agriculture Research and Education, Burlington, VT.

Presentations

Online Summer Workshop in Environmental, Energy and Transportation Economics. *Virtual*, October 2020. The problem with pricing "carbon": exploring forest-driven albedo effects in DICELAND.

Canadian Resource and Environmental Economics Association (CREEA) Workshop. *Virtual*, July 2020. The problem with pricing "carbon": exploring forest-driven albedo effects in DICELAND.

Association of Environmental Resource Economists (AERE) @ Western Economic Association International (WEIA), *Virtual*, June 2020. Analytical framework for assessing the effect of wood mill entry on local forest carbon stocks.

University of California Sacramento Center STEM Solutions Award, *Virtual*, April 2020. Proposal for implementing the California Natural and Working Lands Carbon Bank.

Giannini Foundation of Agricultural and Resource Economics Student Conference (GARESC), *Virtual*, April 2020. Preliminary analytical framework for assessing the effect of wood mill entry on local forest carbon stocks.

American Geophysical Union (AGU), *San Francisco, CA*, December 2019. Poster on "Improving certainty and accuracy in the U.S. land use, land use change, and forestry greenhouse gas inventory".

Agriculture and Applied Economics Association (AAEA), *Atlanta, Georgia*, July 2019. Draft paper on effects of albedo changes on the economically efficient level of forest carbon sequestration under global climate policy.

Giannini Foundation of Agricultural and Resource Economics Student Conference (GARESC), *Davis, CA*, April 2019. Theoretical framework for estimating forest-driven albedo effects on global climate outcomes.

Reducing Climate Policy Risk webinar, *San Francisco, CA*, November 2018. Interim results of "Improving certainty and accuracy in the U.S. land use, land use change, and forestry greenhouse gas inventory" project.

Global Climate Action Summit, *San Francisco, CA*, September 2018. "Land-Energy Nexus in Climate Change Mitigation" on limits to bioenergy plus carbon capture and storage.

Forest and Agriculture Greenhouse Gas Modeling Forum, *Shepherdstown, WV*, September 2018. Gap analysis in modeling social and economic limits to bioenergy plus carbon capture and storage.

Stanford Center for Carbon Storage, *Stanford, CA*, March 2018. Ecological and economic implications of bioenergy plus carbon capture and storage.

Policy Roadmap for Climate-Smart Landscapes webinar, *Washington D.C.*, February 2016. U.S. policy recommendations for reducing GHG emissions and increasing carbon sequestration from land use, land use change, forestry, and agriculture to federal government and NGO experts.

Dutch government delegation, biomass sustainability mission, *Richmond, Virginia*, November 2015. Invited by Dutch embassy to present to delegation of Dutch government representatives as they seek to finalize their biomass sustainability guidelines in 2016.

BIO World Congress, *Montreal, Canada*, July 2015. Scale of potential for "conservation biomass" to support global bioeconomy.

4th Industrial Wood Pellets for Coal Plant Co-Firing, *Minneapolis, Minnesota*, June 2015. EPA's draft biogenic emissions accounting framework.

Advanced Biomass Feedstock Conference, *New Orleans, Louisiana*, June 2015. The Earth Partners' conservation biomass cellulosic ethanol facility under development in southwest Louisiana.

Clearwater Clean Coal Conference, *Clearwater, Florida*, June 2015. Potential for biomass co-firing as Clean Power Plan compliance option.

International Biomass Conference, *Minneapolis, Minnesota*, April 2015. Recommendations for implementing biomass co-firing at existing coal plants.

Dutch Social and Economic Council, Biomass Sustainability, *Utrecht, the Netherlands*, April 2014. Presented "conservation biomass" concept to Dutch government task force to influence national biomass sustainability guidelines.

Asia-Pacific Eco-Town Conference, *Kawasaki, Japan*, September 2013. Keynote speaker on Climate and Clean Air Coalition and discussion moderator on the role of the national government in promoting sustainable cities.

Asia Regional Consultation on short-lived climate pollutants, *Bangkok, Thailand*, February 2012. Led discussions on major polluting sectors of short-lived climate pollutants with high-level representatives from 19 Asian countries to identify regional policy solutions.

Arctic Frontiers Conference, *Tromsoe, Norway*, January 2011. Discussed Arctic Footprint and Policy Analysis, including powerpoint, with international audience of 50+ researchers and policy-makers. Received "Outstanding Oral Presentation."

UNFCCC, *Cancun, Mexico*, December 2010. Led panel discussion and press briefing on youth contributions to climate science.

UNFCCC, *Tianjin, China*, October 2010. Presented side event on independent research project, "Benefit-based framework for climate change burden sharing."

5. Waste

1.6.1. Mr. Phillip Cunningham

RUBY CANYON ENVIRONMENTAL

743 Horizon Ct. Suite 385 · Grand Junction, CO USA 81506
(970) 241-9298 · (970) 256-1761 fax
www.rubycanyonenv.com

Phillip Cunningham
Environmental Scientist

Summary

Phillip Cunningham is an environmental scientist at Ruby Canyon Environmental with experience in technical research, data collection and analysis, and report writing to qualify greenhouse gas (GHG) emission inventories and reduction projects. To date, he has completed over 200 verifications as a lead validator/verifier. His recent activities include verifying an energy efficiency project from technical energy dispatch at a downstream oil and gas refinery and avoided emissions through beneficial use of annular gas- both located in Colombia. Phillip has also been involved with auditing data from oil and gas entities reporting to The Climate Registry and el Registro Nacional de Emisiones (RENE) in Mexico. In the fall of 2019, Phillip was a peer reviewer for several sections of the U.S. EPA's Global Non-CO_2 Greenhouse Gas Emission Projections and Mitigation report.

During his career at RCE, Phillip has visited a variety of facilities including power plants, landfills, wastewater treatment plants, steam distribution plants, sawmills, underground coal and Trona mines, refrigerant reclaiming facilities, hazardous waste combustion facilities, dairy and hog farms, vegetable greenhouses, nitric acid plants, a quick lime plant, composting facilities, a petrochemical and hydrogen cyanide production facility, and other general manufacturing facilities.

He is an approved Lead Verifier for Landfill, Livestock, Ozone Depleting Substances, Coal Mine Methane, Nitric Acid Production, Organic Waste Digestion, Organic Waste Composting, Nitrogen Management and Grasslands Project types under the Climate Action Reserve; an Air Resources Board (ARB) accredited Lead Verifier for Livestock, Ozone Depleting Substances and Coal Mine Methane project verifications; has worked as Lead Verifier under The Climate Registry (TCR) verifying greenhouse gas (GHG) emission inventories for local governments, universities, a transportation company, utility companies and a variety of other industrial sectors. In Canada, he has acted as a Lead Verifier for carbon offset projects and emissions inventories under the British Columbia Climate Investment Branch and British Columbia Reporting Regulation, verified carbon offset projects under Alberta's carbon registry, and verified several facilities under Ontario's mandatory reporting regulation. He has also verified power plants and a variety of manufacturing and industrial facilities reporting under RENE in Mexico as well as manufacturing facilities reporting voluntarily under Mexico's Programma GEI.

Experience

Environmental Scientist, Ruby Canyon Environmental, December 2011 – present

- Verification activities under the Climate Action Reserve, American Carbon Registry, Verra, California Air Resources Board, The Climate Trust, British Columbia Climate Investment Branch, Alberta Emission Offset Program, Mexico's gas de efecto invernadero (GEI) program and CERCARBONO (Colombia).
- Verification of voluntary greenhouse gas reporting under The Climate Registry and mandatory greenhouse gas reporting in British Columbia, Massachusetts, Ontario, California, and Mexico.
- Certified Lead Verifier under the Climate Action Reserve for Landfill, Livestock, Ozone Depleting Substances, Coal Mine Methane, Nitric Acid Production, Organic Waste Digestion, Organic Waste Composting, Nitrogen Management and Grassland project types (U.S. and Canada).
- Certified Lead Verifier under the California Air Resources Board for Livestock, Ozone Depleting Substances and Coal Mine Methane project types.
- Certified Lead Verifier under the California Air Resources Board mandatory reporting program and a transactions specialist.
- Lead Verifier auditing greenhouse gas inventories for local governments, utilities, universities, and a transit authority.
- Performed an external peer review of EPA's Global Non-CO_2 Greenhouse Gas Emissions Projections and Marginal Abatement Cost Analysis.
- Compiled greenhouse gas inventory for one of the world's largest fertilizer companies from 2011 – 2019.
- Contributor to Colorado Energy Office's report "Greenhouse Gas Neutrality Assessment of Coal Mine Methane and Waste-to-energy Pyrolysis Projects.
- Research to determine the GHG benefits of feeding food waste to livestock as opposed to landfilling

- Assisted a landfill registering a carbon credit Project under the Climate Action Reserve.
- Performed study on GHG emission reductions from combustion of refuse derived fuel to produce power.
- Assisted with the compilation of EPA's U.S. Coal Mine Methane inventory from 2011 to 2016.
- Performed site visits throughout the United States, Canada, Mexico, and Colombia.

Education

Colorado Mesa University B.S., Environmental Science and Technology, 2011

Work History

Environmental Scientist, Ruby Canyon Engineering, Inc. – December 2011 – present

Assistant to Staff Scientists, Palisade Insectary, May 2010 - August 2010, May 2011 - November 2011

- Assisted in the development of monitoring protocols for determining status of invasive species populations in different parts of the state of Colorado
- Reared and worked with several different species of bio-control insects
- Conducted greenhouse management to optimize the production of food for bio-control insects
- Documented different bio-control insects through microscope photography

Research Assistant, City of Grand Junction, December 2010 - January 2011

- Reviewed and summarized reports dealing with water use by oil and gas companies in the State of Colorado

1.6.2. Bryan Staley

1.6.3. Ms. Rhonda Sherman

Rhonda L. Sherman
Extension Specialist, Solid Waste Management
North Carolina State University
Department of Horticultural Science
160 Kilgore Hall, Raleigh, NC 27695
Phone: (919) 515-6770; e-mail: sherman@ncsu.edu

Rhonda Sherman holds a 100% extension appointment and her areas of expertise are vermicomposting, composting, recycling and waste reduction. As a leading authority on vermicomposting, she has received requests for information from people in 118 countries. Rhonda gives about 50 presentations annually and has taught composting and vermicomposting in Argentina, Chile, the Dominican Republic, Guyana, Mexico, Italy, Canada, and throughout the United States.

Rhonda organizes the world's only annual conference on large-scale commercial vermicomposting that draws participants from all over the world. She held her 20th Vermiculture Conference in October 2019 (the 2020 conference was cancelled due to COVID-19). Each year, people from most U.S. states attend the conference in addition to participants from foreign countries. Past conference attendees came from Argentina, Aruba, Australia, Austria, Bahamas, Belgium, Canada, China, Dominican Republic, England, Germany, Greece, Guatemala, Hong Kong, India, Ireland, Israel, Latvia, Mexico, Micronesia, Nicaragua, Nigeria, Norway, Philippines, Puerto Rico, Singapore, South Africa, Spain, Switzerland, Thailand, Trinidad & Tobago, Turkey, Uganda, and Zimbabwe.

Rhonda is the founder and director of the Compost Learning Lab (CL2) located at NC State's 1,500-acre Lake Wheeler Road Field Laboratory. The CL2 has a 40-ft by 30-ft Worm Barn, an equipment shed, and a covered teaching shelter. There are 25 types of composting and vermicomposting bins and areas for hands-on training activities.

Sherman has authored over 65 publications on vermicomposting, composting, recycling and waste reduction. Her new book is *The Worm Farmer's Handbook: Mid- to Large-Scale Vermicomposting for Farms, Businesses, Municipalities, Schools, and Institutions*.

Rhonda co-founded the North Carolina Composting Council (NCCC). She was formerly a member of the Board of Directors of the U.S. Composting Council and was a contributing editor to BioCycle Journal of Composting and Organics Recycling.

Scholarly & Creative Activities	Number
Book chapters	8
Books	2
Extension publications	23
Manuals	4
Other publications	42
Conferences/workshops hosted	20
Classroom guest lectures	55
Presentations at conferences, workshops, courses	>1,000
Grants	20 totaling $1,366,070

Education Background

M.A., Environmental and Resources Analysis: Solid Waste Management. 1989. Western Michigan University, Kalamazoo, MI

B.S., Double majors in Environmental Studies and Urban/Regional Planning. 1981. Western Michigan University, Kalamazoo, MI. *Magna cum laude*. *Presidential scholar.*

Professional Experience

Extension Specialist, September 1, 2016 – present, Horticultural Science Department, NC State University

Same work, different department

Extension Specialist, January 1, 1993-August 31, 2016, Biological & Agricultural Engineering, NC State University

Implemented a statewide educational and technical assistance program to increase awareness and understanding of solid waste management issues. Conducted waste assessments and evaluated potential waste reduction program enhancements. Created an international vermicomposting resource center with web pages, written and audiovisual materials, research, and training. Developed a Compost Learning Lab that features an extensive variety of on-site composting and vermicomposting systems, demonstrations of the beneficial reuse of compost, and hands-on training. Provided the only annual training on large-scale vermicomposting. Responded to requests for information from people in 118 countries.

Waste Management Analyst, 1991-1992, Office of Waste Reduction, NC-DEHNR, Raleigh, NC

Designed and implemented solid waste management education and training programs. Provided waste reduction technical assistance to local governments, institutions and businesses. Oversaw grant-funded projects. Developed guidance documents. Coordinated

specific waste reduction and composting projects.

Recycling Coordinator, 1990-1991, Office of Waste Reduction and Recycling, UNC-Chapel Hill
Planned and implemented campus-recycling program. Promoted campus awareness and participation in recycling. Researched effective policies, technologies and programs. Designed promotional and educational brochures. Coordinated recycling strategies and activities with a student group. Hired and supervised assistants.

Assistant Director, 1986-1990, Environmental Studies Program, Western Michigan University, Kalamazoo, MI
Designed and coordinated program and curriculum development, advised students on program requirements and course selection, administered environmental career counseling, wrote and produced newsletter, *created and implemented recruitment strategies that resulted in enrollment increase of 380 percent.* Taught a comprehensive course on environmental problems and solutions. Designed and taught a course on solid waste management. Co-taught senior capstone course.

Books and Book Chapters (9)

Rynk, Robert; Franciosi, Frank; Weindorf; and Black, Ginny (eds). 2021. The Composting Handbook. Elsevier. 566 p.

Sherman, R. 2018. *The Worm Farmer's Handbook: Mid- to Large-Scale Vermicomposting for Farms, Businesses, Municipalities, Schools, and Institutions*. White River Junction, VT: Chelsea Green Publishing.

Sherman, R. 2016. Composting, Chapter 2. *North Carolina Extension Gardener Handbook*. NC Cooperative Extension Service. <http://content.ces.ncsu.edu/2-composting>

Osmond, D. L., Crozier, C. R., Sherman, R., and LeBude, A. V. 2021. Nutrient Contact of Fertilizer Materials, Chapter IV- Fertilizer Use. *AgChem Manual*. NC State University. (2015-present)

Lowe, C. N., Butt, K. R. & Sherman, R. L. 2014. Current and potential benefits of mass earthworm culture. *Mass Production of Beneficial Organisms*. Elsevier, Inc. Chapter 20, 683-709.

Edwards, C., Arancon, N., & Sherman, R. (Eds.). 2011. *Vermiculture Technology: Earthworms, Organic Waste, and Environmental Management*. Boca Raton: FL: CRC Press.

Sherman, R. 2011. Vermicomposting in businesses and institutions. *Vermiculture Technology: Earthworms, Organic Waste, and Environmental Management*. Boca Raton: FL: CRC Press. Chapter 23, 369-390.

Sherman, R. & Bogdanov, P. 2011. The status of vermicomposting in North America: A rapidly developing technology. *Vermiculture Technology: Earthworms, Organic Waste, and Environmental Management*. Boca Raton: FL: CRC Press. Chapter 24, 391-408.

Sherman, R. & Appelhof, M. 2011. Small-scale school and domestic vermicomposting systems. *Vermiculture Technology: Earthworms, Organic Waste, and Environmental Management*. Boca Raton: FL: CRC Press. Chapter 6, 67-78.

Sherman, R. 2007. Chain management issues and good housekeeping procedures to minimize waste. *Waste Management and Co-product Recovery in Food Processing*. Woodhead Publishing Ltd, Abington Cambridge, UK. Chapter 3, 39-58.

Publications (Peer Reviewed - 24)

Sherman, R. and Aquilar, C. 2019. Empacadora Económica para Reciclar Botellas y Garrafas de Plástico (A Low-Cost Plastic Bottle and Jug Baler for Recycling (Spanish version)). AG773-12S. NC State Cooperative Extension.

Sherman, R. 2017. How your business can cut costs by reducing waste. AG-473-10. NC State Cooperative Extension. 6 p.

Sherman, R. 2016. Raising earthworms successfully. AGW-641/E04-43936. NC State Cooperative Extension. 26 p.

Sherman, R. 2016. Community backyard composting programs can reduce waste and save money. AG-599. NC State Cooperative Extension. 12 p.

Sherman, R. 2015. Composting in childcare center gardens. LF-007-07. NC State Cooperative Extension. 8 p. Updated 2020.

Sherman, R. 2015. Vermicomposting in childcare center gardens. LF-007-08. NC State Cooperative Extension. 7 p. Updated 2020.

Sherman, R. 2014. Backyard composting of yard, garden and food discards. AG-791. NC Cooperative Extension. 8 p.

Sherman, R. & Caldwell, E. 2013. Composting at NC residential and summer camps. AG-773. NC State Cooperative Extension. 4 p.

Sherman, R., Liverman, R., & Maxa, E. 2008. Vermicomposting leader's guide: A 5th grade school enrichment curriculum. E08-50326/4H-16-14PW. NC Cooperative Extension. 28 p. Updated 2020.

Classen, J., Rice, M., & Sherman, R. Effects of vermicompost on field crops and rainfall runoff. Compost Science and Utilization, Vol. 15, No. 1 (Winter 2007): 34-39.

Sherman, R. 2003. Raising earthworms successfully. AGW-641/E04-43936. NC State Cooperative Extension. 26 p.

Sherman, R. 2000. Community backyard composting programs can reduce waste and save money. AG-599. NC State Cooperative Extension. 12 p. Updated 2020.

Sherman, R. 1999. Large-scale organic materials composting. AG-593. NC State Cooperative Extension. 14 p. Updated 2020.

Sherman, R. 1998. Before you recycle, choose to reuse. AG-473-27. NC State Cooperative Extension. 6 p.

Sherman, R. 1998. Deconstruction: Giving old buildings new lives. AG-473-25. NC State Cooperative Extension. 6 p.

Sherman, R. 1998. Food recovery & waste reduction: A guide for businesses & institutions. AG-473-26. NC State Cooperative Extension. 8 p.

Sherman, R. & Bambara, S. 1997. Controlling mite pests in earthworm beds. AGW-001. NC State Cooperative Extension. 2 p.

Sherman, R. 1997. Worm away your cafeteria food scraps! AG-551. NC State Cooperative Extension. 8 p.

Sherman, R. 1996. Reduce, reuse, and recycle: A step-by-step guide to help hotels and motels

manage waste. AG-529. NC State Cooperative Extension. 43 p.

Sherman, R. 1994. Worms can recycle your garbage. AG-473-18. NC State Cooperative Extension. 6 p. Updated 2017.

Sherman, R. 1995. Municipal solid waste landfill regulations in North Carolina. AG-473-16. NC State Cooperative Extension. 8 p.

Sherman, R. 1994. A low-cost plastic bottle and jug baler. AG-473-12. NC State Cooperative Extension. 6 p. Updated 2019.

Sherman, R. 1994. Managing construction and demolition debris: A guide for builders, developers, and contractors. AG-473-19. NC State Cooperative Extension. 4 p.

Sherman, R. 1994. Organizing a community recycling program. AG-473-11. NC State Cooperative Extension. 4 p. Updated 2019.

Sherman, R. 1994. Waste reduction and recycling for the lodging industry. AG-473-17. NC State Cooperative Extension. 6 p.

Manuals (4)

Sherman, R. 1995. Reducing commercial and industrial solid waste for community solid waste managers: Trainer's guide. Morgantown, VA: National Environmental Training Center for Small Communities. 100 p.

Sherman, R. 1994 (revised 1995). Reducing commercial and industrial solid waste for community solid waste managers: Participant materials. Morgantown, VA: National Environmental Training Center for Small Communities. 180 p.

Barger, B., Boerschig, S., Clarke, S., Graves, B., Prevo, V., Sherman, R., Trachtman, L. 1993. Source reduction: A guide for North Carolina local governments and solid waste/recycling professionals. NC Recycling Association. 250 p.

Albrecht, T., Mouw, S. & Sherman, R. 1993. Waste reduction programs for commercial and industrial solid waste. Raleigh: NC Office of Waste Reduction, NC-DEHNR. 153 p.

Proceedings, Invited Papers, and Conference Presentations (61)

Sherman, R. 2019. Large-scale vermicomposting around the world: Using earthworms to recycle waste into valuable products. Seventeenth International Waste Management and Landfill Symposium. Sardinia, Italy.

Sherman, R. 2019. Boost your profits with value-added products (vermicompost and compost). US Composting Council's Annual Conference. Glendale, Arizona.

Sherman, R. 2019. Value-added products for composting operations. US Composting Council's Annual Conference. Glendale, Arizona.

Sherman, R. 2019. Waste to wealth with vermicomposting. Northeast Organic Farming Association. Burlington, Vermont.

Sherman, R. 2019. Managing waste for income. Organic Growers School. Mars Hill, NC.

Sherman, R. 2019. Vermicompost increases soil fertility and crop yields. Mother Earth News Conference. Asheville, NC.

Sherman, R. 2019. Vermicomposting: What am I doing wrong? Mother Earth News Conference. Asheville, NC.

Sherman, R. 2019. Vermicomposting: Benefits and uses for soils and plants. Carolina Farm Stewardship Association Annual Conference. Durham, North Carolina.

Sherman, R. 2019. Worming Your Way to Healthy Soils and Plants. Annual NC Extension Conference.

Sherman, R. 2019. Teaching Composting to Master Gardeners and the General Public. Annual NC Extension Conference.

Sherman, R. 2018. Boost your farm income with vermicomposting. Sustainable Agriculture Conference, Carolina Farm Stewardship Association. Durham, North Carolina.

Sherman, R. 2018. Vermicompost: Food scraps to high value compost. BioCycle Conference. Raleigh, North Carolina.

Sherman, R. 2018. Benefits of Compost. Eastern Landscapers Conference. North Carolina.

Sherman, R. 2017. Vermicomposting for businesses, farms, and community gardens. Half-day workshop. US Composting Council Annual Conference. Los Angeles, CA.

Sherman, R. 2016. School vermicomposting. BioCycle West Coast. San Diego, CA.

Sherman, R. 2015. Vermicomposting at businesses and institutions. US Composting Council Annual Conference. Austin, TX.

Sherman, R. 2015 On-farm vermicomposting. Carolina Farm Stewardship Association Annual Conference. Durham, NC.

Sherman, R. 2014. The status of vermicomposting in the United States. 10th International Symposium on Earthworm Ecology. Athens, GA.

Sherman, R. 2014. Food residuals diversion at businesses: On-site vermicomposting. Composting & Organics Recycling Conference at WasteExpo. Atlanta, GA.

Sherman, R. 2014. Keynote address: Nurturing plants and soil with vermicompost. Kerr Lake Master Gardener Symposium, Henderson, NC.

Sherman, R. 2013. Review of mid-to-large scale food residuals vermicomposting. US Composting Council 21st Annual Conference. Orlando, FL.

Sherman, R. 2013. Vermicomposting food residuals at restaurants, businesses and institutions (half-day workshop). US Composting Council 21st Annual Conference. Orlando, FL.

Sherman, R. 2013. Southeast food distributor initiates on-site vermicomposting. BioCycle 27th Annual West Coast Conference. San Diego, CA.

Sherman, R. 2012. Vermicomposting at businesses and institutions. Southeast Food Waste Conference. Charlotte, NC.

Sherman, R. 2011. On-site vermicomposting of food waste. BioCycle Annual Conference. San Diego, CA.

Sherman, R. 2011. The status of vermicomposting in North America. US Composting Council 19th Annual Conference. Santa Clara, CA.

Sherman, R. 2010. Vermicomposting in businesses and institutions in North America. 9th International Symposium on Earthworm Ecology. Xalapa, Mexico.

Sherman, R. 2010. Vermicomposting in businesses and institutions. US Composting Council 18th Annual Conference. Orlando, FL.

Arancon, N. & Sherman, R. 2009. Managing organics, enhancing agricultural productivity through vermiculture. BioCycle International Conference. San Diego, CA.

Sherman, R., Rice, M., Campbell, C., Atkinson, A., Murray, B. Renkow, M., Williams, M. & Rudek,

J. 2008. Pilot project for value-added products development from solid waste generated on swine farms. Poster presented at Soil and Water Conservation Society 2008 Annual Conference. Tucson, AZ.

Sherman, R. 2007. Food residuals recovery at festivals and special events. US Composting Council 15th Annual Conference. Orlando, FL.

Sherman, R. 2006. Effects of vermicompost on plant growth. Carolina Farm Stewardship Association Annual Conference. Spartanburg, SC.

Sherman, R. 2006. Successful components of backyard composting. Carolinas Recycling Coalition Annual Conference. Raleigh, NC.

Sherman, R. 2005. Benefits of vermicompost on soil and plant production. BioCycle Conference. Charlotte, NC.

Sherman, R. 2005. Let it rot! Home-scale composting. Carolina Farm Stewardship Association Sustainable Agriculture Conference. Durham, NC.

Young, M. & Sherman, R. 2004. Backyard composting half-day workshop. US Composting Council 12th Annual Conference. Las Vegas, NV.

Sherman, R. 2004. Best management practices for food residuals. Carolina Recycling Association 14th Annual Conference. Charlotte, NC.

Sherman, R. 2003. Containerized systems for on-site composting of commercial and institutional organic materials. National Recycling Coalition 22nd Annual Congress. Baltimore, MD.

Sherman, R. 2003. Vermicomposting systems overview. BioCycle National Conference. Denver, CO.

Sherman, R. 2003. Trends in managing organic wastes. Kansas 9th Annual Solid Waste Management Conference. Winfield, KS.

Sherman, R. 2003. Commercial earthworm production. Kansas 9th Annual Solid Waste Management Conference. Winfield, KS.

Sherman, R. 2002. Vermicomposting systems overview. BioCycle Northeast Conference. Portland, ME.

Sherman-Huntoon, R. 2002. State-of-the-art food residuals composting programs. National Recycling Coalition. Seattle, WA.

Sherman, R. 2002. Vermicomposting. NC Parks & Recreation Society Annual Conference. Greensboro, NC.

Classen, J., Rice, M. & Sherman-Huntoon, R. 2001. Vermicomposting as an animal waste management component. International Symposium Addressing Animal Production and Environmental Issues. Raleigh, NC.

Sherman-Huntoon, R. 2001. Food residuals trends in the Southeast. BioCycle Southeast Conference. Atlanta, GA.

Sherman. 2001. Food waste composting. Sustainable University: Designing the Future, Raleigh, NC.

Sherman-Huntoon, R. 2000. Medium-to-large scale vermicomposting systems. Y2K Composting in the Southeast Conference. Charlottesville, VA.

Sherman-Huntoon, R. 2000. Medium-to-large scale vermicomposting systems. Vermillenium Conference. Kalamazoo, MI.

Sherman-Huntoon, R. 2000. Food scrap composting on the cutting edge. National Recycling Coalition. Charlotte, NC.

Sherman-Huntoon, R. 2000. On-site composting options. BioCycle Focus on Food Residuals Northeast Conference. Burlington, VT.

Sherman, R. 2000. How to conduct a solid waste audit. Carolina Recycling Association Annual Conference. Asheville, NC.

Sherman, R. 1999. North Carolina's used oil recycling success story: Project HERO. Carolina Recycling Association Annual Conference. Myrtle Beach, SC.

Sherman, R. 1999. Prisoners team up with worms to reduce waste. Carolina Recycling Association Annual Conference. Myrtle Beach, SC.

Sherman, R. 1999. Vermicomposting as an animal waste management component. NCSU Animal Waste Management Symposium. Cary, NC.

Sherman, R. 1998. North Carolina's used oil recycling success story: Project HERO. Carolina Recycling Association Annual Conference. Greensboro, NC.

Sherman, R. 1997. Small-to large-scale vermicomposting. Water & Environmental Programming Conference. Tulsa, OK.

Sherman, R. 1997. Waste reduction and recycling for the lodging industry. North Carolina Recycling Association's 7th Annual Conference & Exhibition. Raleigh, NC.

Sherman, R. 1993. A cooperative approach to solid waste management training. International Waste Management Conference, San Juan, Puerto Rico.

Sherman, R. 1992. Design and implementation of a recycling coordinator's training program. British Columbia Recycling Association Annual Conference. Vancouver, British Columbia.

Sherman, R. 1990. Institutional recycling at a major southern university. Sixth International Conference of Solid Waste Management and Secondary Materials. Philadelphia, PA.

Trade Journal and Popular Press Articles (42)

Sherman, R. Vermicomposting. *Extension Gardener*, NC State Cooperative Extension (Winter 2014).

Sherman, R. Turn kitchen scraps into plant food. *Durham Master Gardener Blog* (December 2013).

Sherman, R. Natural lawn and crop care with composts and teas. BioCycle, Vol. 54, No. 1 (January 2013): 44-46.

Sherman, R. Trading carbon credits for methane recovery. BioCycle, Vol. 47, No. 9 (September 2006): 55-58.

Sherman, R. Compost plays key role in green roof mixes. BioCycle, Vol. 46, No. 3 (March 2005): 29-34.

Sherman, R. Backyard composting developments. *BioCycle*, Vol. 46, No. 1 (January 2005): 45-47.

Sherman, R. Exploring options for organics collection. *BioCycle*, Vol. 45, No. 2 (February 2004): 46-47.

Sherman, R. Arresting corrosion in compost structures. *BioCycle*, Vol. 44, No. 11 (November 2003): 45-50.

Sherman, R. Markets for blends and bags of compost. *BioCycle*, Vol. 44, No. 8 (August 2003):

45-50.
Sherman, R. High volume restaurant makes composting leap. *BioCycle*, Vol. 44, No. 8 (August 2003): 28-32.
Sherman, R. Texas transportation department accelerates highway use of compost. *BioCycle*, Vol. 44, No. 7 (July 2003): 24-28.
Clayton, J & Sherman, R. Commercial food residuals initiative in North Carolina. *BioCycle*, Vol. 44, No. 6 (June 2003): 28-30.
Sherman, R. Versatility key to wood waste, C&D debris recovery. *BioCycle*, Vol. 44, No. 5 (May 2003): 30-34.
Sherman, R. Exploring superior systems to manage manure. *BioCycle*, Vol. 44, No. 2 (February 2003): 32-37.
Sherman, R. Storm brings massive wood waste to North Carolina. *BioCycle*, Vol. 44, No. 1 (January 2003): 30.
Sherman, R. The inside story of the greenest building complex in the U.S. *BioCycle*, Vol. 43, No. 12 (December 2002): 58-60.
Sherman, R. Humic acid as plant growth enhancer in vermicompost. *BioCycle*, Vol. 43, No. 12 (December 2002): 54.
Sherman, R. Vermicomposting systems overview. *BioCycle*, Vol. 43, No. 12 (December 2002): 53-56.
Sherman, R. The greenest building complex in the U.S. *In Business*, Vol. 24, No. 6 (November/December 2002): 22-24.
Sherman, R. Joining the front lines of vermicomposters. *BioCycle*, Vol. 43, No. 10 (October 2002): 36-39.
Sherman, R. From professor to worm farmer. *In Business*, Vol. 24, No. 4, (July/August 2002): 23-24.
Sherman, R. Composting for disaster response. *BioCycle*, Vol. 43, No. 5 (May 2002): 29-32.
Sherman-Huntoon, R. Food residuals composting in the Southeast. *BioCycle*, Vol. 42, No. 12 (December 2001): 27-29.
Sherman-Huntoon, R. Compost as an alternative to methyl bromide. *BioCycle*, Vol 42, No. 9 (September 2001): 57-58.
Sherman-Huntoon, R. Research spotlight shines on organics recycling. *BioCycle*, Vol 42, No. 9 (September 2001): 61-62.
Sherman-Huntoon, R. Wood waste study provides clues to recycling success. *BioCycle*, Vol. 42, No. 7 (July 2001): 68-72.
Sherman-Huntoon, R. Helping organic farmers be more successful. *In-Business*, Vol. 23, No. 3 (Summer 2001): 34.
Sherman-Huntoon, R. Composting animal mortalities in North Carolina. *BioCycle*, Vol.41, No. 12 (December 2000): 57-59.
Sherman-Huntoon, R. Latest developments in mid-to-large-scale vermicomposting. *BioCycle*, Vol.41, No. 11 (November 2000): 51-54.

Sherman, R. Ethanol production plans gain power in North Carolina. *BioCycle*, Vol. 41, No. 8 (August 2000): 71 - 72, 74.

Sherman-Huntoon, R. Keeping organics from getting out of hand. *Resource Recycling*, Vol. XIX, No. 5 (May 2000): 13-18.

Sherman, R. Composting and vermicomposting at correctional facilities. *BioCycle*, Vol. 40, No. 7 (July 1999): 35-37.

Sherman, R. Prison cuts garbage in half with recycling, compost. *The Chapel-Hill Herald* (July 25, 1998).

Sherman, R. Recycling and vermicomposting at North Carolina prisons. *BioCycle*, Vol. 39, No. 5 (May 1998): 78.

Sherman, R. Vermicomposting in North Carolina. *Casting Call*, Vol. 3, No. 1 (February 1998): 1-3.

Sherman, R. Worms bring composters out of the woodwork. *NCCORC News* (Winter 1998): 1, 4.

Sherman, R. Worms solve problems at North Carolina correctional facility. *The R Word*, Vol. 10, No. 1 (Spring 1998): 25.

Sherman, R. No longer down in the dumps...Deconstruction methods can save old building materials for reuse. *North Carolina Builder*, Vol. 27, No. 8 (September 1997): 39.

Hollyer, J. & Sherman, R., Eds. Back yard composting bulletin, *S.C.O.R. Card*. October 1993.

Sherman, R. NC course offers standardized training for recycling coordinators. *Recycling Times* (19 October 1993): 3.

Sherman, R. Rural solution for baling plastics. *BioCycle*, Vol. 34, No. 10 (October 1993): 63.

Hollyer, J. & Sherman, R., Eds. *The S.C.O.R. Card*: Newsletter of the source-separated compost and organics recycling association. May 1993; August 1993.

Sherman, R. A model recycling program: UNC takes action as landfill space shrinks and costs rise. *NACUBO Business Officer* (June 1991): 28-30.

Grants and Contracts (20 totaling $1,366,070)

Compost Training Facility. Sherman. NC State Sustainability Grant. 2015 - 2016. $7,300.

NCSU Compost Training Facility. Sherman. Wake County Commercial Waste Reduction Grant. 2013. $1,500.

Waste Management and Irrigation Water Management. Grabow, Shah, and Sherman. NC Cooperative Extension. 2011. $1,669.

Pilot Project for Value-Added Product Development for Solid Waste Generated on Swine Farms. Co-Project Collaborator with Williams, Rice, Murray, and Renkow. USDA-NRCS Conservation Innovation Grant. 2006 - 2009. $376,988.

Development of Marketable By-Products from Alternative Swine Waste Treatment Technologies. Co-Project Director with Humenik, Classen, Chen, and Zering. GoldenLeaf, Inc. 2004. $200,000.

Comprehensive NPS Pollution Control Training for North Carolina. Co-Project Director with Spooner, Hoover, Lindbo, Lombardo, McLaughlin, Shaffer, and Sheffield. Environmental Protection Agency. 2002 - 2005. $315,000.

Vermicomposting Animal Manures. Sherman. CALS Animal Waste Management Programs.

2001 - 2003. $10,000.

Comprehensive NPS Pollution Control Training for North Carolina. Co-Project Director with Spooner, Hoover, Lindbo, Lombardo, McLaughlin, Shaffer, and Sheffield. Environmental Protection Agency. 2001 - 2003. $250,000.

Vermicomposting as an Animal Waste Management Component. Classen, Rice, & Sherman. Environmental Protection Agency. 1996 -2001. $40,000.

Sustainability Education. Sherman. CEMP 18 funds, NC State Cooperative Extension. 1998 - 1999. $400.

The North Carolina Storm Drain Stenciling Project and Project HERO. Hammett, Sherman, Mojonnier, Robertson, & Jennings. Environmental Protection Agency. 1996 - 1999. $61,730.

Solid Waste Management Education. Sherman. CEMP 18 Funds, NC State Cooperative Extension. 1997 - 1998. $2,535.

Evaluating Residential and Community Water Quality and Waste Management Programs. Co-Project Director with NCCES State Major Program Team. NC State Cooperative Extension. 1996 - 1997. $5,500.

Promoting and Measuring Program Impacts in Residential and Community Water and Waste Management. Co-Project Director with NCCES State Major Program Team. NC State Cooperative Extension. 1996 - 1997. $5,000.

SMP-18 Homepage Maintenance and Updating. Co-Project Director with NCCES State Major Program Team. NC State Cooperative Extension. 1996 - 1997. $2,500.

Self-Directed Learning Modules in Residential and Community Water and Waste Management. Co-Project Director with NCCES State Major Program Team. NC Cooperative Extension. 1995 - 1996. $6,000.

Reducing Commercial and Industrial Solid Waste: A Curriculum for Community Solid Waste Managers. Sherman. National Environmental Training Center for Small Communities. 1994 - 1995. $15,088.

Rowan County Solid Waste Management Plan. Rubin & Sherman. Rowan County. 1994 - 1995. $48,860.

Used Oil Recycling Education and Collection Program. Hammett, Sherman, Roberson, & McCracken. Community Resource Development, NC State Cooperative Extension. 1994 - 1995. $12,000.

Used Oil Recycling. Hammett, Sherman, & Roberson. Water Quality Initiative - Extension Service-U.S. Department of Agriculture. 1993. $4,000.

Scholarly and Professional Honors

Founding Member & Dedicated Leader of the Compost Industry. North Carolina Composting Council. 2017

Earthwise Award - Faculty. NC State University. 2008

Sustainability Award - Faculty. NC State University. 2004

Extension Education Award. NC Association of Cooperative Extension Specialists. 1997

Environmental Professional of the Year: Southeastern United States. Association of Energy and Environmental Engineers. 1991

Environmental Professional of the Year: North Carolina. Association of Energy and

Environmental Engineers. 1991
Presidential Scholar. Department of Geography. Western Michigan University. 1981
Scholastic Achievement Award, Geography. Western Michigan University. 1980

Certificates and Program Completion
Wake County Master Gardener Volunteer. 2016
Durham County Master Gardener Volunteer Program. 2013
Certificate of Technical Ability in Composting. Maine Compost School. 2005
Basic, Advanced, and Leadership Programs. The Legacy Center. 2003 - 2004
Certificate of Non-profit Management. Duke University. 2000
Academic Leadership for Women. BRIDGES VII. 1999
Compost Facility Operator Training. Louisiana State University Agricultural Center. 1998
Recycling Coordinators Training Program. State of North Carolina. 1991

Professional Service and Membership in Associations
North Carolina Composting Council (president; past vice president; co-founder) 2008 - 2016
Green Industry Council (board of directors) 2015 – present
NC Federation of Cooperative Extension Associations (president-elect 2006; president 2007; past-president 2008) 2006 - 2009
NC Association of Cooperative Extension Specialists (board of directors; president-elect 2006-07; president 2007-08; past-president 2008-09), 2002 - 2014
NC Composting and Organics Recycling Council (steering committee 1996 - 2000; 2005 - 2008)
US Composting Council (board of directors 1993 - 1996), 1993 - present
Source-separated Compost & Organics Recycling Assn. (steering committee), 1993
Toastmasters International; NC State Campus Toastmasters, 1993
Tarheel Association of Energy Engineers (vice president, environmental issues), 1991 - 1993
Carolina Recycling Association, 1990 - 2007
National Recycling Coalition, 1987 - 2005

Advisory Board Participation
DriloBASE World Earthworm Database. Editorial Board, Section Ecosystem Services - Agriculture - Vermiculture 2014
Waste Reduction & Recycling Working Group for Campus Environmental Sustainability Team. 2009+
BAE SPA Awards Committee (chair). 2009 - 2012
Duke Lemur Center Board of Directors Education Committee. 2009 - 2010
Eno River Trash-Free Committee (composting coordinator). 2005 – 2012.
NC State University Dining Committee. 2007 - 2010
BAE Distance Learning Committee. 2005 - 2009
BAE Facilities Committee. 2004 - 2009
NCSU CALS Diversity Management Team. 2002
Soil and Water Environmental Technology Center. 1998 - 2004
NC State Long-Range Plan State Major Program Team: Residential & Community Water &

Waste Management. 1997 - 2011
Woodbin II, Board of Directors. 1997 - 1998
Rural Council, NC Recycling Association (vice president). 1993 - 1996
Construction & Demolition Debris Task Force, TJCOG Regional Governments. 1993 - 1998
Water Quality/Waste Management Initiative Task Force, NC State. 1993 - 2003
NC Source Reduction Task Force. 1993 - 1996
Education Committee, North Carolina Recycling Association. 1991 - 1998
NC Recycling Coordinator Training Program Advisory Committee. 1991 - 1996
Program Committee, North Carolina Recycling Association. 1990 - 1993
Van Buren County Citizens for Recycling (co-founder). 1989 - 1990
Van Buren County Solid Waste Management Planning Committee (vice chair). 1988 - 1990
Alliance for Integrated Resource Management (co-founder). 1988 - 1990
Southwest Michigan Greens Solid Waste Task Force. 1988 - 1990
Kalamazoo County Forum Solid Waste Task Force. 1987 – 1990

Invited Guest Lectures and Advising

Horticultural Science Department: Intro to Permaculture (HS432), 2002 – present, 2x/yr. (36)
Crop Science Department: Introduction to Agroecology (CS230), 2007 – present (14)
Central Carolina Community College classes, 2015 - present (5)
World of Horticulture: Principles & Practices (HS201), 2017
Intro to Small Scale Landscape Design (HS242), 2017
Tree & Grounds Maintenance (HS471), 2017
Art & Architecture, The Ohio State University: Vermiculture Furniture, 2013
Entomology Department: Organic Agriculture (NET591-791), 2011 – 2012 (2)
Soil Science Department Seminar Series, 2010
Horticulture Science Department: Small-Scale Landscape Design, 2002
Advise College of Textiles student on composting and vermicomposting cotton textile waste for Sustainability Fund Grant 2016 - 2017
Advised Senior Design students on developing composting unit for horse manure, Bio & Ag Engineering, 2015-16
Served on Masters Non-thesis (MCS) committee for Crop Science Department, 2013
Advised and hosted Fulbright Scholar from India, February 1 – May 31, 2010
Advised PhD candidate in Fiber & Polymer Science, College of Textiles for developing non-woven polypropylene and polyethylene fabrics that can be composted and vermicomposted, 2010
Advised Chemical Engineering Senior Design students on industrial composting, 2008

Consulting Activities

Terra Nova Compost. Vermicomposting instructor for Community Compost Advocate Training Program. Atlanta, GA. June 2016
Institute for Local Self-Reliance. Soil Builder Master Composter Training. Vermicomposting instructor. 2014-15
Vermicomposting and composting technical assistance to a sustainability organization in

California. 2014

Farmer-to-Farmer volunteer with Partners of the Americas: Guyana (South America) in 2013, and Dominican Republic in 2014 and 2012. Taught farmers, greenhouse growers, and general public how to vermicompost, compost, and use vermicompost and teas.

Traveled to Argentina and Chile to provide technical assistance and training on composting and vermicomposting to sustainable farmers. November 2011

Contributing Editor. BioCycle Journal of Composting & Organics Recycling. Researched and wrote articles on a variety of topics including vermicomposting, ethanol production, storm debris recycling, animal mortalities composting, food residuals management, compost as an alternative to methyl bromide, construction and demolition debris management, compost markets, manure management alternatives, organics collection options, and arresting corrosion in composting structures. 2000 – 2007

Professional Recycling Organization of Pennsylvania. Delivered presentations on backyard composting at a statewide workshop. 2005

Researched and developed a report on the characteristics of horse manure compost for a private firm in Florida. 2003

Provided technical review of food waste composting guide and delivered a presentation. State of Colorado Governor's Office of Energy Management and Conservation. March 2002

Served on panel discussion "Vermiculture: Dissecting the Worm Industry." Governor's Office of Agricultural Policy, Frankfort, Kentucky. November 2001

Delivered one-day training course "Solid Waste Management Options for Local Officials." National Environmental Training Center for Small Communities, Morgantown, West Virginia. August 2001

Delivered two-day training course "Solid Waste Management Options for Local Officials." National Environmental Training Center for Small Communities, Morgantown, West Virginia. August 2000

Provided critical evaluation of two solid waste management curricula. National Environmental Training Center for Small Communities. 1999

Instructed "Commercial and Industrial Solid Waste Reduction Training for Community Solid Waste Managers"1-1/2 day course. National Environmental Training Center for Small Communities, Albuquerque, New Mexico. 1998

Instructed "Commercial and Industrial Solid Waste Reduction Training" one day course. Morongo Band of Indians, Palm Springs, California. 1998

Developed The Composting Council's Speakers Bureau. University of Hawaii. 1993