Philip G. Brodrick

260 Panama Street
Stanford, CA 94305

Education

2012 - 2016 **Ph.D. Energy Resources Engineering, Stanford University**
Advisors: Adam Brandt and Lou Durlofsky

2010 - 2012 **M.S. Renewable and Clean Energy, University of Dayton**
Advisor: Kevin Hallinan

2008 - 2010 **B.S. Physics, University of Dayton**

Academic Experience

2015 - Present **Carnegie Institute for Science, Department of Global Ecology**
Position: Postdoctoral fellow and Carnegie Airborne Observatory lead for model development and implementation.
Focus: Statistical learning and upscaling of hyperspectral data and optimization of flight operations

2012 - 2016 **Stanford University, Department of Energy Resources Engineering**
Position: Graduate student researcher
Dissertation: Computational Optimization of Solar Thermal and Natural Gas Power Systems

2010 - 2012 **University of Dayton, Department of Mechanical and Aerospace Engineering**
Position: Research assistant
Focus: Stochastic modeling of residential and commercial energy use

2009 - 2010 **Wright Patterson Air Force Base**
Position: Research assistant
Focus: Design optimization and testing of an air-coupled acoustic aperiodic flat lens

Peer-Reviewed Publications

2018 in review B. Altarhuni, A. Naji, **P.G. Brodrick**, R. Brecha, and K. Hallinan. Large scale residential energy efficiency prioritization enabled by machine learning. *Energy Efficiency (In Review)*, 2018.

F.C. Draper, C. Baraloto, **P.G. Brodrick**, O.L. Phillips, R.V. Vasquez, E.N. Honorio Coronado, T.R. Baker, R.Z. Gomez, C.A. Amasifuen Guerra, M. Flores, R. Garca Villacorta, P.V.A. Fine, L. Freitas, A. Monteagudo-Mendoza, R.J.W. Brienen, and G.P. Asner. Imaging spectroscopy predicts variable distance decay across contrasting amazonian tree communities. *Journal of Ecology (In Review)*, 2018.

2018 in press T. Jucker, G.P. Asner, M. Dalponte, **P.G. Brodrick**, C. Philipson, N. Vaughn, C. Brelsford, D. Burslem, N. Deere, R. Ewers, J. Kvasnica, S. Lewis, Y. Malhi, S. Milne, R. Nilus, M. Pfeifer, O. Phillips, L. Qie, N. Renneboog, G. Reynolds, T. Riutta, M. Struebig, M. Svtek, Y.A. Teh, and E. Turner. Estimating aboveground carbon density and its uncertainty in Borneos structurally complex tropical forests using airborne laser scanning. *Biogeosciences*, 2018.

2018 **P.G. Brodrick**, A.R. Brandt, and L.J. Durlofsky. Optimized costs of CO_2 reduction in integrated solar combined cycles. *Applied Energy*, 226:979–990, 2018. doi: 10.1016/j.apenergy.2018.06.052.

T. Paz-Kagan, N.R. Vaughn, R. Martin, **P.G. Brodrick**, N.L. Stephenson, A.J. Das, K.R. Nydick, and G.P. Asner. Landscape-scale Variation in Canopy Water Content of Giant Sequoias During Drought. *Forest Ecology and Management*, 419-420, 2018. doi: 10.1016/j.foreco.2017.11.018.

N.R. Vaugh, G.P. Asner, **P.G. Brodrick**, R.E. Martin, J.W. Heckler, D.E. Knapp, and R.F. Hughes. An Approach for High-resolution Mapping of Hawaiian Metrosideros Forest Mortality Using Laser-guided Imaging Spectroscopy. *Remote Sensing*, 10, 2018. doi: 10.3390/rs10040502.

R.E. Martin, K.D. Chadwick, **P.G. Brodrick**, L. Carranza-Jimenez, N.R. Vaughn, and G.P. Asner. An Approach for Foliar Trait Retrieval from Airborne Imaging Spectroscopy of Tropical Forests. *Remote Sensing*, 10, 2018. doi: 10.3390/rs10020199.

G.P. Asner, **P.G. Brodrick**, C. Philipson, N.R. Vaughn, R.E. Martin, D.E. Knapp, J. Heckler, L. Evans, T. Jucker, B. Gossens, D.J. Stark, G. Reynolds, R. Ong, N. Renneboog, F. Kugan, and D.A. Coomes. Mapping Imprints of Forest Use on Carbon Stocks to Advance Ecosystem Protection and Recovery in Malaysian Borneo. *Biological Conservation*, 217: 289–310, 2018. doi: 10.1016/j.biocon.2017.10.020.

R. Niemiec, G.P. Asner, **P.G. Brodrick**, J.A. Gaertner, and N.M. Ardoin. Scale-dependence of Environmental and Socioeconomic Drivers of Biological Invasion in Hawaii. *Landscape and Urban Planning*, 2018. doi: 10.1016/j.landurbplan.2017.08.008.

2017 T. Paz-Kagan, **P.G. Brodrick**, N.R. Vaughn, A.J. Das, N.L. Stephenson, K.R. Nydick, and G.P. Asner. What mediates tree mortality during drought in the southern Sierra Nevada? *Ecological Applications*, 2017. doi: 10.1002/eap.1620.

P.G. Brodrick, A.R. Brandt, and L.J. Durlofsky. Operational Optimization of Integrated Solar Combined Cycles (ISCCs) under practical time-dependent constraints. *Energy*, 141: 1569–1584, 2017. doi: 10.1016/j.energy.2017.11.059.

H. Teichgraeber, **P.G. Brodrick**, and A.R. Brandt. Optimal design and operations of a flexible oxyfuel natural gas plant. *Energy*, 141:506–518, 2017. doi: 10.1016/j.energy.2017.09.087.

P.G. Brodrick and G.P. Asner. Remotely Sensed Predictors of Conifer Tree Mortality During Severe Drought. *Environmental Research Letters*, 12(11), 2017. doi: 10.1088/1748-9326/aa8f55.

2016 G.P. Asner, **P.G. Brodrick**, C.B. Anderson, N.R. Vaughn, D.E. Knapp, and R.E. Martin. Progressive forest canopy water loss during the 2012–2015 California drought. *Proceedings of the National Academy of Sciences*, 113(2):E249–E255, 2016. doi: 10.1073/pnas.1523397113.

2015 **P.G. Brodrick**, C.A. Kang, A.R. Brandt, and L.J. Durlofsky. Optimization of carbon-capture-enabled coal-gas-solar power generation. *Energy*, 79:149–162, January 2015. ISSN 03605442. doi: 10.1016/j.energy.2014.11.003.

2014 R. Villoria-Siegert, **P.G. Brodrick**, K. Hallinan, and R.J. Brecha. Cost-availability curves for hierarchical implementation of residential energy-efficiency measures. *Energy Efficiency*, August . ISSN 1570-646X. doi: 10.1007/s12053-014-9291-5.

2012 J.T. Welter, S. Sathish, J.M. Dierken, **P.G. Brodrick**, M.R. Cherry, and J.D. Heebl. Broadband aperiodic air coupled ultrasonic lens. *Applied Physics Letters*, 100(21):214102, 2012. ISSN 00036951. doi: 10.1063/1.4720149.

K. Hallinan, H. Enns, S. Ritchey, **P.G. Brodrick**, N. Lammers, N. Hanus, M. Rembert, and T. Rainsberger. Energy Information Augmented Community-Based Energy Reduction. *Sustainability*, 4(7):1371–1396, 2012. ISSN 20711050. doi: 10.3390/su4071371.

2011 J.T. Welter, S. Sathish, D.E. Christensen, **P.G. Brodrick**, J.D. Heebl, and M.R. Cherry. Focusing of longitudinal ultrasonic waves in air with an aperiodic flat lens. *Journal of the Acoustical Society of America*, 130(5):2789–96, 2011. ISSN 15208524. doi: 10.1121/1.3640841.

K.P. Hallinan, **P.G. Brodrick**, J. Northridge, J.K. Kissock, and R.L. Brecha. Establishing Building Recommissioning Priorities and Potential Energy Savings from Utility Energy Data. *ASHRAE Transactions*, 117(2):495–505, 2011. ISSN 00012505.

Conference Proceedings

2016 M. Ames, **P.G. Brodrick**, and R. Horne. Thermal Forecasting Ability of Temperature-Sensitive Tracers. In *Stanford Geothermal Workshop*, 2016.

2015 M. Ames, **P.G. Brodrick**, and R. Horne. A Framework for Comparative Inverse Modeling of Tracers for Thermal Breakthrough Forecasting Using Fracture Network Models. *Proceedings, Fourtieth Workshop on Geothermal Reservoir Engineering*, 2015.

2013 J.T. Welter S., Sathish, M.R. Cherry, and **P.G. Brodrick**. High resolution mechano-optical method for acoustic field measurements in air. In *AIP Conference Proceedings*, volume 1511. AIP Publishing, 2013. ISBN 9780735411296. doi: 10.1063/1.4789215.

2012 K.P. Hallinan, Y. Tesfay, J. Monn, E. Krehnovi, and **P.G. Brodrick**. An Improved Method for Predicting Energy in Variable Occupancy Academic Buildings. In *2nd World Sustainability Forum*, 2012.

Talks

2017 P.G. Brodrick, G.P. Asner. Remotely sensed advance indicators of mortality in conifers throughout the Sierra Nevada. ESA. Portland, OR, August 2017.

2013 P.G. Brodrick, C.A. Kang, A.R. Brandt, and L.J. Durlofsky. Optimization of CCS-Enabled Coal-Gas-Solar Power Generation. Carbon Management Technology Conference. AICHE. Arlington, VA, October 2013.

2012 P.G. Brodrick. Utility Savings Measurement and Verification Using Evolutionary Algorithms. University Clean Energy Alliance of Ohio. Columbus, OH, April 2012.

2011 P.G. Brodrick, K. Hallinan. Algorithmic Approaches to Normalized Energy Consumption. Dayton Engineering Science Symposium. Dayton, OH, October 2011.

Academic Service

Mentorship
Recipient of the 2018 Certificate of Achievement in Mentoring in the School of Earth, Energy & Environmental Sciences at Stanford University.

Peer Review
Including *Energy*, *Applied Energy*, *Remote Sensing of Environment*, and *Environmental Research Letters*.

Carnegie Institution Postdoc Association
Served as a department of global ecology representative as a part of an interdepartmental effort to enrich the professional and personal experience of Carnegie Postdocs (2018 -).

Graduate Student Advisory Committee
Served as a member of the student advisory committee to the Dean of the School of Earth, Energy, and Environment at Stanford University (2015 - 2016).

President's Committee for the Environment
Served on the eight member committee to advise the office of the president at the University of Dayton on matters of sustainability and the environment (2009 - 2011).

Director of Sustainability
Served as a member of the University of Dayton's Student Government Organization (2008 - 2010).

Teaching Experience

2018 **Optimization of Energy Systems**, Guest lecturer, Stanford University, California

2017 **Computational Ease and Efficiency Seminar**, Course development and primary lecturer, Carnegie Institution for Science, Stanford, California

2016 **Optimization of Energy Systems**, Guest lecturer and teaching assistant, Stanford University, California

2015 **Guest Lecturer at Stanford University**
-Fundamentals of energy systems (graduate course)
-Earth on the edge: introduction to geophysics (undergraduate course)

2014 **Optimization of Energy Systems**, Guest Lecturer and Teaching Assistant, Stanford University, California

Technical Experience

Experience Developing With:
C/C++, Python, Bash, CShell, Matlab, Julia, GDAL, H2O, Scikit-learn, R, Theano, Tensor-Flow

Distributed Computing Experience
-Experience on multiple independent platforms, with CentOS 5/6/7 and Ubuntu distributions
-Experience with MPI, OpenMP, and CUDA-based parallelization