Josh Gray

NC State University
Dept. of Forestry & Environmental Resources
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Education

University of North Carolina, Chapel Hill, NC.
Ph.D., Geography, 2012

University of North Carolina, Chapel Hill, NC.
B.S., Environmental Science, 2005

Research Interests

Global Agricultural Change
Effects of agricultural change on carbon and water cycles; Food- and water-security challenges of climate change; Sustainable intensification

Remote Sensing and Spatial Analysis
Terrestrial vegetation and global land cover dynamics; Multi-temporal image analysis; Big-data computational strategies; UAV remote sensing

Professional Experience

North Carolina State University
Assistant Professor, Department of Forestry & Natural Resources, 2016–present
Faculty Fellow, Center for Geospatial Analytics, 2016–present

Boston University
Research Assistant Professor, 2014–2016
Postdoctoral Research Associate, 2012–2014

University of North Carolina at Chapel Hill
NASA Earth and Space Science Fellow, 2010–2012
Research Assistant, 2008–2010

UNC Engineering Information Services
GIS Technician, 2005-2008

Funded Proposals

An operational multisource land surface phenology product from Landsat and Sentinel 2.
NASA, co-investigator, $1,109,038, 2018–2021.

UAS Roadmap.
NC-DOT, principal investigator, $249,949, 2017–2019.

Water, Climate, and Food in the Anthropocene
NASA, principal investigator, $266,809, 2016–2019.

NSF RAPID: Collaborative Research: Impacts of Extreme Flooding on Hydrologic Connectivity and Water Quality in the Atlantic Coastal Plain and Implications for Vulnerable Populations
NSF, co-investigator, $29,828, 2016–2017.

A Multi-scale Satellite-based Indicator of Climate Change Impacts on Land-surface Phenology
NASA, principal investigator, $433,693, 2016–2019.

Multisource Imaging of Seasonal Dynamics in Land Surface Phenology: A Fusion Approach Using Landsat and Sentinel-2
NASA, co-investigator, $739,115, 2015–2018.

Final Maintenance and Refinement of the MODIS Land Cover Product
NASA, co-investigator, $230,306, 2014–2015.

Earth and Space Science Fellowship
NASA, principal investigator, $90,000, 2010–2012

Publications

Moon, M., X. Zhang, G. Henebry, L. Liu, **J.M. Gray**, and M. Friedl. (2018). Long-term continuity in land xurface phenology measurements: A comparative assessment of the MODIS Land Cover Dynamics and VIIRS Land Surface Phenology products. *Remote Sensing of Environment.* under-review

Sull-Menashe, D., **J.M. Gray**, P. Abercrombie, and M. Friedl. (2018). Hierarchical mapping of annual global land cover 2001 to present: The MODIS Collection 6 Land Cover product. *Remote Sensing of Environment.* accepted

Singh, K., Y. Chen, L. Smart, **J.M. Gray**, and R.K. Meentemeyer. (2018). Intra-annual phenology for detecting understory plant invasion in urban forests. *ISPRS Journal of Photogrammetry and Remote Sensing.* accepted

Zhang, X., J. Senthilnath, L. Liu, M. Friedl, G. Henebry, Y. Liu, C. Schaaf, A.D. Richardson, and **J.M. Gray**. (2018). Evaluation of Land Surface Phenology from VIIRS Data using Time Series of PhenoCam Imagery. *Agricultural and Forest Meteorology.* in-press

Richardson, A., K. Hufkens, T. Milliman, D. Aubrecht, M. Chen, **J.M. Gray**, M. Johnston, T. Keenan, S. Klosterman, M. Kosmala, E. Melaas, M. Friedl, and S. Frolking. (2018). Tracking vegetation phenology across diverse North American biomes using PhenoCam imagery. *Scientific Data.* in-press

Singh, K., M. Madden, **J.M. Gray**, and R. Meentemeyer. (2018). The managed clearing: An overlooked land-cover type in urbanizing regions? *PLoS One.* 13(2):e0192822.

Zhang, X., J. Wang, F. Gao, Y. Liue, C. Schaaf, M. Friedl, Y. Yu, S. Jayavelu, **J.M. Gray**, L. Liu, D. Yan, and G.M. Henebry. (2017). Exploration of scaling effects on coarse resolution land surface phenology. *Remote Sensing of Environment.* 190:318–330.

Pickard, B., **J.M. Gray**, and R. Meentemeyer. (2017). Comparing Quantity, Allocation and Configuration Accuracy of Multiple Land Change Models. *Land.* 6(3).

Melaas, E.K., D. Sulla-Menashe, **J.M. Gray**, A. Black, T.H. Morin, A.D. Richardson, and M.A. Friedl. (2016). Multisite Analysis of Land Surface Phenology in North American Temperate and Boreal Deciduous Forests from Landsat. *Remote Sensing of Environment.* 186:452–464.

Chen, M., E.K. Melaas, **J.M. Gray**, M.A. Friedl, and A.D. Richardson. (2016). A new seasonal-deciduous spring phenology submodel in the Community Land Model 4.5: impacts on carbon and water cycling under future climate scenarios. *Global Change Biology.* doi:10.1111/gcb.13326

Gray, J.M., M. Friedl, S. Frolking, N. Ramankutty, E. Kort, D. Ray, and C. Kucharik. (2014). Direct human influence on atmospheric CO_2 seasonality from increased cropland productivity. *Nature.* 515(7527):398–401.

Klosterman, S.T., K. Hufkens, **J.M. Gray**, Melaas, E., Sonnentag, O., Lavine, I., Mitchell, L. Norman, R., Friedl, M.A., and Richardson A.D. (2014). Evaluating remote sensing of deciduous forest phenology at multiple spatial scales using PhenoCam imagery. *Biogeosciences.* 11(16):4305–4320

Friedl, M., **J.M. Gray**, E. Melaas, A. Richardson, K. Hufkens, T. Keenan, M. Toomey, S. Klosterman, A. Bailey, and J. O'Keefe. (2014). A tale of two springs: Using anomalous climate events to quantify the sensitivity of temperate forest phenology to climate change. *Environmental Research Letters.* 9(5):054006

Gray, J.M., M. Friedl, S. Frolking, N. Ramankutty, A. Nelson, and M. Gumma. (2014). Mapping Asian cropping intensity with MODIS. *Journal of Selected Topics in Applied Earth Observation and Remote Sensing.* 7(8):2344630

Keenan, T., **J.M. Gray**, M. Friedl, M. Toomey, G. Bohrer, D. Hollinger, J. Munger, J. O'Keefe, H. Schmid, I. Sue-Wing, B. Yang, and A. Richardson. (2014). Net carbon uptake has increased through warming-induced changes in forest phenology. *Nature Climate Change.* 4(7):598–604

Li, L., M. Friedl, Q. Xin, **J.M. Gray**, Y. Pan, and S. Frolking. (2014). Mapping Crop Cycles in China Using MODIS-EVI Time Series. *Remote Sensing.* 6:2473–2493.

Gray, J.M., and Song, C. (2013). Consistent classification of image time series with automatic adaptive signature generalization. *Remote Sensing of Environment.* 134:333–341.

Gray, J.M., and Song, C. (2012). Mapping leaf area index using spatial, spectral, and temporal information from multiple sensors. *Remote Sensing of Environment.* 119:173–183.

Song, C., **Gray, J.M.**, and Gao, F. (2011). Remote sensing of vegetation with Landsat imagery. In Weng, Q., editor, *Advances in Environmental Remote Sensing: Sensors, algorithms and applications.* CRC Press.

Teaching & Mentorship

Instructor, 2018–present
Earth from Space (ES113), NC State University, College of Natural Resources

Instructor, 2018–present
Analysis of Environmental Issues (ES400), NC State University, College of Natural Resources

Instructor, 2017–present
Geospatial Data Mining (GIS713), NC State University, Center for Geospatial Analytics

Instructor, 2015–2016
Digital Image Processing - Remote Sensing (GE 440/640), Boston University, Dept. of Earth & Environment

Mentor, Research Experiences for Undergraduates, 2012–2013
Harvard Forest, with Dr. Mark Friedl, Boston University, and Dr. Andrew Richardson, Harvard

Co-instructor, Introduction to Remote Sensing, 2012
University of North Carolina, with Dr. Aaron Moody

Future Faculty Fellowship, 2011
University of North Carolina; pedagogical, leadership, and career workshops for future faculty

Conference Presentations

Gray, J.M., A. Khan and M. Friedl (2018). USA-NPN observations reveal the ecological relevance of remotely sensed phenology. *Fall Meeting of the American Geophysical Union, Dec 10–14, Washington D.C.* (presentation)

Gray, J.M., E. Sills and M. Amanatides (2017). Using Remote Sensing and Synthetic Controls to Understand Deforestation Drivers and their Moderation by Forest Use in Kalimantan, Indonesia. *Fall Meeting of the American Geophysical Union, Dec 11–15, New Orleans, LA.* (presentation)

Riveros-Iregui, D.A., H.A. Moser, E.C. Christenson, J.M. Gray, M. Hedgespeth, T. Jass, D.S. Lowry, K. Martin, E. Nichols, J. Stewart, and R.E. Emanuel. Impacts of Extreme Flooding on Hydrologic Connectivity and Water Quality in the Atlantic Coastal Plain and Implications for Vulnerable Populations. *Fall Meeting of the American Geophysical Union, Dec 11–15, New Orleans, LA.* (poster)

Gray, J.M., M.A. Friedl and K. Singh. (2016). Multisource Image Kalman Filtering for Rapid Phenological Monitoring and Forecasting. *Fall Meeting of the American Geophysical Union, Dec 12–16, San Francisco, CA.* (poster)

Gray, J.M., D. Sulla-Menashe, and M. Friedl. (2016). MODIS Collection 6 Land Cover and Dynamics. *NASA MODIS Science Team Meeting, June 6–10, Silver Springs, MD.* (presentation)

Gray, J.M., D. Sulla-Menashe, and M. Friedl. (2016). A Kalman Filter approach to multisensor data fusion. *NASA Multisource Land Imaging Science Team Meeting, April 18–19, North Bethesda, MD.* (presentation)

Gray, J.M. and M. Friedl. (2016). A Kalman Filter approach to multisensor data fusion. *Annual Meeting of the U.S. Regional Association of the International Association for Landscape Ecology, April 3–7, Asheville, NC.* (presentation)

Gray, J.M. and M.A. Friedl. (2015). Incorporating phenology into yield models. *Fall Meeting of the American Geophysical Union, Dec 14–18, San Francisco, CA.* (poster)

Gray, J.M., M.A, Friedl, S. Frolking, N. Ramankutty, E. Kort, D. Ray, and C. Kucharik. (2014). Direct human influence on atmospheric CO2 seasonality from increased cropland productivity. *Fall Meeting of the American Geophysical Union, Dec 15–19, San Francisco, CA.* (poster)

Gray, J.M., M.A. Friedl, and S. Frolking (2013). Large scale maps of cropping intensity from MODIS and QuickSCAT. *Fall Meeting of the American Geophysical Union, Dec 11–13, San Francisco, CA.* (poster)

Gray, J.M., M.A. Friedl, and S. Frolking (2013). Large scale maps of cropping intensity from MODIS. *MultiTemp 2013, June 25–27, Banff, Alberta, Canada.* (presentation)

Richardson, A.D., M.A. Friedl, R. Pless, S. Frolking, M.P. Toomey, J.M. Gray, and T.E. Milliman (2012). PhenoCam: A continental scale observatory for monitoring the phenology of terrestrial vegetation. *NSF MacroSystems Biology PI Meeting, June 6–7, Arlington VA.* (poster)

Gray, J.M. and M.A. Friedl (2013). Large scale maps of cropping intensity from MODIS. *NASA Terrestrial Ecology Workshop, April 30–May 2, La Jolla, CA.* (poster)

Gray, J.M., M.A. Friedl, and X. Zhang (2013). Overview of progress on the MEASURES phenology product assessment. *Vegetation Index and Phenology Group Workshop, Jan 23–24, University of Arizona.* (presentation)

Gray, J.M. and C. Song (2012). Understanding regional water resource dynamics due to land-cover/land-use and climate changes in the North Carolina Piedmont. *Fall Meeting of the American Geophysical Union, Dec 3-7, San Francisco, CA.* (poster)

Gray, J.M. and C. Song (2011). Mapping LAI using spatial, spectral, and temporal information from multiple sensors. *Fall Meeting of the American Geophysical Union, Dec 5–9, San Francisco, CA.* (presentation)

Gray, J.M. and C. Song (2011). Mapping LAI time series using multi-sensor, multi-scale, multi-temporal imagery. *Association of American Geographers Annual Meeting, April 12–16, Seattle, WA.* (poster)

Gray, J.M. and C. Song (2011). Temporally-dense, high-resolution LAI estimation using multi-sensor fusion. *NASA LCLUC Science Team Meeting, Mar 28–30, Adelphi, MD.* (poster)

Gray, J.M. and C. Song (2010). MODIS and Landsat fusion for high temporal and spatial resolution LAI Mapping. *Association of American Geographers Annual Meeting, April 14–18, Washington D.C.* (presentation)

Gray, J.M. and C. Song (2009). Mapping LAI using image texture and spectral vegetation indices. *Association of American Geographers Annual Meeting, Mar 22-27, Las Vegas, NV.* (poster)

Gray, J.M. and C. Song (2008). Retrieving LAI from remotely sensed images: spectral indices vs. spatial texture. *Fall Meeting of the American Geophysical Union, Dec 15–19, San Francisco, CA.* (presentation)

Gray, J.M., S. Zhang, and C. Song (2008). Scaling-up eddy covariance measurements with remote sensing to estimate regional scale transpiration. *Association of American Geographers Annual Meeting, Apr 15-19, Boston, MA.* (poster)

Professional Service

Invited talk
Harvard University Plants and Climate Change Seminar Series, Feb 2014
NCSU Coffee&Viz Tropical Forest Conservation: The View from 700 km. Apr 2018

Working group co-lead
CEOS LPV, Phenology Working Group North America lead, 2019–present

Session co-convener
AGU 2014 Fall Meeting, Near-surface Remote Sensing of Vegetation Structure, Function, and Stress
AGU 2013 Fall Meeting, Low- and No-altitude Remote Sensing

NSF Award Review Panelist 2014 & 2015

NASA Panelist 2016 & 2017

President, Graduate Association of Geography Students
UNC Dept. of Geography, 2010–2011

Invited Reviewer
Remote Sensing of Environment, Agricultural and Forest Meteorology, Geophysical Research Letters, Global Ecology and Biogeography, IEEE Transactions on Geoscience and Remote Sensing, Nature Scientific Data, Journal of Geophysical Research, Remote Sensing

Member
American Geophysical Union, Association of American Geographers