

## BRIAN D. WARDLOW

Center for Advanced Land Management Information Technologies (CALMIT)  
School of Natural Resources  
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### EDUCATION

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**Ph.D. Geography (Honors)**, University of Kansas, Lawrence, Kansas, December 2005.

Dissertation title: *The Development of a Crop-Related Land Use/Land Cover Mapping Protocol in the U.S. Central Great Plains Using Time-Series MODIS 250-Meter Vegetation Index Data.*

Advisor: Dr. Stephen L. Egbert

**M.A. Geography**, Kansas State University, Manhattan, Kansas, May 1996.

Thesis title: *Temporal Monitoring of Suspended Sediment Patterns Using Landsat Thematic Mapper Imagery – A Study of Tuttle Creek Reservoir, Kansas.*

Advisor: Dr. John A. Harrington, Jr.

**B.S. Geography (Geology minor) (Magna Cum Laude)**, Northwest Missouri State University, Maryville, Missouri, May 1994.

Advisor: Dr. Don Hagan

### RESEARCH INTERESTS

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Remote Sensing	Land Use/Land Cover Characterization	Drought Monitoring
Geographic Information Systems (GIS)	Land Surface Phenology	Biogeography
Climate-Vegetation Interactions	Land Use/Land Cover Change	Plant Ecology
Natural Resource Management	Environmental Geography	Geovisualization

### PRESENT POSITION

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**Director and Associate Professor**, 8/2012 – Present, Center for Advanced Land Management Information Technologies (CALMIT), School of Natural Resources (SNR), University of Nebraska-Lincoln, Lincoln, NE.

Current appointment: 45% research, 30% administration, 25% teaching and 2% university service. Conduct research on the use of remote sensing and GIS for drought monitoring, the characterization of land use/land cover and vegetation dynamics (phenology and biophysical characteristics), and agricultural and natural resource applications. Provide leadership, coordinate projects, supervise staff, and administer all Center activities for CALMIT. Advise and mentor graduate students in Geography and SNR interested in the use of remote sensing and GIS for environmental monitoring and agricultural and natural resource applications. Teach upper-level undergraduate and graduate-level remote sensing courses including Introduction to Remote Sensing, Digital Image Analysis, Applications of Remote Sensing in Agriculture and Natural Resources, and special topics (e.g., drought monitoring tools). Conduct training and outreach activities to promote the use and transfer of satellite-based monitoring tools within the global drought monitoring community.

## **WORK EXPERIENCE**

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*Assistant Professor*, 3/30/2012 – 07/31/2012, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE.

*Research Assistant Professor and GIScience Program Area Leader*, 3/2006 – 3/2012, National Drought Mitigation Center, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE.

*NASA Earth System Science Graduate Research Fellow*, 9/2002 - 3/2006, Kansas Applied Remote Sensing Program, University of Kansas, Lawrence, KS

*Graduate Research Assistant*, 9/1999 - 8/2002, Kansas Applied Remote Sensing Program, University of Kansas, Lawrence, KS

*Remote Sensing Scientist*, 10/1996 - 8/1999, USGS Earth Resources Observation Science (EROS) Center, Sioux Falls, SD

*Graduate Research Assistant*, 5/1996 - 9/1996, Kansas Geological Survey, University of Kansas, Lawrence, KS

*Graduate Research Assistant*, 5/1995 - 9/1995, Department of Geography, Kansas State University, Manhattan, KS

*Community and Regional Planning Intern*, 5/1993 - 9/1994, Southeast Nebraska Development District (SEND), Humboldt, NE

## **TEACHING EXPERIENCE**

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### **Courses Taught**

- Introduction to Remote Sensing
- Practical Applications of Remote Sensing in Agriculture and Natural Resources
- Survey of Drought Monitoring Techniques Special Topics
- Special Topics: Selected Topics in Remote Sensing
- Introduction to Global Positioning Systems (GPS)

### **Previous Teaching Experience**

*Guest Lecturer*, Spring 2006, GEOG 980 Remote Sensing Graduate Seminar, Department of Geography, University of Kansas, Lawrence, KS.

Lecture topics include time-series analysis of remotely sensed data for land cover characterization and classification and regression tree analysis techniques.

*Guest Lecturer*, Fall 2004, GEOG 526 Remote Sensing I, Department of Geography, University of Kansas, Lawrence, KS.

Lecture topics included the theory and history of vegetation indices (VIs), temporal compositing techniques of time-series VI data, the AVHRR and MODIS sensors, and applications of time-series VI data (land cover classification, vegetation monitoring, and biophysical modeling).

*Graduate Teaching Assistant*, Fall and Spring 1994-1996, Remote Sensing of the Environment Lab (GEOG 705) Department of Geography, Kansas State University, Manhattan, KS

Course content included air photo interpretation, photogrammetry, digital image processing methods, and selected remote sensing applications (e.g., land cover classification). Duties included the instruction of 30-40 undergraduate and graduate students per semester, development of lab exams and exercises, and guest lecturing in the lecture portion of the course.

## **HONORS AND AWARDS**

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- 2007 John I. Davidson President's Award for Best Practical Paper presented by the American Society of Photogrammetry and Remote Sensing
- 2007 Leica Geosystems Award for Best Scientific Paper in Remote Sensing presented by the American Society of Photogrammetry and Remote Sensing

- 2003 GIS/Remote Sensing Specialty Group Illustrated Paper Award (1<sup>st</sup> place), Association of American Geographers 99<sup>th</sup> Annual Meeting, New Orleans, LA.
- 2000 USGS EROS Data Center Group Achievement Award for the National Land Cover Data Set Mapping Team
- 1996 Distinguished Graduate Assistantship Award, Department of Geography, Kansas State University.
- 1994 Mark Jefferson Outstanding Geography Student Award, Department of Geography, Northwest Missouri State University.
- 1994 Scholar Athlete Award, Northwest Missouri State University
- 1992-1994 Academic All-Conference Team, Mid-America Intercollegiate Athletic Association (MIAA)
- 1990-1994 Regents' Scholarship, Northwest Missouri State University
- 1990-1994 Athletic Department Scholarship, Northwest Missouri State University

## **PUBLICATIONS**

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### **Refereed Journal Articles (Published or In Press)**

- Nam, W.-H., T. Tadesse, **B.D. Wardlow**, M.J. Hayes, M.D. Svoboda, and M.-W. Jung. 2018. Developing the Vegetation Drought Response Index for South Korea (VegDRI-SKorea) to assess the vegetation condition during drought events. *International Journal of Remote Sensing* 39:5: 1548-1574.
- Zambrano, F., **B. Wardlow**, T. Tadesse, M. Lillo-Saavedra, and O. Lagos. 2017. Evaluating satellite-derived long-term historical precipitation datasets for drought monitoring in Chile. *Atmospheric Research* 186:26-42 doi 10.1175/JAMC-D-16-0292.1.
- Tadesse, T., **B.D. Wardlow**, G.B. Demisse, Y.A. Bayissa, C. Champagne, T.A. Hadwen, and J.F. Brown. 2017. Building the Vegetation Drought Response Index for Canada (VegDRI-Canada) to monitor agricultural drought. *GIScience and Remote Sensing* 54(2):230-257.
- Aegerter, C., J. Wang, C. Ge, S. Irmak, R. Oglesby, **B. Wardlow**, H. Yang, J. You, and M. Shulski. 2017. Mesoscale modeling of the meteorological impacts of irrigation during the 2012 Central Plains drought. *Journal of Applied Meteorology and Climatology* 56(5):1259-1283.
- Demisse, G., T. Tadesse, A. Atnafu, S. Hill, **B.D. Wardlow**, Y. Bayissa, and A. Shiferaw. 2017. Information mining from heterogeneous data sources: a case study on drought predictions. *Information* 8(79) doi:10.3390/info8030079.
- Zeng, L., **B. Wardlow**, R. Wang, J. Shan, T. Tadesse, M.J. Hayes, and D. Li. 2016. A hybrid approach for detecting corn and soybean phenology with time-series MODIS data. *Remote Sensing of Environment* 181:237-250.
- Ambika, A.K., **B. Wardlow**, and V. Mishra. 2016. Remotely sensed high resolution (250 m) irrigated area mapping in India (2000-2015). *Scientific Data* 3:160118, DOI:10.1038/sdata.2016.118.
- Otkin, J.A., M.C. Anderson, C. Hain, M. Svoboda, D. Johnson, R. Mueller, T. Tadesse, **B. Wardlow**, and J. Brown. 2016. Assessing the evolution of soil moisture and vegetation conditions during the 2012 United States flash drought. *Agricultural and Forest Meteorology* 218-219:230-242.
- Wang, J. A.L. Kessner, C. Aegerter, A. Sharma, L. Judd, **B. Wardlow**, J. You, M. Shulski, S. Irmak, A. Kilic, and J. Zeng. 2016. A multi-sensor view of the 2012 Central Plains drought from space. *Frontiers in Environmental Science* 4:45. doi: 10.3389/fenvs.2016.00045.
- Otkin, J., M. Shafer, M. Svoboda, **B. Wardlow**, M.C. Anderson, C. Hain, and J. Basara. 2015. Facilitating the use of drought early warning information through interactions with stakeholders. *Bulletin of the American Meteorology Society (BAMS)* 96(7):1073-1078.
- AghaKouchak, A., A. Farahmand, F.S. Melton, M.C. Anderson, J. Teixeira, **B.D. Wardlow**, and C.R. Hain. 2015. Remote sensing of drought: progress, challenges, and opportunities. *Reviews of Geophysics* 53:452-480.

- Zeng, L., **B.D. Wardlow**, T. Tadesse, J. Shan, M.J. Hayes, and D. Li. 2015. Estimating daily maximum and minimum air temperature using both daytime and nighttime MODIS land surface temperature products over the Corn Belt in US. *GIScience and Remote Sensing* 7(1):951-970.
- Tadesse, T., **B.D. Wardlow**, J.D. Brown, and K. Callahan. 2015. Assessing the vegetation condition impacts of the 2011 drought across the U.S. Southern Great Plains using the Vegetation Drought Response Index (VegDRI). *Journal of Applied Meteorology and Climatology* 54(1):153-169.
- Nam, W.-H., T. Tadesse, **B. Wardlow**, M.-W. Jang, and S.-Y. Hong. 2015. Satellite-based hybrid drought assessment using Vegetation Drought Response Index in South Korea (VegDRI-SKorea). *Journal of the Korean Society of Agricultural Engineers* 57(4):1-9.
- Wardlow, B.D.** and K. Callahan. 2014. Landscape and field level accuracy assessment of the MODIS irrigated agriculture data set over Nebraska. *GIScience and Remote Sensing* 51(5):575-592.
- Trnka, M., R. Brazdil, M. Mozny, P. Stepanek, P. Dobrovolny, P. Zahradnick, J. Balek, D. Semaradova, M. Dubrovsky, P. Hlavinka, J. Eitzinger, **B. Wardlow**, M. Svoboda, M. Hayes. 2014. Soil moisture trends in the Czech Republic between 1961 and 2012. *International Journal of Climatology* in press.
- Harms, S., T. Tadesse, and **B. Wardlow**. 2014. Improving drought risk modeling: using multiple periods of satellite data with ensembles of data mining algorithms. *International Journal of Society, Systems, and Science* 6(2):143-158.
- Hunt, E.D., M. Svoboda, **B. Wardlow**, K. Hubbard, M. Hayes, and T. Arkerbauer. 2014. Monitoring the effects of rapid onset of drought on non-irrigated maize with agronomic data and climate-based drought indices. *Agricultural and Forest Meteorology* 191:1-11.
- Swain, S., **B.D. Wardlow**, S. Narumalani, D. Rundquist, and M. Hayes. 2013. Relationships between vegetation indices and root zone soil moisture under maize and soybean canopies in the U.S. Corn Belt: a comparative study using close-range sensing approach. *International Journal of Remote Sensing*, 34(8):2814-2828.
- Trnka, M., C. Kersenbaum, J. Eitzinger, M. Hayes, P. Hlavinka, M. Svoboda, M. Dubrovsky, D. Semaradova, **B. Wardlow**, E. Pokorny, M. Mozny, D. Wilhite, W. Waltman, and Z. Zalud. 2013. Consequences of climate change for the soil climate in central Europe and central U.S. *Global Change Biology*, 120:405-418.
- Anderson, M.C., C. Hain, J. Otkin, X. Zhan, K. Mo, M. Svoboda, **B. Wardlow**, and A. Pimstein. 2013. An intercomparison of drought indicators based on thermal remote sensing and NLDAS-2 simulations. *Journal of Hydrometeorology*, 14:1035-1056.
- Sakamoto, T., A.A. Gitelson, A.L. Nygun-Robertson, T.J. Arkebauer, **B.D. Wardlow**, A.E. Suyker, S.B. Verma, and M. Shibayama. 2012. An alternative method using digital cameras for continuous monitoring of crop status. *Agriculture and Forest Meteorology*, 154-155:113-126.
- Sakamoto, T., A.A. Gitelson, **B.D. Wardlow**, T.J. Arkebauer, S.B. Verma, A.E. Suyker, and M. Sibayama. 2012. Application of day and night digital photographs for estimating maize biophysical characteristics. *Precision Agriculture*, 13:285-301.
- Sakamoto, T., A.A. Gitelson, A.L. Nguy-Robertson, T.J. Arkebauer, **B.D. Wardlow**, A.E. Suyker, S.B. Verma, and M. Shibayama, 2011. Estimating daily gross primary production of maize based only on MODIS WDRVI and shortwave radiation data. *Remote Sensing of Environment*, 115:3091-3101.
- Swain, S., D. Rundquist, T. Arkebauer, S. Narumalani, and **B. Wardlow**. 2011. Non-invasive estimation of relative water content in soybean leaves using infrared thermography. *Israel Journal of Plant Sciences*, 60:25-36.
- Swain, S., **B.D. Wardlow**, S. Narumalani, T. Tadesse, and K. Callahan. 2011. Assessment of vegetation response to drought in Nebraska using Terra-MODIS land surface temperature and normalized difference vegetation index. *GIScience and Remote Sensing* 48(3):432-455.
- Sakamoto, T., **B.D. Wardlow**, and A.A. Gitelson. 2011. Detecting region-based corn phenology in the U.S. Corn Belt using MODIS WDRVI data. *IEEE Transactions on Geoscience and Remote Sensing* 49(6):1926-1936.

- Anderson, M.C., C. Hain, **B. Wardlow**, A. Pimstein, J.R. Mecikalski, and W.P. Kustas. 2011. Evaluation of a drought index based on thermal remote sensing of evapotranspiration over the continental U.S. *Journal of Climate* 24:2025-2044.
- Albright, T.P., A.M. Pidgeon, C.D. Rittenhouse, M.K. Clayton, **B.D. Wardlow**, C.H. Flather, P.D. Culbert, and V.C. Radeloff. 2010. Combined effects of heat waves and droughts on avian communities across the conterminous United States. *Ecospheres* 1(5): DOI:10.1890/ES10-0057.1.
- Sakamoto, T., **B.D. Wardlow**, A.A. Gitelson, S.B. Verma, A.E. Suyker, and T.J. Arkebauer. 2010. The two-step filtering approach for detecting maize and soybean phenology with time-series MODIS data. *Remote Sensing of Environment* 114(10):2146-2159.
- Masialeki, I., S.Egbert, and **B.D. Wardlow**. 2010. A comparative analysis of phenological curves for major crops in Kansas. *GIScience and Remote Sensing* 47(2):241-259.
- Wardlow, B.D.** and S.L. Egbert. 2010. A comparison of MODIS 250-m evi and ndvi data for crop mapping in the U.S. Central Great Plains. *International Journal of Remote Sensing* 31(3):805-830.
- Tadesse, T., **B.Wardlow**, M. Hayes, M. Svoboda, and J. Brown. 2010. The Vegetation Outlook (VegOut): a new method for predicting vegetation seasonal greenness. *GIScience and Remote Sensing* 47(1):25-52.
- Albright, T., A. Pidgeon, C. Rittenhouse, M. Clayton, C. Flather, P. Culbert, **B. Wardlow**, and V. Radeloff. 2010. Effects of drought on avian community structure. *Global Change Biology* doi:10.1111/j.1365-2486.02120x.
- Gu, Y., E. Hunt, **B.D. Wardlow**, J.B. Basara, J.F. Brown, and J.P. Verdin. 2008. Evaluation and validation of MODIS NDVI and NDWI for vegetation drought monitoring using Oklahoma mesonet soil moisture data. *Geophysical Research Letters*, doi:10.1029/2008GL035772.
- Tadesse, T., M. Haile, G. Senay, C. Knutson, and **B.D. Wardlow**. 2008. Building integrated drought monitoring and food security systems in sub-Saharan Africa. *Natural Resources Forum* 32:265-279.
- Brown, J.F., **B.D. Wardlow**, T. Tadesse, M.J. Hayes, and B.C. Reed. 2008. The Vegetation Drought Response Index (VegDRI): a new integrated approach for monitoring drought stress in vegetation. *GIScience and Remote Sensing* 45(1):16-46.
- Wardlow, B.D.** and S.L. Egbert. 2008. Large-area crop mapping using time-series MODIS 250 m NDVI data: an assessment for the U.S. Central Great Plains. *Remote Sensing of Environment* 112:1096-1116.
- Gitelson, A.A., **B.D. Wardlow**, G.P. Keydan, and B. Leavitt. 2007. Green leaf area index estimation in crops using MODIS 250 meter data. *Geophysical Research Letters* 34:L20403, doi:10.1029/2007GL031620.
- Wardlow, B.D.**, S.L. Egbert, and J.H. Kastens. 2007. Analysis of time-series MODIS 250-meter vegetation index data for crop discrimination in the U.S. Central Great Plains. *Remote Sensing of Environment* 108:290-310.
- Gu, Y., J.F. Brown, J.P. Verdin, and **B.D. Wardlow**. 2007. A five-year analysis of MODIS NDVI and NDWI for grassland drought assessment over the Central Great Plains of the United States. *Geophysical Research Letters* 34:L06407, doi:10.1029/2006GL029127.
- Brown, J.C., W. Jepson, J. Kastens, **B. Wardlow**, J. Lomas, and K. Price. 2007. Multi-temporal, moderate spatial resolution remote sensing of modern agricultural production and land modification in the Brazilian Amazon. *GIScience and Remote Sensing* 44(2):L1-32.
- Wardlow, B.D.**, J.H. Kastens, and S.L. Egbert. 2006. Using USDA crop progress data for the evaluation of greenup onset date calculated from MODIS 250-meter data. *Photogrammetric Engineering and Remote Sensing* 72(11):1225-1234.
- Wardlow, B.D.** and S.L. Egbert. 2003. A state-level comparative analysis of the GAP and NLCD land cover data sets. *Photogrammetric Engineering and Remote Sensing* 69(12):1387-1397.

### **Refereed Journal Articles (In Review)**

- Wardlow, B.D.**, M.S. Svoboda, C. Hain, M.A. Anderson, T. Tadesse, J.F. Brown and D. Mocko. 2017. Quick Drought Response Index – A Short-term Dryness Indicator for Drought Monitoring. *GIScience and Remote Sensing*, in review.
- Bijaber, N., D. El Hadani, M. Saidi, M.D. Wardlow, **B.D. Wardlow**, C.R. Hain, C. Poulsen, M. Yesséf, and A. Rochdi. 2017. Developing a remotely sensed drought monitoring indicator for Morocco. *GIScience and Remote Sensing*, in review.
- Mariano, D.A., C.A.C. Santos and **B.D. Wardlow**. 2017. Detecting drought and human-induced land degradation using time series trend analysis in Northeastern Brazil drylands. *Arid Environments*, in review.
- Bayissa, Y.A., T. Tadesse, M. Svoboda, **B. Wardlow**, C. Poulsen, J. Swigart and S.J. van Anandel. Developing and evaluating satellite-based combined drought index to monitor historic drought: a case study for Ethiopia. *International Journal of Remote Sensing*, in review.
- Yang, Y., M.C. Anderson, F. Gao, A. Suyker, **B. Wardlow**, C.R. Hain, J. Otkin, L. Sun and W. Dulaney. 2017. Field-Scale Mapping of Evaporative Stress Indicators of Crop Yield: an Application over Mead, NE. *Remote Sensing of Environment*, in review.
- Masialetti, I., **B. Wardlow** and S. Egbert. 2017. Agricultural ground reference data set creation and refinement. *GIScience and Remote Sensing*, in review.
- Trnka, M., M. Hayes, F. Jurecka, L. Bartosova, M. Anderson, R. Brazdil, J. Brown, J.J. Camarero, P. Cudlin, P. Dobrovolny, J. Eitzinger, S. Feng, T. Finessey, G. Gregoric, P. Havlik, C. Hain, I. Holman, D. Johnson, K. Kersebaum, F. Ljungqvist, J. Luterbacher, F. Micale, C. Hartl-Meier, M. Mozny, P. Nejedlik, J. Olesen, M. Ruiz-Ramos, R. Rotter, G. Senay, S. Vincente-Serrano, M. Svoboda, A. Susnikda, T. Tadesse, A. Vizina, **B. Wardlow**, U. Buntgen, and Z. Zalud. 2017. Priority questions in multidisciplinary drought research. *Environmental Research Letters*, in review.
- Cai, Y., K. Guan, J. Peng, S. Wang, Z. Li, C. Seifert, and **B. Wardlow**. 2017. A high-performance and in-season classification system of field-level crop types using time-series Landsat data and a machine learning approach. *Remote Sensing of Environment*, in review.
- Hunt, E., **B. Wardlow**, K. Hubbard, and T. Arkebauer. 2017. A soil water climatology of a rainfed field in eastern Nebraska. *International Journal or Climatology*, in review.

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### **Refereed Book Chapters (Published)**

- Wardlow, B.D.**, M. Anderson, C. Hain, W. Crow, J. Otkin, T. Tadesse, and A.AghaKouchak. 2017. Advancements in Satellite Remote Sensing for Drought Monitoring. Chapter 10, *Drought and Water Crisis*, 2<sup>nd</sup> Edition. Boca Raton, FL:CRC Press, 223-249.
- Wardlow, B.D.**, M. Anderson, T. Tadesse, C. Hain, W. Crow, and M. Rodell. 2015. Remote sensing of drought: emergence of a satellite-based toolkit for the United States. Chapter 15, *Remote Sensing Handbook” Vol. III: water Resources, Disasters, and Urban: Monitoring, Modeling, and Mapping*, ed. P. Thenakenbail, Boca Raton, FL:CRC Press, 367-399.
- Domingo, C., X. Pons, J. Cristrobal, M. Ninyerola, and **B. Wardlow**. 2015. Integration of climate time series and MODIS data as an analysis tool for forest drought detection. Chapter 13 in *Drought Research and Science-Policy Interfacing*, eds.J. Adreu-Alvarex, A. Solera, J. Paredes-Arquiola, D. Haro-Montegudo, and H. van Lanen, Boca Raton, FL:CRC Press, 97-104.
- Wardlow, B.D.**, T. Tadesse, J.F. Brown, K. Callahan, S. Swain, and E. Hunt. 2012. The Vegetation Drought Response Index (VegDRI): an integration of satellite, climate, and biophysical data. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow, M.A. Anderson, and J. Verdin, Boca Raton, FL:CRC Press, 51-74.
- Wardlow, B.D.**, M.A. Anderson, J. Sheffield, B. Doorn, J.P. Verdin, X. Zhan, M. Rodell. 2012. Future opportunities and challenges in remote sensing of drought. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow. M.A. Anderson, and J.P. Verdin, Boca Raton, FL:CRC Press, 389-409.

- Tadesse, T., **B.D. Wardlow**, M. Hayes, and M. Svoboda. 2012. The Vegetation Outlook (VegOut): a new method for predicting vegetation seasonal greenness. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow, M.A. Anderson, and J.P. Verdin, Boca Raton, FL:CRC Press, 75-94.
- Nghiem, S.V., **B.D. Wardlow**, D. Allured, M.D. Svoboda, D. LeComte, M. Rosencrans, S.K. Chan, and G. Neumann. 2012. Microwave remote sensing of soil moisture – science and applications. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow, M.A. Anderson, and J.P. Verdin, Boca Raton, FL:CRC Press, 197-226.
- Hayes, M., M. Svoboda, **B.D. Wardlow**, M.C. Anderson, and F. Kogan. 2012. Drought monitoring: historical and current perspectives. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow, M.A. Anderson, and J.P. Verdin, Boca Raton, FL:CRC Press, 1-22.
- Anderson, M.C., C. Hain, **B.D. Wardlow**, A. Pimstein, J.R. Mecikalski, and W.P. Kustas, 2012. A drought index based on thermal remote sensing of evapotranspiration. In *Remote Sensing of Drought: Innovative Monitoring Approaches*, eds. B.D. Wardlow, M.A. Anderson, and J.P. Verdin, Boca Raton, FL:CRC Press, 145-168.
- Harms, S., T. Tadesse, and **B. Wardlow**. 2009. Algorithm and feature selection for VegOut: a vegetation condition prediction tool. In *Discovery Science: Lecture Notes in Computer Science*, eds. J. Gama et al., Berlin/Heidelberg, Germany:Springer, 107-120.
- Tadesse, T., **B. Wardlow**, and M. Hayes. 2008. The application of data mining for drought monitoring and prediction. *Data Mining Applications for Empowering Knowledge Societies*, New York, NY: Idea Group Publishers, 280-291.

### **Books Edited**

- Wardlow, B.D.**, M.C. Anderson, and J.P. Verdin. 2012. *Remote Sensing and Drought: Innovative Monitoring Approaches*. Boca Raton, FL:CRC Press.

### **Ph.D. Dissertation**

- Wardlow, B.D.** 2005. *An Evaluation of Time-Series MODIS 250-Meter Vegetation Index Data for Crop Mapping in the U.S. Central Great Plains*. Ph.D. Dissertation, University of Kansas, Lawrence, KS.

### **Master's Thesis**

- Wardlow, B.D.** 1996. *Temporal Monitoring of Suspended Sediment Patterns Using Landsat Thematic Mapper Imagery – A Study of Tuttle Creek Reservoir, Kansas*. Master's thesis, Kansas State University, Manhattan, KS.

### **Other Refereed Publications and Conference Proceedings**

- Zambrano, F., **B. Wardlow** and T. Tadesse. 2016 Evaluating satellite-derived long-term historical precipitation datasets for drought monitoring in Chile. *Proceedings of SPIE 9998, Remote Sensing for Agriculture, Ecosystems and Hydrology XVIII*. 999823, doi: 10.1117/12.2241032
- Lawford, R., D. Toll, B. Doorn, J. Entin, D.M. Mocko, M. Svoboda, M. Rodell, R. Koster, S. Shubert, X.-Z. Liang, X. Cai, **B. Wardlow**, Y. Xia, J. Verdin, and M. Ek. 2014. On the use of NASA Earth observations to characterize the 2012 U.S. Drought. *Global Energy and Water Exchanges (GEWEX) News*, World Climate Research Program 23(2): 13-16.
- Semeradova, D., P. Hlavinka, M. Trnka, L.V. Bohovic, T. Tadesse, **B. Wardlow**, M. Hayes, and Z. Zalud. 2013. Remotely sensed NDVI as an indicator of drought stress on the vegetation. *Environmental Changes and Adaptation Strategies Conference*, Sholica, Slovakia, September 9-11, 3 pp.

- Hlavinka, P., D. Semeradova, M. Trnka, V. Lukas, R. Bohovic, J. Balek, **B. Wardlow**, M. Hayes, T. Tadesse, and Z. Zalud. 2013. Remotely sensed NDVI as a support tool for agricultural drought assessment. *International Global Change and Resilience Conference*, Brno, Czech Republic, May 22-24.
- Sivakumar, M.V.K., R. Stone, P.C. Sentelhas, M. Svoboda, P. Omondi, J. Sarkar, and **B. Wardlow**. 2011. Agricultural drought indices: summary and recommendations. *Proceedings of the WMO/UNISDR Expert Group Meeting on Agricultural Drought Indices*, 2-4 June 2-1-, Murcia, Spain: Geneva, Switzerland: World Meteorological Organization, AGM-11, WMO/TD No. 1572; WOAB-2011, 157-182.
- Hain, C.R., M.C. Anderson, X. Zhan, M. Svoboda, **B. Wardlow**, K. Mo, J.. Meckalski, W.P. Kustas, and J. Brown. 2011. A GOES thermal-based drought early warning index for NIDIS. *Science and Technology Infusion Climate Bulletin, 36<sup>th</sup> NOAA Annual Climate Diagnostics and Prediction Workshop*, Fort Worth, TX, October 3-6.
- Houborg, R., M. Rodell, J. Lawrimore, B. Li, R. Reichle, R. Heim, M. Rosenkrans, R. Tinker, J. Famiglietti, M. Svoboda, **B. Wardlow**, and B. Zaitchik. 2010. Using enhanced GRACE water storage data to improve drought detection by the U.S. and North American drought monitors. *IEEE International Geoscience and Remote Sensing Symposium*, Honolulu, HI, July 25-30.
- Wardlow, B.D.**, M.J. Hayes, M.D. Svoboda, T. Tadesse, and K.H. Smith. 2009. Sharpening the Focus on Drought – New Monitoring and Assessment Tools at the National Drought Mitigation Center. *Earthzine*. Available online at: <http://www.earthzine.org/2009/03/30/sharpening-the-focus-on-drought-%e2%80%93-new-monitoring-and-assessment-tools-at-the-national-drought-mitigation-center/>.
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- Tadesse, T. and **B. Wardlow**. 2007. The Vegetation Outlook (VegOut): a new tool for providing outlooks of general vegetation conditions using data mining techniques. *Seventh IEEE International Conference on Data Mining*, Omaha, NE, October 28-31

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- Tadesse, T., T. Haigh, N. Wall, M.J. Hayes, B. Zaitchik, and **B. Wardlow**. 2015. Lessons learned in monitoring and predicting hydroclimatic extremes in the Greater Horn of Africa. *3<sup>rd</sup> Inter-drought Summer School Proceedings*, Mikulov, Czech Republic, June 8-10.
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- Brown, J.F., **B. Wardlow**, T. Tadesse, D. Howard, K. Callahan, and C. Poulsen. 2014. Satellite data continuity for drought monitoring in VegDRI and QuickDRI models and products. *Pecora 19: Sustaining Land Imaging: UAS to Satellites*, Denver, CO, November 17-20.
- Hlavinka, P., D. Semeradova, M. Trnka, V. Lukas, R. Bohovic, J. Balek, B. Wardlow, M. Hayes, T. Tadesse, and Z. Zalud. 2013. Remotely sensed NDVI as a support tool for agricultural drought assessment. *International Global Change and Resilience Conference*, Brno, Czech Republic, May 22-24.

- Hlavinka, P., M. Trnka, D. Semeradova, P. Dobrovolny, J. Balek, M. Mozny, P. Stepanek, M. Hayes, M. Svoboda, **B. Wardlow**, and Z. Zalud. 2012. Using remotely sensed NDVI for drought impact assessment within selected crops. *BioClimate 2012 – Bioclimatology of Ecosystems*, Labem, Czech Republic, August 29-31.
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- Wardlow, B.D.** 2010. Emerging remote sensing applications for drought monitoring. *Proceedings of the Inter-Regional Workshop on Drought Indices and Early Warning Systems for Drought*, Lincoln, NE, December 8-11, 2009.
- Houborg, R., M. Rodell, B. Li, R. Reichle, R. Heim, J. Lawrimore, M. Rosencrans, R. Tinke, J.S. Famiglietti, M. Svoboda, **B. Wardlow**, and B.F. Zaitchik. 2010. Toward integrating enhanced terrestrial water storage data into the U.S. and North American drought monitors. *American Meteorological Society 90<sup>th</sup> Annual Meeting*, Atlanta, GA, January 18-21.
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- Wardlow, B.D.** and S.L. Egbert. 2001. A comparison of the GAP and USGS NLCD land cover data sets for the state of Kansas – classification systems, methods, and results. *Proceedings, 2001 American Society of Photogrammetry and Remote Sensing*, St. Louis, MO, April 23-27.

### White Papers

- Wardlow, B.** 2011. *New and Emerging Remote Sensing Approached for Drought Monitoring*. Submitted to United Nation (UN) Foreign Agricultural Organization (FAO), Ankara, Turkey office.
- Wardlow, B.** 2011. *Introduction to Satellite Remote Sensing for Drought Monitoring*. Submitted to United Nation (UN) Foreign Agricultural Organization (FAO), Ankara, Turkey office.
- Wardlow, B.**, M. Hayes, M. Svoboda, and T. Tadesse. 2010. *Opportunities for Integrating NASA Data into Drought Applications: A Prospectus from the National Drought Mitigation Center (NDMC)*. Submitted to NASA Water Resources Applied Sciences Program.

## Other Publications

*The Vegetation Drought Response Index (VegDRI) brochure*. 2011. National Drought Mitigation Center, University of Nebraska-Lincoln.  
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## Abstracts for Professional Meetings (for Presentation or Poster)

- Mariano, D.A., C.A. Costa dos Santos and **B. Wardlow**. Detecting drought and human-induced land degradation using time series trend analysis in northeastern Brazil drylands. *American Geophysical Union (AGU) Annual Meeting*, New Orleans, LA, Dec. 11-15.
- Yang, Y., M.C. Anderson, F. Gao, **B. Wardlow**, C. Hain, J. Otkin, L. Sun and W. Dulaney. 2017. Satellite-based mapping of field-scale stress indicators for crop yield forecasting: an application over Mead, NE. *American Geophysical Union (AGU) Annual Meeting*, New Orleans, LA, Dec. 11-15.
- Tadesse, T., Y.A. Bayissa, G.B. Demisse and **B. Wardlow**. 2017. Predicting the vegetation condition of the 2015-16 drought across the Great Horn of Africa (GHA): model evaluation and preliminary results. *American Geophysical Union (AGU) Annual Meeting*, New Orleans, LA, Dec. 11-15.
- Tadesse, T., G. Demisse, Y.A. Bayissa, and **B. Wardlow**. 2017. Vegetation Outlook for the Greater Horn of Africa (VegOut-GHA): a seasonal prediction model. *NASA IDS Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa 3<sup>rd</sup> Participatory Research Workshop*, Addis Abba, Ethiopia, Oct. 25-26.
- Bumann, E., T. Awada, **B. Wardlow**, M. Hayes, C. Helzer, J. Hiller and P. Cherubini. 2017. Assessing climatic responses of *betula papyrifera* (paper birch) in a remnant population along the Niobrara River in Nebraska through dendroecological and remote sensing techniques. *Ecological Society of America Annual Meeting*, Portland, OR, August 6-11.
- Sanchez, N., A. Gonzalez-Zamora, J. Martinez-Fernandez, M. Piles, M. Pablos, **B. Wardlow**, T. Tadesse and M. Svoboda. 2017. Preliminary assessment of an integrated SMOS and MODIS application for global agricultural drought monitoring. *IEEE International Geoscience and Remote Sensing Symposium*, Fort Worth, TX, July 23-28.
- Tadesse, T., G.B. Demisse, Y.A. Bayissa and **B.D. Wardlow**. 2017. Vegetation outlook for the Greater Horn of Africa (VegOut-GHA): a seasonal prediction model. *International Agro-meteorology Conference*, Addis Abba, Ethiopia, July 3-5.
- Mariano, D. and **B. Wardlow**. 2017. Timing and magnitude assessment of drought indicators for crops in the Midwestern U.S. *2017 Water for Food Global Conference*. Lincoln, NE April 10-12.
- Bumann, E., T. Awada, B. Wardlow, M. Hayes, C. Helzer, J. Hiller and P. Cherubini. 2017. Assessing annual growth response to climate variability in birch trees (*Betula Papyrifera*) along the Niobrara River valley of NE using dendroecological and remote sensing techniques. *2017 Water for Food Global Conference*. Lincoln, NE April 10-12.
- Stafford, T., B. Wardlow, M. Vaitkus, B. Leavitt, and R. Perk. 2015. Comparison of PhenoCam and Landsat greenness signals for two tallgrass prairies. Kearney, NE, October 9-10.
- Brown, J.F., **B. Wardlow**, T. Tadesse, D. Howard, K. Callahan, and C. Poulsen. 2014. Satellite data continuity for drought monitoring in VegDRI and QuickDRI models and products. *Pecora 19: Sustaining Land Imaging: UAS to Satellites*, Denver, CO November 17-20.
- Aegerter, C., J. Wang, C. Ge, A. L. Kessner, A. Sharma, L. Judd, **B. Wardlow**, J. You, M. Shulski, S. Irmak, and A. Kilic. 2014. Modeling and satellite remote sensing of the meteorological effects of irrigation during the 2012 Central Plains drought. *American Geophysical Union (AGU) Annual Meeting*, San Francisco, CA, Dec. 14-18.
- Hunt, R., A. Gitelson, and **B. Wardlow**. 2014. The comparison of evaporative demand and evapotranspiration to soil moisture over maize fields during a flash drought. *American Geophysical Union (AGU) Annual Meeting*, San Francisco, CA, Dec. 14-18.

- Domingo, C., M. Ninyerola, X. Pons, **B. Wardlow**, and J. Cristobal. 2014. Integration of MODIS and Climate Time Series as an Analysis Tool for Forest Drought Detection, *Global Vegetation Monitoring and Modeling International Conference*, Avignon, France, February 3-7.
- Frels, K., M. Gutteri, L. Doetterer, F. Al-Aboud, R. Perk, B. Leavitt, **B. Wardlow**, and P. Baenziger. 2013. Evaluation of airborne hyperspectral imaging for us in nitrogen use efficiency phenotyping of hard winter wheat. *ASA-CSSA-SSSA International Meeting*, Tampa, FL, November 3-6.
- Hunt, E., **B. Wardlow**, M. Svoboda, K. Hubbard, T. Arkebauer. 2012. Use of standardized drought indices to monitor the rapid onset of agricultural drought at a non-irrigated maize site. *ASA-CSSA-SSSA International Meeting*, Cincinnati, OH, October 20-24.
- Hunt, E., **B. Wardlow**, M. Svoboda, K. Hubbard, and T. Arkebauer. 2012. Comparison of standardized drought indices to monitor rapid onset agricultural drought at Mead, NE: a case study of the 2003 growing season. *Water for Food Conference*, Lincoln, NE, May 30 – June 1.
- Wardlow, B.**, M. Hayes, T. Tadesse, K. Callahan, and M. Svoboda. 2012. National Drought Mitigation Center – delivering drought information services to the world. *Using Satellites for Better Water and Environment Management, Joint Training Session by the World Bank and U.S. Government Agencies Working in Remote Sensing*, Washington, DC, February 29.
- Sakamoto, T., A. Gitelson, A.L. Nguy-Robertson, T.J. Arkebauer, **B. Wardlow**, and M. Shibayama. 2011. Using digital cameras for continuous monitoring of crop status. *American Geophysical Union Annual Meeting*, San Francisco, CA, December 5-9.
- Albright, T.P., A. Pidgeon, V. Radeloff, **B. Wardlow**. 2011. Identifying thermally challenging landscapes and time periods for wildlife using remote sensing. *American Geophysical Union Annual Meeting*, San Francisco, CA, December 5-9.
- Wardlow, B.D.** 2011. New directions in satellite remote sensing for drought monitoring. *International Workshop on Water-related Disaster Prediction and Reduction*, Hohai University, Nanjing, China, November 28-December 1.
- Sakamoto, T., M. Shibayama, **B.D. Wardlow**, A.A. Gitelson, S.B. Verma, A.E. Suyker, T.J. Arkebauer, E. Takada, K. Morita, W. Takahashi, and S. Miura. 2011. Application of digital camera for logging seasonal changes in crop growth and estimating bio-physical parameters. *51<sup>st</sup> Autumn Conference of the Remote Sensing Society of Japan*, Hirosaki, Aomori, Japan, November 10-11.
- Brown, J., D. Howard, **B. Wardlow**, K. Callahan, and C. Poulsen. 2011. Monitoring drought stress across multiple vegetation types within the Upper Colorado River Basin. *World Climate Research Programme Open Science Conference – Climate Research in Service to Society*, Denver, CO, October 24-28.
- Hunt, E.H., **B. Wardlow**, K. Hubbard, and T. Arkebauer, T. 2011. An analysis of eight years of soil moisture over three agroecosystems at Mead, NE. *American Society of Agronomy-Crop Science Society of America-Soil Science Society of America International Annual Meetings*, San Antonio, TX, October 16-19.
- Albright, T., C. Rittenhouse, A. Pidgeon, P. Culbert, M. Clayton, C. Flather, **B. Wardlow**, and V. Radeloff. 2011. Timing and geography structure of heat wave and drought effects on avian community dynamics. *NASA Carbon Cycle and Ecosystems Joint Science Workshop*, Alexandria, VA, October 3-7.
- Hunt, E.H., **B. Wardlow**, K. Hubbard, T. Schimelfenig, G. Roebke. 2011. An analysis of eight years of soil moisture over three agroecosystems at Mead, NE. *2011 Water For Food Conference*, Lincoln, NE, May 2-4.
- Wardlow, B.D.** 2011. Vegetation Drought Response Index (VegRI): a tool for agricultural drought monitoring, *NASA Global Drought Monitoring Workshop*, Silver Springs, MD, April 11-12.
- Swain, S., S. Narumalani, B. Wardlow, D. Rundquist, and M.J. Hayes. 2011. Relationships among vegetation indices, canopy temperatures, and root-zone soil moisture in the U.S. Corn Belt: a close-range sensing approach. *Association of American Geographers Annual Meeting*, Seattle, WA, April 12-16.

- Albright, T.P., C.D. Rittenhouse, A.M. Pidgeon, M.L. Clayton, P.D. Culbert, V.R. Radeloff, C.H. Flather, and **B.D. Wardlow**. 2011. Timing and geography structure heat wave and drought effects on avian community dynamics. *5<sup>th</sup> International Conference of the International Biogeography Society*, Irakleio Crete, Greece, January 7-11.
- Sakamoto, T., M. Shibayama, **B.D. Wardlow**, A.A. Gitelson, S.B. Verma, A.E. Suyker, T.J. Arkebauer, E. Takada, and K. Morita. 2010. Application of low-cost digital image camera data for monitoring and recording seasonal changes in crop growth. *American Society of Photogrammetry and Remote Sensing Annual Meeting*, San Diego, CA, April 26-30.
- Brown, J.F., **B.D. Wardlow**, and T. Tadesse. 2010. Advantages of real-time satellite data for operational drought monitoring: the utility of MODIS and AVHRR. *Association of American Geographers Annual Meeting*, Washington, DC, April 14-18.
- Swain, S., S. Narumalani, **B.D. Wardlow**, T. Tadesse, and K. Callahan. 2010. Evaluating drought-induced changes in grassland and cropland cover types in southwestern Nebraska using Terra-MODIS LST and NDVI. *Association of American Geographers Annual Meeting*, Washington, DC, April 14-18.
- Callahan, K., **B.D. Wardlow**, J.F. Brown, Y. Gu, S. Pervez, and S. Maxwell. 2010. Accuracy assessment of the 2020 MODIS irrigated agriculture dataset. *Association of American Geographers Annual Meeting*, Washington, DC, April 14-18.
- Tadesse, T., **B.D. Wardlow**, K. Callahan, and C.C. Poulsen. 2010. Integrating satellite, climate, oceanic, and biophysical information to predict the general vegetation condition. *Association of American Geographers Annual Meeting*, Washington, DC, April 14-18.
- Albright, T., C. Rittenhouse, A. Pidgeon, C. Flather, M. Clayton, **B. Wardlow**, P. Culbert, and V. Radeloff. 2010. Birds under stress: effects of heat waves and drought on U.S. avian communities. *Association of American Geographers Annual Meeting*, Washington, DC, April 14-18.
- Tadesse, **B. Wardlow**, M. Hayes, M. Svoboda, J. Li, K. Callahan, and C.C. Poulsen. 2010. Scenario-based Vegetation Outlook (S-VegOut): predicting general vegetation condition using different scenarios over the central United States. *90<sup>th</sup> Annual American Meteorological Society Annual Meeting*, Atlanta, GA, January 17-21.
- Sakamoto, T., **B.D. Wardlow**, A.A. Gitelson, S.B. Verma, A.E. Suyker, and T.J. Arkebauer. 2009. Detecting crop growth stage of maize and soybeans using time-series MODIS data. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 14-18.
- Brown, J.F., M.A. Anderson, and **B.D. Wardlow**. 2009. Remote sensing techniques for monitoring drought hazards: an intercomparison. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 14-18.
- Svoboda, M., M. Hayes, C. Knutson, and **B. Wardlow**. 2009. A look into the National Drought Mitigation Center: providing 15 years of drought services. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 14-18.
- Sakamoto, T. and **B.D. Wardlow**. 2009. Developing a simple algorithm for early identification of corn and soybean fields in Nebraska with MODIS time-series imagery. *4<sup>th</sup> Global Vegetation Workshop*, Missoula, MT, June 15-19.
- Tadesse, T. and **B.D. Wardlow**. 2009. Predicting vegetation conditions by integrating climate, satellite, oceanic, and environmental data – a case study for the central U.S. *4<sup>th</sup> Global Vegetation Workshop*, Missoula, MT, June 15-19.
- Wardlow, B.D.** and T. Tadesse. 2009. A hybrid-based remote sensing approach for predicting vegetation conditions – results from the central U.S. *Association of American Geographers Annual Meeting*, Las Vegas, NV, March 22-27.
- Brown, J., **B. Wardlow**, T. Tadesse, K. Callahan, and S. Pervez. 2009. Monitoring recent drought effects on corn yields across the corn belt with the Vegetation Drought Response Index. *Association of American Geographers Annual Meeting*, Las Vegas, NV, March 22-27.

- Swain, S., S. Narumalani, **B. Wardlow**, and T. Tadesse. 2009. An integrated approach for drought induced vegetation stress assessment in Nebraska using remote sensing and GIS. *Association of American Geographers Annual Meeting*, Las Vegas, NV, March 22-27.
- Albright, T.P., C.D. Rittenhouse, A.M. Pidgeon, C.D. Flather, P.D. Culbert, M.K. Clayton, **B.D. Wardlow**, and V.C. Radeloff. 2009. Diverse responses of avian communities to heat waves. *Association of American Geographers Annual Meeting*, Las Vegas, NV, March 22-27.
- Tadesse, T., **B.D. Wardlow**, and J.H. Ryu. 2009. Discovering the spatial and temporal relationships between vegetation condition and climate in monitoring drought. *Climate Prediction Applications Science Workshop*, Norman, OK, March 23-25.
- Brown, J.F. and **B.D. Wardlow**. 2008. Improving decision support for drought using new geospatial models and online tools. *A Conference on Ecosystem Services (ACES)* Naples, FL, December 8-11.
- Swain, S., S. Narumalani, **B. Wardlow**, and T. Tadesse. 2008. An assessment of vegetation response to drought in Nebraska using Terra-MODIS land surface temperature and normalized difference vegetation index. *AAG Great Plains-Rocky Mountain Regional Meeting*. Grand Forks, ND, September 12-13.
- Gu, Y., E. Hunt, **B. Wardlow**, J.B. Basara, J.F. Brown, and J.P. Verdin. 2008. Evaluation and validation of MODIS NDVI and NDWI for vegetation drought monitoring over the Central Great Plains of the United States. *XXI Congress for the International Society for Photogrammetry and Remote Sensing (ISPRS)*, Beijing, China, July 3-11.
- Wardlow, B.D.**, T. Tadesse, J.F. Brown, Y. Gu, and K. Callahan. 2008. The Vegetation Drought Response Index (VegDRI) – Zooming in to a Local Scale to Meet the Needs of the Drought Monitoring Community. *Association of American Geographers Annual Meeting*, Boston, MA, April 15-19.
- Albright, T.P., A.M. Pidgeon, M.K. Clayton, C.H. Flather, C.D. Rittenhouse, **B.D. Wardlow**, and V.C. Radeloff. 2008. Characterization and influence of drought on avian abundance and diversity in the Great Plains, USA. *US Regional Association of the International Association of Landscape Ecology Annual Meeting*, Madison, WI, April 6-10.
- Brown, J.F., Pervez, S., **Wardlow, B.**, Tadesse, T. and Callahan, K.. 2008. Assessment of 2006 and 2007 drought patterns in the Vegetation Drought Response Index across Nebraska. *Pecora 17 Symposium*, Denver, CO, November 16-18.
- Tadesse, T., **B.D. Wardlow**, and J.H. Ryu. 2008. Monitoring and predicting general vegetation condition using climatic, satellite, oceanic, and biophysical data. *Climate Prediction Applications Science Workshop (CPASW)*, Chapel Hill, NC, March 4-7.
- Gitelson, A.A., D.C. Rundquist, J.G. Masek, **B.D. Wardlow** and G.P. Keydan. 2007. Quantitative Remote Estimation of Land Surface Biophysical Characteristics Using ETM+ Landsat and 250-m MODIS Data. *AGU Fall Meeting*, San Francisco, CA, December 10-14.
- Gu, Y., J.F. Brown, J.P. Verdin, and **B. Wardlow**. 2006. A five-year analysis of MODIS NDVI and NDWI for rangeland drought assessment: preliminary results. *EOS Transactions AGU Fall Meeting Supplement*, 87(52), Abstract GC41A-1038, San Francisco, CA, December 11-15.
- Brown, J., J. Verdin, T. Tadesse, and **B. Wardlow**. 2006. Remote sensing tools for improving drought decision support. *Managing Drought and Water Scarcity in Vulnerable Environments – Creating a Roadmap for Change in the United States Meeting*, The Geological Society of America, Longmont, CO, September 18-20.
- Wardlow, B.D.**, T. Tadesse, J. Brown, M. Hayes, D. Wilhite, and M. Svoboda. 2006. The Vegetation Drought Response Index: a new drought monitoring tool integrating climate, satellite, and biophysical data. *Global Vegetation Workshop*, University of Montana, Missoula, MT, August 8-10.
- Wardlow, B.D.**, and S.L. Egbert. 2006. An evaluation of multi-temporal MODIS 250-meter vegetation index data for crop mapping in the U.S. Central Great Plains. *Global Vegetation Workshop*, University of Montana, Missoula, MT, August 8-10.

- Gu, Y. J.F. Brown, and **B.D. Wardlow**. 2006. A 5-year analysis of MODIS NDWI/NDVI for rangeland drought assessment. *Global Vegetation Workshop*, University of Montana, Missoula, MT, August 8-10.
- Wardlow, B.D.** and S.L. Egbert. 2004. Regional scale crop mapping using a decision tree classifier. *Association of American Geographers 100<sup>th</sup> Annual Meeting*, Philadelphia, PA, March 14-19.
- Wardlow, B.D.** and S.L. Egbert. 2003. Crop mapping in the U.S. Central Great Plains region using time-series MODIS 250-meter data: a case study of Southwest Kansas. *30<sup>th</sup> International Symposium on Remote Sensing of Environment*, Honolulu, HI, November 10-14.
- Wardlow, B.D.** and S.L. Egbert. 2003. An agricultural land use/land cover (LULC) mapping protocol for the U.S. Central Great Plains region. *Association of American Geographers 99<sup>th</sup> Annual Meeting*, New Orleans, LA, March 5-8.
- Wardlow, B.D.** and S.L. Egbert. 2002. Discrimination of cropping patterns in Kansas using time-series MODIS 250-meter NDVI data. *MODIS Vegetation Workshop*, University of Montana, Missoula, MT, August 16-18.

## GRANTS

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### Current Grants

- Development of a Global Evaporative Stress Index Based on Thermal and Microwave LST towards Improved Monitoring of Agricultural Drought. C. Hain, M. Anderson, T. Homes, F. Gao, J. Otkin, M. Svoboda, **B. Wardlow**, X. Zhan, I. Becker-Reshef, B. Barker, and R. Terrault. *NASA Earth Science Applications: Water Resources* \$687,987 (1/2017 – 12/2019), Investigator.
- Improving Water Management, Agricultural Production and Food Security in Drought-Prone Areas. C. Neale, R. Kaur, M. Hayes, M. Svoboda, T. Tadesse, **B. Wardlow**, A. Kilic, D. Heeren, D. Martin, K. Callahan, M. Khanna, M. Singh, N. Patel, R. Sahoo, V. Sehgal, A. Sarangi, and S. Kumar. *Indo-US 21<sup>st</sup> Century Knowledge Initiative, U.S.-India Educational Foundation* \$62,175 (1/2017-12/2019), Investigator.
- Development of the Middle East-North Africa (MENA) Regional Drought Management System. R. McDonnell, M. Hayes, C. Neale, D. Wilhite, M. Svoboda, **B. Wardlow**, M. Anderson, and C. Hain. *U.S. Agency for International Development (US AID) Middle East Program*, \$3,959,242 (02/01/2016 – 9/30/2018), Investigator.
- Downscaling of GRACE Terrestrial Water Storage Observations and Application to Global Drought Monitoring. M. Rodell, R. Reichle, R. Houborg, **B. Wardlow**, and B. Zaitchik. *NASA Terrestrial Hydrology Program*, \$614,518 (01/2015-12/2018), Investigator.
- Integrating GRACE and GRACE Follow On Data into Flood and Drought Forecasts for the Continental U.S. M. Rodell, B. Zaitchik, E.Nelsen, T. Bertschi, P. Restrepo, **B. Wardlow**, M. Svoboda, S. Bettadpur, S. Kumar, and R. Reichle. *NASA Earth Science Applications: Water Resources* \$1,637,284 (11/2014 – 10/2018), Investigator.
- Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa Under Evolving Climate Conditions to Support Adaptations Strategies. T. Tadesse, **B. Wardlow** *NASA* \$1,625,032 (1/2014-2/2018), Investigator.

### Previous Grants

- Planning Grant for a Conference on Remote Sensing and Spatial Analysis for Agricultural Productivity and Sustainability. J. Taylor, N. Bickford, R. Dasgupta, N. Mueller, H. Sharif, **B. Wardlow**, and W. Woldt. *Food for Health Initiative Planning Grant, University of Nebraska System*, \$75,000 (2016); Investigator.
- High-Plains Earth System Modeling Complex (HP-ESMC) – Toward Integrated Assimilation of Satellite Remote Sensing and Ground-based Observations. J. Wang, C. Rowe, R. Oglesby, Q. Hu, M. Anderson, A. Houston, M. Van Den Broeke, J. Zeng, X-H. Chen, **B. Wardlow**, T. Tadesse, M. Shulski, J. You, T. Awada, H. Yang, D. Swanson, H. Yu, S. Irmak, and A. Kilic. *University of Nebraska-Lincoln Office of Research and Economic Development Big Ideas Accelerator Seed Grant*, \$100,000 (1/2015 – 12/2017); Investigator.
- Irrigated Lands Mapping for the State of Nebraska. B. Wardlow, K. Callahan, and M. Vaitkus. *Nebraska Department of Natural Resources* \$75,000 (2015 – 2016); Principal Investigator.
- Ecological Spectral Information System (ESIS): Integration of Spectral Data with Measurements of Vegetation Functional Traits. Townsend, P., S. Ustin, D. Roberts, S. Serbin, J. Gamon, A. Zygielbaum, **B. Wardlow**, R. Green, S. Hook, T. Kampe, and S. Petroy. *NASA Terrestrial Ecology* \$939,730 (2013 – 2016); Investigator.
- Monitoring Phenology in the North Central Region of the U.S. R. Landenberger, R. Lawrence, K. Dobbs, M. O’Neill, B. Rundquist, M. Viatkus, and **B. Wardlow**. *U.S. Department of the Interior, North Central Climate Center Program*, \$23,000 (2013 – 2015); Investigator.
- Center for Integrated Earth Observation and Modeling (CIEOM): Needs, Strategic Plans, and Funding Outlooks. Wang, J., C. Rowe, R.J. Oglesby, G. Hu, M. Shulski, **B. Wardlow**, H. Yang, and H. Yu. *Pathway to Interdisciplinary Research Centers, Phase 1 Planning Grant, Office of Research and Economic Development, University of Nebraska-Lincoln* \$10,000 (2013 – 2015); Investigator.
- Facilitating Adaptive Management under Conditions of Rapid Drought Onset using GOES-based Evaporative Stress Index. J. Otkin, M. Schafer, M.C. Anderson, J. Basara, M. Svoboda, and B. Wardlow. *NOAA Climate and Societal Interactions (CSI) Competition Sectoral Applications Research Program (SARP)* \$290,000 (2013 – 2015); Investigator.
- The Quick Drought Response Index (QuickDRI): An Integrated Approach for Rapid Response Agricultural Drought Monitoring. **B. Wardlow**, M. Svoboda, J. Brown, M. Anderson, M. Rodell, M. Hayes, T. Tadesse, D. Mocko, M. Brewer, C. McNutt, and C. Hain. *NASA Earth Science Applications: Water Resources*, \$1,509,768 (8/16/2012 – 8/14/2016), Co-Principal Investigator.
- Development of a Multi-Scale Remote Sensing Based Framework for Mapping Drought over North America. C.R Hain, M.C. Anderson, X. Zhan, G. Gao, M. Svoboda, **B. Wardlow**, R. Mueller, L. Beard, I. Laszlo, J.R. Mecikalski, and I. Mladenova. *NASA Earth Science Applications: Water Resources*, \$1,300,000 (8/2012 – 8/2016); Investigator.
- Developing VegDRI-Canada-Phase 2. T. Tadesse and **B. Wardlow**. *Agriculture and Agri-Food Canada – Agri-Environment Services Branch*, \$24,453 (2012 – 2014); Co-Principal Investigator.
- Evapotranspiration and Drought Monitoring Using GOES-R Products for NIDIS. **B. Wardlow** and M. Svoboda. *NOAA GOES-R Risk Reduction Program*, \$8,897 (2012 – 2013); Principal Investigator.
- NASA Workshop on Remote Sensing for Drought Monitoring and Water Resources Applications. M. Svoboda and **B. Wardlow**. *NASA Topical Workshops, Symposia, and Conferences*, \$25,701 (2012-2013); Co-Principal Investigator.
- Dual Assimilation of Microwave and Thermal-Infrared Satellite Observations of Soil Moisture into NLDAS for Improved Drought Monitoring. Zhan, X., M.C. Anderson, C. Hain, M. Ek, M. Svoboda, **B. Wardlow**, W. Crow, J.R. Mecikalski, and W.P. Kustas. *NOAA Modeling, Analysis, Predictions, and Projections (MAPP) Competition*, \$592,374 (2011 – 2014); Investigator.
- Developing VegDRI-Canada-Phase 1. **B. Wardlow** and T. Tadesse. *Agriculture and Agri-Food Canada – Agri-Environment Services Branch*, \$24,000 (2011– 2012); Co-Principal Investigator.
- Use of Satellite Data and Model Products in Improving the Categorization, Delineation, and Mitigation of Agricultural Drought. McNider, R.T., J.R. Christy, G. Hoogenboom, M.D. Svoboda, A.S. Limaye,

- J.J. O'Brien, **B.D. Wardlow**, J.R. Mecikalski, D.F. Zierden, and D.E. Stooksbury. *NASA Gulf of Mexico*, \$20,383 (2010 - 2012); Investigator.
- Drought Mitigation Nebraska Project 2010. Hayes, M., M. Svoboda, **B. Wardlow**, and C. Knutson. *USDA NIFA*, \$558,441 (2010 – 2011); Investigator.
- A GOES Thermal-Based Drought Early Warning Index for NIDIS. Anderson, M.C., K.C., Mo, M. Svoboda, **B. Wardlow**, X. Zhan, J.R. Mecikalski, W.P. Kustas, and J.F. Brown. *NOAA Climate Dynamics and Experimental Prediction (CDEP) Competition*, \$592,864 (2009 – 2012); Investigator.
- Drought Mitigation Nebraska Project 2009. Hayes, M., M. Svoboda, **B. Wardlow**, and C. Knutson. *USDA CSREES*, \$437,243 (2009 – 2010); Investigator.
- Integrating Enhanced GRACE Water Storage Data into the U.S. and North American Drought Monitors. Rodell, M., J. Lawrimore, J.S. Famiglietti, R. Heim, R. Reichle, M. Svoboda, **B. Wardlow**, B. Zaitchik, and A. Pinheiro. *NASA ROSES Decision Support through Earth Science Research Results*, \$597,000 (2008-2010); Investigator.
- Drought Mitigation Nebraska Project 2008. Hayes, M., M. Svoboda, **B. Wardlow**, and C. Knutson. *USDA CSREES*, \$347,246 (2008 – 2009); Investigator.
- Incorporating Remote Sensing Information into the U.S. Drought Monitor. Svoboda, M., **B. Wardlow**, T. Tadesse, and D. Wilhite. *U.S Geological Survey Unsolicited Proposal Award*, \$152,598 (2007-2009); Investigator.
- The Development of a Near Real-Time Mapping and Monitoring Protocol for the U.S. Great Plains Agroecosystem Using Time-Series MODIS 250-Meter Data. **Wardlow, B.** *NASA Earth System Science Graduate Research Fellowship*, \$72,000 (2002-2005); Investigator.

### **Other Funded Grants and Contracts**

- High Resolution Land Cover for Nebraska and Windbreak Assessments for the Northern Plains. **B. Wardlow** and M. Vaitkus. *U.S. Forest Service* \$107,902 (2016-2018); Principal Investigator.
- CALMIT GIS Support for Agricultural Monitoring. **B. Wardlow** and M. Vaitkus. *Nebraska Department of Agriculture* \$50,000 (2013-2018); Principal Investigator.
- StateView Program Development and Operations for the State of Nebraska (2015). **B. Wardlow** and M. Vaitkus. *USGS AmericaView Program*, \$96,000 (2013 –2017); Principal Investigator.
- Comparison of Crop Type Classification Products for the COHYST Region. **B. Wardlow**, K. Callahan, and M. Vaitkus. *Nebraska Department of Natural Resources* \$25,000 (2014–2015); Principal Investigator.
- Global Positioning System (GPS) and Internal Navigation System (INS) Upgrade for CALMIT Aircraft Remote Sensing Program. **B. Wardlow**, C. Neale, and A. Zygielbaum, *UNL Agricultural Research Division (ARD) Strategic Funding*, \$30,000 (2015); Principal Investigator.
- 2013 Protected Area Database -US State Data Steward Grant. **B. Wardlow**, M. Vaitkus, and K. Callahan. *USGS GAP Stewardship Program*, \$20,000 (2013–2014); Principal Investigator.
- University of Nebraska-Lincoln Institute of Agriculture and Natural Resources (IANR) Research Travel Grant, \$800 (2010); Principal Investigator.
- Kansas EPSCoR Graduate Student Travel Grant, \$500 (2003); Principal Investigator.
- University of Kansas Graduate School Conference Travel Grant, \$500 (2002); Principal Investigator.

### **INVITED PRESENTATIONS**

- 2017 Quick Drought Response Index – Characterizing Short-Term Dryness Conditions *NASA Water Resources Applied Science Meeting*, Pasadena, CA.
- 2017 QuickDRI – A Composite Index for Monitoring Short-term Drought Conditions. *Tenth Biennial U.S. Drought Monitor Forum*, Keystone, SD
- 2016 Quick Drought Response Index (QuickDRI) *North American Fire, Drought, and Climate Services Forum*, Fort Worth, TX.

- 2015 Recent Operational, Satellite-based Agricultural Drought Monitoring Tools – Examples from the United States and North America. *World Meteorological Organization’s Task Team on the Use of Remote Sensing Data for Climate Monitoring Meeting*, Pretoria, South Africa.
- 2015 Development of Remote Sensing-based Composite Drought Indices for Agricultural Drought Monitoring. *2015 Inter-drought Summer School*, Mikulov, Czech Republic.
- 2015 Quick Drought Response Index (QuckDRI) – A Composite Index for Monitoring Rapid-Onset Agricultural Drought. *NASA Applied Sciences Program: Water Resources Meeting*, College Park, MD.
- 2015 Drought Chasing from Space – Advances in Monitoring and Early Warning. *University of Nebraska at Kearney Geography Awareness Week Plenary Session*, Kearney, NE.
- 2014 Remote Sensing: An Introduction and Options for Entomology, *Department of Entomology seminar series*, University of Nebraska-Lincoln, Lincoln, NE.
- 2014 An Overview of the Center for Land Management Information Technologies (CALMIT) and Opportunities for Spatial Analysis Tools for Human Health Applications, *University of Nebraska Research Retreat on Water, Food, and Health*, Ashland, NE.
- 2014 Remote Sensing of Agriculture and Natural Resources at Field to Landscape Scales: Activities and Innovations at CALMIT, *InterDrought Workshop on Remote Sensing Tools in Drought Monitoring*, Brno, Czech Republic.
- 2013 Drought Monitoring and Precipitation Data – A U.S. Perspective on Current Uses and Needs, *NASA Global Precipitation Mission (GPM) Applications Workshop*, College Park, MD.
- 2013 Drought Chasing from Space – Recent Innovations in Satellite-based Remote Sensing Tools, *University of Kansas GIS Day*, Lawrence, KS.
- 2013 VegDRI – A Hybrid-based Agricultural Drought Monitoring Tool for the CONUS, *ASA-CSSA-SSSA Annual Meeting*, Tampa, FL.
- 2013 VegDRI to QuickDRI: Evolution of Operational Agricultural Drought Monitoring Tools for the CONUS, *NASA Applied Science Water Resources Program Annual Meeting*, Lincoln, NE.
- 2013 Remote Sensing of Drought: Advances for Operational Drought Monitoring and Early Warning, *Czech Inter-Drought Project Summer School*, Telc, Czech Republic.
- 2012 U.S. Drought Monitor (USDM): Overview, Applications, and Recent Efforts to Enhance Through Remote Sensing, *Water Cycles Group Seminar, NASA Jet Propulsion Laboratory (JPL)*, Pasadena, CA.
- 2012 An Emerging Remote Sensing Toolkit for Drought Monitoring – Recent Efforts to Improve the U.S. Drought Monitor, *California Water Resources Remote Sensing Workshop*, San Diego, CA.
- 2012 Incorporating Operational Remote Sensing Products into the USDM, University of Alabama-Huntsville, Huntsville, AL.
- 2012 Vegetation Drought Response Index (VegDRI) – An Introduction and Prospects for Mexico, *North American Drought Monitor Forum*, Cancun, Mexico.
- 2012 Time-Series Vegetation Index Data – Concepts and Applications for Monitoring Agricultural Landscapes, *School of Natural Resources teaching seminar*, University of Nebraska-Lincoln, Lincoln, NE.
- 2012 Vegetation Drought Response Index (VegDRI) – A Hybrid Remote Sensing Approach for Drought Monitoring, *School of Natural Resources research seminar*, University of Nebraska-Lincoln, Lincoln, NE.
- 2011 Satellite Remote Sensing of Drought – New Monitoring Options, *International Workshop on Water-Related Disaster Prediction and Reduction*, Nanjing, China.
- 2011 Emerging Remote Sensing Tools for Drought Monitoring: Activities at the National Drought Mitigation Center, *National Hydrologic Warning Council Conference*, San Diego, CA.
- 2011 New and Emerging Remote Sensing Tools for Drought Monitoring, *UN/FAO Drought Monitoring Tools and Practices Workshop*, Ankara, Turkey.

- 2011 Introduction to Satellite Remote Sensing for Drought Monitoring, *UN/FAO Drought Monitoring Tools and Practices Workshop*, Ankara, Turkey.
- 2011 Vegetation Drought Response Index (VegDRI): Recent Accomplishments and Activities, *2011 U.S. Drought Monitor Forum*, Fairfax, VA.
- 2010 Vegetation Drought Response Index (VegDRI): An Overview and Prospects for Canada, *Canadian Drought Monitor Meeting*, Regina, Saskatchewan.
- 2010 Remote Sensing and Drought Monitoring: Current and Future Directions, *Argentina Congress of Animal Production, Drought Early Warning System Working Group*, Viedma, Argentina.
- 2010 GIScience Activities at the National Drought Mitigation Center, *USDA wNational Agricultural Statistics Service (NASS)*, Fairfax, VA.
- 2010 An Overview of Remote Sensing Activities at the National Drought Mitigation Center, *Hydrology and Remote Sensing Laboratory, USDA Agricultural Research Service (ARS)*, Beltsville, MD.
- 2010 The U.S. Drought Monitor, NIDIS, and Opportunities for Remote Sensing. *NASA Hydrologic Applications Branch, NASA Headquarters*, Washington, DC.
- 2009 The Future of Remote Sensing Applications for Drought Monitoring, *World Meteorological Organization (WMO) Drought Workshop*, Lincoln, NE.
- 2009 Vegetation Drought Response Index (VegDRI): 2009 Update and Ongoing Activities, *2009 U.S. Drought Monitor Forum*, Austin, TX.
- 2009 Remote Sensing and Drought – An Overview and Opportunities for Mali, *WMO Drought Workshop*, Bamako, Mali.
- 2009 Remote Sensing and Drought Monitoring - New Tools and Future Directions, *National Hydrologic Warning Council Conference*, Vail, CO.
- 2008 VegDRI – A New Hybrid Drought Index for Monitoring Vegetation in the U.S., *U.S.-Canada GEO Bilateral Workshop on Ice and Water*, National Science Foundation (NSF), Arlington, VA.
- 2008 Vegetation Drought Response Index (VegDRI): A Hybrid-Based Approach for Vegetation Drought Monitoring, *2008 North American Drought Monitor Workshop*, Ottawa, Canada.
- 2008 The Vegetation Drought Response Index (VegDRI) – An Update on Progress and Future Research Activities. *U.S. Drought Monitor Forum*, Portland, OR.
- 2007 Geospatial Tools for Environmental Monitoring in a Changing World. Presentation at the USGS and UNL Workshop on Climate Change – Partnerships in Climate Change Science, University of Nebraska-Lincoln, Lincoln, NE.
- 2007 Remote Sensing Activities at the NDMC – Bridging the Drought Monitoring Gaps. Presentation at the School of Natural Resources Research Colloquium, University of Nebraska- Lincoln, Lincoln, NE.
- 2007 New NDMC Tool Development Update: Working to Meet the Needs of Drought Monitor, RMA, and NIDIS End Users, *2007 U.S. Drought Monitor Forum*, Portland, OR.
- 2006 Evaluation of MODIS 250-Meter Vegetation Index Data for Regional-Scale Crop Mapping – Results from the State of Kansas. Presentation to Geographic Information Science Center of Excellence, South Dakota State University, Brookings, SD.
- 2005 Regional-Scale Crop Mapping in the U.S. Central Great Plains Using MODIS 250-Meter NDVI Data – Results and Future Directions for Drought Monitoring. Presentation to the National Drought Mitigation Center, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE.
- 2005 An Evaluation of MODIS 250-Meter Vegetation Index Data for Regional-Scale Crop Characterization in the U.S. Central Great Plains. Presentation to the Science and Application Branch, USGS EROS Data Center, Sioux Falls, SD.
- 2005 Regional-Scale Crop Mapping in the U.S. Central Great Plains Using MODIS 250-Meter Vegetation Index Data: Results and Future Research Directions. Presentation to the Department of Geography, Oklahoma State University, Stillwater, OK.

- 2003 An Overview of Crop Mapping Activities Using Time Series MODIS 250 Meter Data. Presentation to the Science and Applications Branch, USGS EROS Data Center, Sioux Falls, SD.
- 2003 A State-Level Crop Mapping and Monitoring Prototype for Kansas. Presentation to the KansasView State and Local Government (SLG) Remote Sensing Applications Workshop, University of Kansas, Lawrence, KS.
- 2002 Proposal Strategies for the NASA Earth System Science (ESS) Graduate Research Fellowship. Presentation at the Mt. O'Read Geospatial Technologies Club Scholarship/Grant Writing Workshop, University of Kansas, Lawrence, KS.
- 1998 USGS EROS Data Center: Remote Sensing Science for a Changing World and the Multi Resolution Land Cover Characterization Land Cover Mapping Project. Presentation to the Department of Geography, Kansas State University, Manhattan, KS.
- 1996 Temporal Monitoring of Suspended Sediment Patterns Using Landsat Thematic Mapper Imagery, Presentation to the Science and Applications Branch, USGS EROS Data Center, Sioux Falls, SD.

## **INTERNATIONAL ACTIVITIES**

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### **Projects**

- 2017 **Tunisia.** Provide technical training session in Tunis, Tunisia to scientists and technical staff from various Tunisian governmental ministries on the development and implementation of a remote sensing-based composite drought indicator for the country.  
**India.** Hosted scientists from the Indian Agricultural Research Institute (IARI) to develop conceptual framework towards the development of an operational, remote sensing-based composite drought indicator for India. Hosted IARI Ph.D. students to begin research and development of the indicator.  
**Spain.**
- 2016 **India.** Hosted a faculty member from the Indian Institute of Technology to investigate the development of a regional-scale, remote sensing-based composite drought indicator for India and collaborate on irrigation mapping research.  
**Middle East/North Africa (MENA).** Worked on a US AID-funded project to develop a remote sensing-based composite drought indicator for the MENA region with scientists from the International Center for Biosaline Agriculture (ICBA) in Dubai, UAE. Provided expert input for decision maker engagement meetings in Jordan, Morocco and Tunisia.  
**Chile.** Hosted a Ph.D. student from the University of Concepcion to investigate the use of satellite-based precipitation data sets for drought monitoring in Chile.  
**Canada.** Worked with scientists at Agriculture and Agri-Food Canada to develop a VegDRI drought monitoring tool for Canada that was similar to the version for the United States in support of the North American Drought Monitor.  
**China.** Hosted a faculty member from HuaZhong Agricultural University to investigate the use of various time-series data analysis techniques to identify drought signals in long-term satellite image data records.
- 2015 **Morocco.** Conducted a Composite Drought Indicator Workshop in Rabat to complete the development of this indicator developed as part of a World Bank project.  
**United Arab Emirates.** Worked with scientists from the International Center for Biosaline Agriculture (ICBA) in Dubai, UAE to scope an agricultural drought composite index approach for the Middle East/North Africa (MENA) and develop a proposal to U.S. American International Development (US AID) to support the development of this index.

- 2014 **Morocco.** Worked with the Royal Center for Remote Sensing to develop a composite agriculture drought index for Morocco that integrates various types of remote sensing observations and products.  
**The Netherlands.** Invited expert peer reviewer and moderator of drought monitoring session at the a World Bank Water Partnership Program entitled ‘Workshop for Understanding Water through Space – How to Navigate through Remotely Sensed Data and Applications for Improved Water Resources Management’ in the Hague.  
**Czech Republic.** Co-organizer and invited speaker at the InterDrought Workshop on Remote Sensing Tools in Drought Monitoring in Brno.
- 2013 **Spain.** Hosted Ph.D. student specializing in remote sensing and GIS from Barcelona Autonomous University to develop and apply satellite-based tools and products for drought monitoring over the Iberian Peninsula.  
**Czech Republic.** Invited speaker at the Inter-Drought Summer School sponsored by the CzechGlobe Group in Telc and conducted exploratory research collaborations with faculty at Mendel University in Brno.  
**Canada.** Provided consultation on the development of a VegDRI-Canada tool with researchers from Agriculture and AgriFood Canada.  
**China.** Hosted and supervised a Ph.D. student from Wuhan University on the development and application of satellite-based remote sensing for vegetation phenology and drought monitoring.  
**India.** Worked with scientists from the Indian Agricultural Research Institute (IARI) on technological transfer and development of a prototype VegDRI tool for the country.
- 2012 **Mexico.** Participated as an invited speaker in the North American Drought Monitor Forum in Cancun. Worked with scientists at the Servicio de Informacion Agroalimentaria y Pesquera (SIAP) to develop a proof-on-concept VegDRI tool for Mexico.
- 2011 **China.** Participated in the International Workshop on Water-related Disaster Prediction and Prevention held in Nanjing.  
**The Netherlands.** Participated in developing a collaborative graduate-level, remote sensing research opportunity between UNL/Water for Food Institute and IHE Institute for Water Education in Delft.  
**Turkey.** Participated in the UN FAO Drought Monitoring Tools and Practices Workshop held in Ankara.  
**Czech Republic.** Hosted scientists from the Institute of Agricultural Systems and Bioclimatology, Mendel University in Brno for training to develop a proof-of-concept VegDRI tool for central Europe.
- 2010 **Argentina.** Participated in discussions with researchers from the Argentina Congress of Animal Production about developing a regional drought early warning system for the Patagonia region and the potential role of remote sensing.  
**Canada.** Hosted scientists from Agriculture and Agri-Food Canada for training to develop a VegDRI-like tool for Canada.  
**Japan.** Hosted visiting scientist, Toshihiro Sakamoto, from the National Institute for Agro-Environmental Sciences (NIAES) to conducted remote sensing of phenology research for crops across the U.S. Corn Belt and Great Plains.
- 2009 **Mali.** Participated in a World Meteorological Organization (WMO) Drought Monitoring Tools Workshop for West Africa in Bamako.

2008 **Canada:** Participated in the North American Drought Monitor Forum in Ottawa.

### International Students and Scientists Hosted

- Alka Rani, Indian Agricultural Research Institute (IARI), New Delhi, India (2017)
- Vijay Prajapati, Indian Agricultural Research Institute (IARI), New Delhi, India (2017)
- Rigghi Singh, Indian Institute of Technology (ITT), Hyderabad, India (2017)
- Vimal Mishra; Indian Institute of Technology (ITT), Gandhinagar, India (2016)
- Francisco Zambrano; Universidad de Concepcion, Chile (2016)
- Hu Lia; HuaZhong Agricultural University; China (2016-2017)
- Linglin Zeng; Wuhan University; China (2013-2014)
- Cristina Domingo; Universitat Autonoma de Barcelona, Spain (2013)
- Toshihiro Sakamoto; National Institute for Agro-Environmental Sciences, Japan (2009 – 2011)

### NDMC WORKSHOPS

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- 2010 Raleigh, NC: April 1<sup>^</sup>  
Boise, ID: July 27<sup>^#</sup>
- 2009 Bastrop, TX: February 11<sup>^</sup>  
Coalinga, CA: February 24<sup>^#</sup>  
Woodland, CA: February 26<sup>^#</sup>  
Kearney, NE: August 10<sup>^#</sup>
- 2008 Wolf Point/Fort Peck, MT: March 12<sup>^#</sup>  
San Angelo, TX: April 24<sup>^</sup>  
Walla Walla, WA: November 11<sup>^#</sup>  
Cheney, WA: November 12<sup>^#</sup>
- 2007 Bismarck, ND: April 27<sup>^</sup>
- 2006 Roswell, NM: May 23<sup>^</sup>

<sup>^</sup> participated

<sup>#</sup> organized

### UNIVERSITY SERVICE

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- **Search Committee Chair**, Spatial scientist faculty position, School of Natural Resources, University of Nebraska-Lincoln (2016-2017)
- **Search Committee Member**, Remote sensing faculty position, School of Natural Resources, University of Nebraska-Lincoln (2017)
- **Board of Governors**, Center for Great Plains Studies (2015-2017)
- **Member**, Nominating Committee, Center for Great Plains Studies (2015-2017)
- **Member**, University of Nebraska Unmanned Aerial Systems (UAS) policy working group (2015)
- **Steering Committee Member**, Doctorate of Plant Health Program, University of Nebraska-Lincoln (2014-present)
- **Faculty Fellow**, Daugherty Water for Food Institute (DWFI), University of Nebraska-Lincoln (2014-present)
- **Conference Organizing Committee Member**, Daugherty Water for Food Institute (DWFI) Water for Food Conference (2014)
- **Member**, Long-Term Agricultural Research (LTAR) Leadership Team at the University of Nebraska (2014-present)
- **Courtesy Associate Professor**, Department of Agronomy and Horticulture, University of Nebraska-Lincoln (2013-present)

- **Faculty Area Leader**, Geography and GIScience, School of Natural Resources, University of Nebraska-Lincoln (2013-present)
- **Principal Investigator**, NebraskaView program (2013-present)
- **Reviewer**, IANR Dinsdale Family Faculty Award, University of Nebraska-Lincoln (2013 and 2014))
- **Faculty Fellow**, National Drought Mitigation Center (NDMC), University of Nebraska-Lincoln (2012-present)
- **UNL Faculty Leader**, University of Nebraska Geospatial Technologies Retreat (2012)
- **Faculty Task Force** for Principles of Faculty Excellence, College of Agricultural Sciences and Natural Resources/Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln (2011)
- **Faculty Advisor**, Gamma Theta Upsilon (GTU) student chapter, University of Nebraska-Lincoln (2010-2013)
- **Finance and Personnel Committee**, Center for Great Plains Studies, University of Nebraska-Lincoln (2009-2012)
- **Faculty Advisor**, Geography Student Organization (GSO), University of Nebraska-Lincoln (2008-2013)
- **Faculty Fellow**, Center for Great Plains Studies, University of Nebraska-Lincoln (2008-present)
- **Graduate Committee**, Geography Program, University of Nebraska-Lincoln (2008–present)
- **Search Committee Member**, Spatial scientist staff position search, National Drought Mitigation Center, University of Nebraska-Lincoln (2008)
- **Faculty Fellow**, Center for Advanced Land Management and Information Technologies (CALMIT), University of Nebraska-Lincoln (2007-2012)
- **Graduate Faculty**, Geography, University of Nebraska-Lincoln (2006-present)
- **Courtesy Graduate Faculty**, Department of Geography, University of Kansas (2007-2009)

### **Post-Doctoral Research Advisor**

- Hatim Gali, 2016.

### **Graduate Committees**

#### Ph.D. Completed

- Humphrey Kalibo, Geography, University of Nebraska-Lincoln, May 2016.
- Eric Hunt, Natural Resources, University of Nebraska-Lincoln, August 2015. (**Advisor**)
- Anthony Nguy-Robertson, Natural Resources, University of Nebraska-Lincoln, August 2013
- Sharmistha Swain, Geography, University of Nebraska-Lincoln, August 2012 (**Co-advisor**)
- Roberto Bonifaz, Geography, University of Nebraska-Lincoln, August 2011
- Iwake Masialeli, Fulbright student in the Department of Geography, University of Kansas, August 2008

#### Ph.D. in Progress

- Saran Aadhar, 2016-present. Student in Civil Engineering, Indian Institute of Technology (IIT) Gandhinagar campus, India. Coursework in progress.
- Denis Mariano, 2015-present. Student in the School of Natural Resources, University of Nebraska-Lincoln. ABD. (**Advisor**)
- Gabriel Torres, 2016-present. Student in Earth and Atmospheric Sciences, University of Nebraska-Lincoln. ABD.
- Ahmed Jasmin, 2016-present. Student in Agronomy and Horticulture, University of Nebraska-Lincoln. Coursework in progress.

- Amy Zoller, 2012-present. Student in Geography, University of Nebraska-Lincoln. Course work in progress. (*Advisor*)
- Benjamin Loseke, 2014-present. Student in Agronomy and Horticulture, University of Nebraska-Lincoln, ABD.
- Yi Wang, 2014-present. Student in Earth and Atmospheric Science, University of Nebraska-Lincoln. Coursework in progress.
- Andualem Shiferaw, 2014-present. Student in the School of Natural Resources, University of Nebraska-Lincoln, ABD.

### Master's. Completed

- Evan Bumann, School of Natural Resources, University of Nebraska-Lincoln, December 2017.
- Xiaochen Dong, School of Natural Resources, University of Nebraska-Lincoln, December 2017
- Joseph Lehnert, School of Natural Resources, University of Nebraska-Lincoln, August 2017 (*Co-  
advisor*)
- Maria Ana Mulet Jalil, Biological Systems Engineering, University of Nebraska-Lincoln, August 2016
- Adam Smith, School of Natural Resources, University of Nebraska-Lincoln, May 2016
- Brian Baskerville, Geography, University of Nebraska-Lincoln, December 2013
- Wendy Austin, Geography, University of Nebraska-Lincoln, August 2013 (*Advisor*)
- Martha Isabel Posada, Geography, University of Nebraska-Lincoln, December 2012
- Nicole Wayant, Geography, University of Nebraska-Lincoln May 2011
- Jeff Nothwehr, School of Natural Resources, University of Nebraska-Lincoln, August 2007

### Master's.in Progress

- Marketa Podebradska, 2017-present. Student in the School of Natural Resources, University of Nebraska-Lincoln. Coursework underway.
- Ryan Moore, 2016-present. Student in Geography, University of Nebraska-Lincoln. Coursework underway (*Advisor*).
- Amanda Sanford, 2016—present. Student in Agronomy and Horticulture, University of Nebraska-Lincoln. Coursework underway.
- Lingzi Zhang, 2016-present. Student in Geography, University of Nebraska-Lincoln.
- Paul Merani, 2106-present. 2015-present. Student in the School of Natural Resources, University of Nebraska-Lincoln. Coursework completed.
- Aaron Greuel, 2013-present. Student in Geography, University of Nebraska-Lincoln. Coursework completed. (*Advisor*)
- Kevin McMillan, 2013-present. Student in Geography, University of Nebraska-Lincoln. Coursework completed.
- Junyao Chen, 2013-present. Student in Geography, University of Nebraska-Lincoln. Coursework completed.

## **PROFESSIONAL ORGANIZATION SERVICE**

### **Professional Working Group Membership**

- University Consortium for Geographic Information Science (USGIS) Delegate
- USDA Long-Term Agroecosystem Research (LTAR) Remote Sensing and GIS Working Group
- NASA Soil Moisture Active Passive (SMAP) Early Adopter
- NASA Soil Moisture Active Passive (SMAP) Applications Working Group
- National Phenology Network (NPN) Land Surface Phenology and Remote Sensing Working Group
- NASA Soil Moisture Active Passive (SMAP) Satellite Applications Working Group

- U.S. – Canada Group on Earth Observations (GEO) Drought Definitions and Indices Study Team
- U.S. – Canada Group on Earth Observations (GEO) Prairie Region Test bed Study Team

**Manuscript Reviewer for the Following Professional Journals:**

- Advances in Space Research
- Advances in Water Resources
- Agronomy Journal
- African Journal of Environmental Science and Technology
- Agricultural and Forest Meteorology
- Agricultural Systems
- Applied Earth Observation and Geoinformation
- Applied Geography
- Applied Remote Sensing
- Applied Vegetation Science
- Biofuels, Bioproducts, and Biorefining
- British Journal of Environment and Climate Change
- Canadian Journal of Remote Sensing
- Climate Change
- Disaster Prevention and Management
- Field Crops Research
- Geomatics, Natural Hazards and Risk
- GeoCarto International
- GIScience and Remote Sensing
- Great Plains Research
- Environmental Monitoring and Assessment
- Environmental Research Letters
- EOS, Transactions, American Geophysical Union
- IEEE Geoscience and Remote Sensing Letters
- IEEE International Geoscience and Remote Sensing Symposium (abstracts)
- IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (JSTARS)
- IEEE Transactions on Geoscience and Remote Sensing
- International Journal of Applied Earth Observation and Geoinformation
- International Journal of Digital Earth
- International Journal of Hydrology Science and Technology
- International Journal of Remote Sensing
- ISPRS Journal of Photogrammetry and Remote Sensing
- Journal of Agricultural Science and Technology
- Journal of Agronomy
- Journal of Applied Meteorology and Climatology
- Journal of Applied Remote Sensing
- Journal of Environmental Management
- Journal of Geophysical Research - Atmospheres
- Journal of Hydrology
- Journal of Hydrometeorology
- Journal of Land Use Science
- Landscape and Urban Planning
- Natural Hazards
- Nature Climate Change
- Pedosphere
- Photogrammetric Engineering and Remote Sensing

- PLOS ONE
- Remote Sensing
- Remote Sensing of Environment
- Sensors
- Theoretical and Applied Climatology
- Water Resources Research

### **External Reviewer for:**

- Netherlands Space Office User Support Programme Space Research proposal review, 2013 and 2017
- Columbia University Press, Drought: An Interdisciplinary Perspective book review, 2017
- USDA Agricultural Research Service (ARS) senior scientist position evaluation, 2017
- CRC Press, Data Analytics Applications for Smart Cities, book chapter review, 2017
- USDA Agricultural Research Service (ARS) Scientific Program Plan, 2016
- White House Office of Science and Technology Policy Earth Observation Assessment 2016, 2015-2016
- NASA Terrestrial Water Program Soil Moisture Active Passive (SMAP) proposals, 2016
- United Nations Food and Agricultural Organization (UN FAO) Strategic Framework for Drought Management and Enhancing Resilience in Africa white paper, 2016
- National Science Foundation (NSF) Geography and Spatial Sciences (GSS) Program, 2015
- Water Advanced Research and Innovation (WARI) Fellowship Program, 2015-2016
- CRC Press Book Proposal; 2014, 2015, and 2016
- World Bank Water Partnership Program (WPP) Global Initiative on Remote Sensing for Water Resources Management report, invited peer reviewer, 2014
- University of California-Santa Barbara, Department of Geography faculty promotion file, 2014
- Illinois State University, Department of Geography faculty tenure and promotion file, 2014
- University of Maryland, Earth System Science Interdisciplinary Center (ESSIC) research scientist promotion evaluation file, 2013
- USDA Agricultural Research Service, Senior scientist promotion file, 2012
- NASA MEASURES program proposals, 2012
- NASA Postdoctoral Program proposals, 2011 and 2012
- UNESCO-IHE Institute for Water Education, Ph.D. student proposal, Delft, the Netherlands, 2012
- USDA Agricultural Research Service (ARS) senior research scientist promotion evaluation, 2011
- U.S. EPA Greenhouse Gas Emission Lifecycle Analysis (land use change component) report, 2009
- NOAA Coastal Restoration and Enhancement through Science and Technology (CREST) Program proposals, 2009
- U.S.-Central Asian Research Travel Grant Competition, U.S. Civilian Research and Development Foundation proposals, 2008 and 2010

### **Professional Organization Positions and Meetings Service**

- **Expert** (invited), Second National Earth Observations Assessment (EOA 2016), White House Office of Science and Technology (2015-2016)
- **North American Leader and Global Co-Leader (invited)**, Climate Monitoring and Assessment Task Team on the Use of Remote Sensing Data for Climate Monitoring, Commission for Climatology, World Meteorological Organization (WMO) (2014-present)
- **Judge (invited)**, Student poster competition for the Water for Food Conference, Lincoln, NE (2016 and 2017)

- **Co-organizer**, Planning Workshop on Remote Sensing and Spatial Analysis of Agricultural Productivity, University of Nebraska System, Omaha, NE (2016)
- **Organizing Committee**, Center for Great Plains Studies' 2017 Central Great Plains Symposium (2016)
- **Expert** (invited), Committee on Earth Observation Satellites (CEOS) Water Constellation Feasibility Study (2016)
- **Director**, Remote Sensing Specialty Group, Association of American Geographers (2011-2015)
- **Associate Editor**, *Earthzine*, Agriculture and Remote Sensing section (2009 – 2014)
- **Session Chair**, Methodological Advances in the Remote Sensing of Drought, 3<sup>rd</sup> InterDrought Summer School; Mikulov, Czech Republic (2015)
- **Session Chair**, Remotely Sensed Drought Indicators, 2014 North American Drought Monitor Workshop, Toronto, Canada (2014)
- **Co-organizer**, Remote Sensing Tools in Drought; CzechGlobe InterDrought Workshop, Brno, Czech Republic (2014)
- **Planning Committee Member**, 2014 Water for Food Global Conference; Seattle, WA (2014)
- **Judge** (invited), Student poster competition for the Water for Food Conference, Lincoln, NE (2013)
- **Reviewer** (invited), Association of American Geographers' Remote Sensing Specialty Group Best Paper Award Competition for Early Career Scholars (2012)
- **Judge** (invited), Remote Sensing Specialty Group Student Paper Competition, Annual Meeting, Association of American Geographers, New York, NY (2012)
- **Session Chair**, Contributions of Data Assimilation Products and Models in Monitoring and Predicting Drought, NASA Global Drought Monitoring Workshop, Silver Springs, MD (2011)
- **Breakout Session Chair**, Scientific and Technical Issues and Considerations for Earth Observations and Models in the Development of Global Drought Monitoring Systems, NASA Global Drought Monitoring Workshop, Silver Springs, MD (2011)
- **Breakout Session Chair**, Global Drought Monitoring System Needs, Global Drought Assessment Workshop, Asheville, NC (2010)
- **Session Organizer and Chair**, Remote Sensing and Drought, Annual Meeting of Association of American Geographers, Washington, DC (2010)
- **Session Chair**, Remote Sensing, Annual Meeting, Great Plains-Rocky Mountain Division / West Lakes Division, American Association of Geographers, Lincoln, NE (2006)
- **Session Chair**, Land Cover Change, Pecora 16 Symposium, Sioux Falls, SD (2005)
- **Session Chair**, Remote Sensing: Agriculture and Fractals, Annual Meeting of Association of American Geographers, Philadelphia, PA (2004)
- **Session Chair**, Macro Land Cover Mapping, Annual Meeting, American Society of Photogrammetry and Remote Sensing, St. Louis, MO (2001)
- **Judge** (invited), Remote Sensing Specialty Group Student Paper Competition, Annual Meeting, Association of American Geographers, New Orleans, LA (2003)
- **Vice-President**, Mount O'Read Geospatial Technologies Club and American Society of Photogrammetry and Remote Sensing Student Chapter, University of Kansas, Lawrence, KS, (2002–2006)
- **Liaison**, AmericaView MODIS Database Representative for the State of Kansas (2001-2006)

## **MEMBERSHIPS**

Association of American Geographers (AAG)

American Society of Photogrammetry and Remote Sensing (ASPRS)

American Geophysical Union (AGU)

Gamma Theta Upsilon (GTU) International Geographic Honor Society  
Sigma Gamma Epsilon National Honor Society for the Earth Sciences