Feng Zhao

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Department of Geographical Sciences
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Employment

2013-present	Research Assistant Professor Department of Geographical Sciences University of Maryland, College Park
2012-2013	North American Forest Dynamics (NAFD) Project Manager Department of Geographical Sciences University of Maryland, College Park
2011-2012	Postdoctoral Research Associate Department of Environmental Science, Policy, and Management University of California, Berkeley

EDUCATION

2010	Ph. D., Remote Sensing & GIS Department of Geography Boston University
2006	M.A., Remote Sensing & GIS Department of Geography University of South Carolina
2003	M. S., Forest Management Chinese Academy of Forestry
2000	B.A., Forestr Protection Beijing Forestry University

RESEARCH EXPERIENCE

- Forest disturbance mapping using time-series analysis of Landsat imagery across the conterminous U.S.
- Forst post-disturbance regrowth modeling across the conterminous U.S.
- Forest biomass mapping using time series of Landsat data
- Assessment of how the forest vegetation treatments to prevent wildfire affect fire risk, forest health, and hydrology
- Wetland mapping of Leaf Area Index (LAI)
- Retrieval of vegetation structure and carbon balance parameters using a ground-based Lidar and upscaling foliage profiles to airborne Lidar sensors

PUBLICATIONS

In Review & Prep.

Zhao, F., Huang, C., Schleeweis, K., Goward, S.N., Masek, J.G., Cohen, and W., Gretchen, G. Age structure of North American forest from time series of Landsat data. In Prep.

Goward, S.N., **Zhao, F.**, Huang, C., Schleeweis, K., and Masek, J.G. United States forest disturbance trends ovserved using Landsat time series from 1985 to present. In prep.

Zhao, F., Masek J.G., Huang, C., Goward, S.N. , and Schleeweis, K. Development of Landsat-based annual US forest disturbance history maps (1986-2010) in support of the North American Carbon Program. *Remote Sensing of Environment.* In review.

Tang, H., Song, X.P., **Zhao, F.,** Strahler, A.H., Schaaf, L.C., Goetz, S., Huang, C.Q., Hansen, M., and Dubayah R., A comparative analysis tree cover measurements from field, lidar and Landsat observations in the Sierra National Forests, USA. *Remote Sensing of Environment*. In Review

Huang, CQ., Goward, S.N., **Zhao, F.**, Schleeweis, K., Dungan, J., Masek, J., and Nemani, R. Longevity of Undisturbed forests in the United States and the aichi conservation target. *Conservation Letters.* In review

Yao, T., Yang, X., **Zhao, F**., Wang, Z., Zhang, Q., Jupp, D.L.B., Culvenor, D.S., Newnham, G.J., Ni-Meister, W., Schaaf, C.B., Woodcock, C.E., and Strahler, A.H. Monitoring forest change and ice storm disturbance to forest structure using Echidna® Ground-Based Lidar. *Remote sensing of Environment*. In review

Ni-Meister, W., Yang, W., Lee, S., Strahler, A.Hl., **Zhao, F.**, Evaluation of an analytic clumped two-stream (ACTS) of canopy radiative transfer LiDAR waveform model for forest canopies. *Remote Sensing of Environment*. In review

Ni-Meister, W., Yang, W., Lee, S., Strahler, A.Hl., **Zhao, F**., Simulating LiDAR waveforms for clumped forest canopies. *Remote Sensing of Environment*. In review

Published

Gu, H., Williams, A.C., Ghimire, B., **Zhao, F.**, Huang, C. (2016) High-resolution mapping of time since disturbance and forest carbon flux from remote sensing and inventory data to assess harvest, fire, and beetle disturbance legacies in the Pacific Northwest. *Biogeosciences,* 13, 6321-6337.

Gu, H., Williams, A.C., Ghimire, B., **Zhao, F.**, Huang, C. (2016) Improved forest carbon flux mapping and monitoring in the Pacific Northwest with time since disturbance and disturbance legacies inferred from remote sensing and inventory data. *Biogeosciences Discuss.,* doi:10.5194/bg-20160163

Zhao, R.F., Meng, R., Huang, C.Q.., Zhao, M., **Zhao, F.,** Gong, P., Yu, L., and Zhu, Z.. (2016) Long-term post disturbance forest recovery in the Greater Yellowstone ecosystem analyzed using Landsat time series stack. *Remote Sensing.*, 8(8), 687.

Neigh, C., Masek, J., Bourget, P., Rishmawi, K., **Zhao, F**., Huang, C., Cook, B., Nelson, R. (2016) Regional rates of US forest regeneration measured from annual Landsat disturbance history and IKONOS stereo imagery. *Remote Sensing of Remote Sensing of Environment*. 173, 282-293

Goward, S.N., Huang, C., **Zhao, F.**, Schleeweis, K., Rishmawi, K., Lindsey, M., Dungan, J.L. and Michaelis, A. (2015). NACP NAFD Project: Forest Disturbance History from Landsat, 1986-2010. ORNL DAAC, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/1290

Tang, H., Brolly, M., **Zhao, F.**, Strahler, A. H., Schaaf, C. L., Ganguly, S., and Dubayah, R. (2014). Deriving and validating Leaf Area Index (LAI) at multiple spatial scales through lidar remote sensing: A case study in Sierra National Forest, CA. *Remote Sensing of Environment*, *143*, 131–141.

Neigh, C., Masek, J., Bourget, P., Cook, B., Huang, C., Rishmawi, K., and **Zhao, F.** (2014). Deciphering the Precision of Stereo IKONOS Canopy Height Models for US Forests with G-LiHT Airborne LiDAR. *Remote Sensing*, *6*, 1762–1782.

Zhao, F., Yang, X., Strahler, A. H., Schaaf, C. L., Yao, T., Wang, Z., and Dubayah, R. O. (2013). A comparison of foliage profiles in the Sierra National Forest obtained with a full-waveform under-canopy EVI lidar system with the foliage profiles obtained with an airborne full-waveform LVIS lidar system. *Remote Sensing of Environment*, *136*, 330–341.

Yang, X., Schaaf, C., Strahler, A., Li, Z., Wang, Z, Yao, T., **Zhao, F.,** Saenz, E., Paynter, I., Douglas, E., Chakrabarti, S., Cook, T., Martel, J., Howe, G., Woodcock, C., Jupp, D., Culvenor, D., Newnham, G., and Lovell, J. (2013). Studying canopy structure through 3-D reconstruction of point clouds from full-waveform terrestrial lidar, *Proceedings International Geoscience and Remote Sensing Symposium* 2013, Melbourne, Australia, July 21 – 26, 2013, pp. 3375–3378. DOI: 10.1109/IGARSS.2013.6723552

Li, Z., Douglas, E., Strahler, A., Schaaf, C., Yang, X., Wang, Z., Yao, T., **Zhao, F**., Saenz, E., Paynter, I., Woodcock, C., Chakrabarti, S., Cook, T., Martel, J., Jupp, D., Culenor, D., Newnham, and G., Lovell, J. (2013 Separating leaves from trunks and branches with dual-wavelength terrestrial lidar scanning, *Proceedings International Geoscience and Remote Sensing Symposium* 2013, Melbourne, Australia, July 21 – 26, 2013, pp. 3383¬3386. doi: 10.1109/IGARSS.2013.6723554

Yang, X., Strahler, A. H., Schaaf, C. B., Jupp, D. L. B., Yao, T., **Zhao, F.,** and Ni-Meister, W. (2013). Three-dimensional forest reconstruction and structural parameter retrievals using a terrestrial full-waveform lidar instrument (Echidna). *Remote Sensing of Environment*, *135*, 36–51.

Zhao, F., Guo, Q., and Kelly, M. (2012). Allometric equation choice impacts lidar-based forest biomass estimates: A case study from the Sierra National Forest, CA. *Agricultural and Forest Meteorology*, *165*, 64–72.

Zhao, F., Strahler, A. H., Schaaf, C. L., Yao, T., Yang, X., Wang, Z., and Newnham, G. J. (2012). Measuring gap fraction, element clumping index and LAI in Sierra Forest stands using a full-waveform ground-based lidar. *Remote Sensing of Environment*, *125*, 73–79.

Zhao, F., Sweitzer, R. A., Guo, Q., and Kelly, M. (2012). Characterizing habitats associated with fisher den structures in the Southern Sierra Nevada, California using discrete return lidar. *Forest Ecology and Management*, *280*, 112–119.

Strahler, A.H., Schaaf, C., Woodcock, C., Jupp, D., Culvenor, D., Newnham, G., Dubayah, R., Yao, T., **F. Zhao**, and Yang, X.. (2011). ECHIDNA Lidar Campaigns: Forest Canopy Imagery and Field Data, U.S.A., 2007-2009. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. http://dx.doi.org/10.3334/ORNLDAAC/1045

Yao, T., Yang, X., **Zhao, F.**, Wang, Z., Zhang, Q., Jupp, D., and Strahler, A. (2011). Measuring forest structure and biomass in New England forest stands using Echidna ground-based lidar. *Remote Sensing of Environment*, *115*, 2965–2974.

Zhao, F., Yang, X., Schull, M. A., Roman-Coln, M. O., Yao, T., Wang, Z., and Strahler, A. H. (2011). Measuring effective leaf area index, foliage profile, and stand height in New England forest stands using a full-waveform ground-based lidar. *Remote Sensing of Environment*, *115*, 2954–2964.

Chopping, M., Schaaf, C. B., **Zhao, F.**, Wang, Z., Nolin, A. W., Moisen, G. G., and Bull, M. (2011). Forest structure and aboveground biomass in the southwestern United States from MODIS and MISR. *Remote Sensing of Environment*, *115*, 2943–2953.

Olofsson, P., Torchinava, P., Woodcock, C. E., Baccini, A., Houghton, R., Ozdogan, M., **Zhao, F.**, and Yang, X. (2010). Implications of land use change on the national terrestrial carbon budget of Georgia. *Carbon Balance and Management*, *5*, 4.

Anderson, M. G., Ferree, C. E., Olivero, A. P., and **Zhao, F.** (2010). Assessing floodplain forests: using flow modeling and remote sensing to determine the best places for conservation. *Natural Areas Journal*, 30(1), 39–52.

Ni-Meister, W., Strahler, A. H., Woodcock, C. E., Schaaf, C. B., Jupp, D. L. B., Yao, T., **Zhao, F.**, and Yang, X. (2008). Modeling the hemispherical scanning, below-canopy lidar and vegetation structure characteristics with a geometric-optical and radiative-transfer model. *Canadian Journal of Remote Sensing*. 34, S385–S397.

Strahler, A. H., Jupp, D. L. B., Woodcock, C. E., Schaaf, C. B., Yao, T., **Zhao, F.**, and Boykin-Morris, W. (2008). Retrieval of forest structural parameters using a ground-based lidar instrument (Echidna ®). *Canadian Journal of Remote Sensing*, *34*, S426–S440.

CONFERENCE ABSTRACTS AND POSTERS

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek. Application of remote sensing big data in resource and environment management. Fudan Talent Forum. Shanghai, China, Dec 28-30, 2016.

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek, Biomass and Forest disturbance history mapping from 1986 to 2010. *International Workshop on Quantitative Remote Sensing for Heterogeneous Land Surface*, Beijing, China, July 9-10, 2016.

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek, Forest disturbance history mapping from 1986 to 2010. *2016 LCLUC Science Team Meeting,* North Bethesda, Maryland, Apr 18-19, 2016.

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek, Forest disturbance history mapping from 1986 to 2010. *NUS Regional Association of the International Association for Landscape Ecology*, Asheville, North Carolina, Apr 3-7, 2016.

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek, Forest disturbance history mapping from 1986 to 2010. *The 2015 International Workshop on Image and Data Fusion, Kona, Hawaii*, July 21-23, 2015.

Zhao, F, Huang, C., Goward, S., Schleeweis, K., Rishmawi, K., Masek, Forest disturbance history mapping from 1986 to 2010. *NASA Carbon Cycle and Ecosystems Joint Science Workshop*, College Park, Maryland, Apr 20, 2015.

Neigh, C., Masek, J., Bourget, P., Rishmawi, K., **Zhao, F.,** Huang, C., Nelson, R. Regional rates of US forest regeneration measured from annual Landsat disturbance history and IKONOS stereo imagery. *American Geophysical Union (AGU),* Sanfrancisco, CA, Dec., 15-19, 2014.

Huang, C., Goward, S., **Zhao, F.,** Schleeweis, K., Rishmawi, K., Masek, J., Cohen, W., Yang, Z., Dungan, J., Moisen, G., Nemani, R. A quarter century U.S. forest disturbance history mapped from Landsat. *American Geophysical Union (AGU),* Sanfrancisco, CA, Dec., 15-19, 2014.

Schleeweis, K., Huang, C., Goward, S., **Zhao, F.,** Rishmawi, K., Dungan, J., Michaelis, A., Nemani, R., Masek, J., Toney, C., Moisen, G., Schroeder, T. Using NASA Earth Exchange (NEX) to develop annual US forest disturbance products. *American Geophysical Union (AGU),* Sanfrancisco, CA, Dec., 15-19, 2014.

Zhao, F., Huang, C, Goward, S., Masek, J, Rishmawi, K., US Forest disturbance mapping observed from Landsat between 1986 and 2010. *Land Cover and Land Use (LCLUC) 2014*, Rockville, Maryland, Apr 23, 2014.

Zhao, F., Strahler, A., Schaaf, C., Yang, X., Wang, Z., Woodcock, C., Culvenor, D., Jupp, D., Newnham, and G., Lovell, J. A comparison of foliage profiles in Sierra National Forest obtained from full-waveform under-canopy EVI lidar system with the foliage profiles obtained with an airborne full-waveform LVIS lidar system. *SilviLaser2013*, Beijing, China, October 9, 2013.

Tang, H**.**, Dubayah, R., **Zhao, F.,** Deriving Leaf Area Index (LAI) from multiple lidar remote sensing systems. *American Geophysical Union (AGU),* Sanfrancisco, CA, Dec., 3-7, 2012.

Strahler, A.H., Yao, T., **Zhao, F.,** Yang, X., Schaaf, C., Wang, Z., Li, Z., Woodcock, C., Culvenor, D., Jupp, D., Newnham, G., Lovell, J. Further studies of forest structure parameter retrievals using the Echidna ground-based LiDDAR. *American Geophysical Union (AGU),* Sanfrancisco, CA, Dec., 3-7, 2012.

Zhao, F., Sweitzer, R.A., Guo, Q., and Kelly, M. Improving the characterization of forest habitat for Mammals with lidar remote sensing-a case study on denning sites of fishers in the Sierra National Forest, CA. *American Society for Photogrammetry and Remote Sensing (ASPRS)*, Sacramento, CA, March 19, 2012.

Tian, Y., **Zhao, F.**, Strahler, A., Schaaf, C., Yang, X., Wang, Z., Woodcock, C., Culvenor, D., Jupp, D., Newnham, G., and Lovell, J. Further studies of Echidna scanning in California conifer stands and New England hardwood and softwood stands. *SilviLaser2012*, Vancouver, BC, Canada, September 16, 2012.

Strahler, A., Yao, T., **Zhao, F.**, Wang, Z., Schaaf, C., Woodcock, C., Jupp, D., Culvenor, D., Newnham, G., and Lovell, J., Using a full-waveform, ground-based, scanning lidar (Echidna®) to retrieve forest vegetation structural parameters in American hardwood and conifer studies. *International Symposium on Remote Sensing of Environment (ISRSE)*, Sydney, Austrilia, April 10, 2011.

Strahler, A.H., Yao, T., **Zhao, F.**, Yang, X., Schaaf, C., Woodcock, C.E., Jupp, D.L., Culvenor, D., Newham, G., Lovell, J., and Ni-Meister, W., vegetation structure and 3-D reconstruction of forest canopies using ground-based Echidna® Lidar. *Terrestrial Ecology Science Team Meeting*, La Jolla, CA, March 15–17, 2010.

Strahler, A.H., Yao, T., **Zhao, F.**, Yang, X., Schaaf, C., Woodcock, C.E., Jupp, D.L., Culvenor, D., Newham, G., and Lovell, J. Retrieval of vegetation structural parameters and 3D reconstruction of forest canopies using ground-based Echidna®. *American Geophysical Union (AGU),* San Francisco, CA, December 13–17, 2010.

Chopping, M.J., Schaaf, C.E., **Zhao, F.**, and Wang, Z., Mapping forest crown cover, mean canopy height, and aboveground biomass using a Geometric-Optical Model and MODIS Data. *2nd NACP All-Investigators Meeting*, San Diego, CA, February 17–20, 2009.

Zhao, F., Roman, M.O, Strahler, A.H., Woodcock, C.E., Schaaf, C.B., Liu, J., Newnham, G.J, Jupp, D.L.B, Culvenor, D.S, Lovell, J.L, Ni-Meister, W., Lee, S., Li, X., Zhang, Q., Wang, Z., and Shuai,Y. Retrieval of the Leaf Area Index (LAI) and foliage profile of New England forest stands using a ground-Based Lidar instrument (Echidna®). *NASA Carbon Cycle & Ecosystems Joint Science Workshop*, Adelphi, MD, April 28, 2008.

Zhao, F., Roman, M.O, Schull, M.A, Strahler, A.H., Woodcock, C.E. Newnham, G.J. Jupp, D.L.B., Culvenor, D.S., Lovell, J.L., Ni-Meister, W, Lee, S., Li, X., Zhang, Q., Wang, Z., and Shuai, Y. Leaf Area Index (LAI) and vertical foliage profile retrieval using ECHIDNA (EVI). *Association of American Geographers (AAG)*, Boston, MA, April 18, 2008.

Zhao, F., and Jensen, J.R. Synergistic use of LIDAR and color aerial photography for mapping shadow in forests. *American Society for Photogrammetry and Remote Sensing (ASPRS)*, Reno, NV, May 1 - 5, 2006.

GRANT PROPOSALS

Proposal Selected

Forest carbon assessment using time series satellite observations and field inventory data, Dr. Chengquan Huang (PI), Dr. **Feng Zhao** (Co-I) and Dr. Khaldoun Rishimawi (Co-I), NASA (2014), $287, 823

Carbon consequences of land management: a multi-region assessment. Dr. Chengquan Huang (PI), Dr. **Feng Zhao** (Co-I) and Dr. Maosheng Zhao (Co-I), USGS. (2014), $487,044

Characterization of Forest post-disturbance recovery , Samuel Goward (Co-PI), **Feng Zhao** (Co-PI). Augmentation to grant NNX12AF81G. (2012), $119,715

Collaborator in Proposal

Role of forest disturbance and regrowth in US carbon budget. Dr. Chengquan Huang (PI), Dr. Dr. Samuel N. Goward (Science PI), Dr. Jeffrey G. Masek, Dr. Richard A. Houghton & Dr. Karen Schleeweis (Institutional PI), Dr. Andrew J. Lister & **Feng Zhao** (Collaborator). NASA Carbon Cycle Science program. (2014), $1,138,854

Asessment of North American forests: disturbances, biomass extraction and growth vigor. Dr. Chengquan Huang (PI), Dr. Peter Potapov (Co-PI), Dr. Matt Hansen (Co-PI) and Dr. Samuel Goward (Co-PI) & **Feng Zhao** (Collaborator). NASA LCLUC program. (2013), $ 823,135.57

Travel Awards

Characterizing habitats associated with fisher den structures in the southern Sierra Nevada, California using discrete return Lidar. New Hope for Conservation. (2013), $2,000

TEACHING EXPERIENCE

Summer 2015	Introduction to Remote Sensing, University of Maryland
Spring 2015	Geography of China, University of Maryland
Fall 2013	Introduction to Remote Sensing, University of Maryland
Fall 2012	Advanced Remote Sensing, University of Maryland
Fall 2009	Remote Sensing of Environment, Boston University
Fall 2007	Digital Image Processing, Boston University
Spring 2007	Introductory GIS, Boston University
Fall 2006	Advanced GIS, Boston University
Fall 2003	Micrometeorology, University of South Carolina

PROFESSIONAL MEMBERSHIPS

Member, American Geophysical Union (AGU)
Member, American Society for Photogrammetry and Remote Sensing (ASPRS)
Member, Association of American Geographers (AAG)

PROFESSIONAL SERVICE: JOURNAL REVIEWER

IEEE Transactions on Geoscience and Remote Sensing
Agriculture and Forest Meterology
Geocarto International
Remote Sensing of Environment
International Journal of Remote Sensing
Remote Sensing

RELEVANT SKILLS

1. **Experimental facility**
   - Digital hemispherical photography
   - Tracing Radiation and Architecture of canopies (TRAC) to retrieve LAI and clumping
   - Soil core sampler
   - ASD Spectrometer and Exotech radiometer
2. **Programming & software**
   - Linux C, Matlab, IDL/GDL, Python
   - R, Minitab
   - Oracle Database
   - ArcGIS, ENVI/IDL, ERDAS Imagine and eCognition