

MICHAEL J. HAYES

PERSONAL

Work Address: National Drought Mitigation Center (NDMC)
University of Nebraska-Lincoln
School of Natural Resources
819 Hardin Hall
Lincoln, NE 68583-0988

Telephone: (402) 472-4271
Fax: (402) 472-2946
E-mail: mhayes2@unl.edu

EDUCATION

Ph.D.	1994	University of Missouri-Columbia	Atmospheric Science
M.S.	1989	University of Missouri-Columbia	Atmospheric Science
B.S.	1986	University of Wisconsin-Madison	Meteorology

PRESENT POSITION

10/2016-current, Professor, School of Natural Resources, University of Nebraska-Lincoln
Current appointment: 64% research/outreach, 34% teaching, and 2% university service.
Conduct research on drought risk management and climate-related risk and vulnerability, as well as teach courses in Applied Climate Science within the Applied Climate Science Mission Area of SNR.

EXPERIENCE AND TRAINING

7/2011-9/2016, *Professor/Director*, National Drought Mitigation Center, Lincoln, NE
Appointment: 30% NDMC Director, 35% service/outreach, 23% research, 10% teaching, and 2% university service. Administer the research and outreach programs of the NDMC; conduct research on the impacts of drought and assist with post-drought evaluations; develop new monitoring and impact assessment methodologies; analyze current drought plans and assist local, state, tribal, and federal officials, as well as the private sector, with drought preparedness and drought mitigation issues; and assist in the organization and conduct of workshops and conferences, as well as the preparation of technical and non-technical reports.

8/2007-6/2011, *Associate Professor/Director*, National Drought Mitigation Center, Lincoln, NE
Appointment: 30% NDMC Director, 35% service/outreach, 23% research, 10% teaching, and 2% university service. See the description above.

4/2006-7/2007, *Research Associate Professor/Associate Director*, National Drought Mitigation Center, Lincoln, NE
Appointment: 58% research, 40% service/outreach, and 2% university service.
Researched new drought monitoring, impact assessment, and planning methodologies; assisted local, state, tribal, and federal officials with drought planning and mitigation; helped organize and conduct drought workshops and conferences; and prepared technical and non-technical reports.

7/2003-3/2006, *Research Associate Professor/Climate Impacts Specialist*, National Drought Mitigation Center, Lincoln, NE

See position description above.

7/1995-6/2003, *Research Assistant Professor/Climate Impacts Specialist*, National Drought Mitigation Center, Lincoln, NE

See position description above.

2/1995-7/1995, *Physical Scientist*, AScI Corporation, Columbia, Missouri

Worked with the National Biological Service in support of the Long-Term Ecological Monitoring Program within the National Park Service. Responsible for developing the protocols for monitoring the climate and weather conditions that impact the populations of two endangered prairie plant species; one in southwest Missouri and one in southwest Minnesota.

1987-1994, *Graduate Research Assistant*, Department of Atmospheric Science, University of Missouri-Columbia

Responsible for thesis and dissertation research, and interacted with the Food and Agricultural Policy Research Institute (FAPRI) and the NOAA Climate Applications Branch, both located in Columbia, Missouri.

AWARDS/HONORS

Irv Omtvedt Innovation Award, 2013: in recognition of exceptional service at the University of Nebraska and the Institute of Agriculture and Natural Resources throughout the drought of 2012.

2014: Robert B. Daugherty Water for Food Institute Faculty Fellow

2015: Robert B. Daugherty Water for Food Institute Faculty Fellow

2016: Robert B. Daugherty Water for Food Institute Faculty Fellow

2015: WMO Commission on Agricultural Meteorology Expert Team on Drought

RESEARCH INTERESTS

Drought mitigation strategies and technology; drought impacts, vulnerability assessment, and risk analysis; economic impacts of drought and other natural hazards; water and hydrological issues; precipitation indices, and remote sensing applications.

PROFESSIONAL MEMBERSHIPS

American Meteorological Society

American Geophysical Union

Robert B. Daugherty Water for Food Institute (Faculty Fellow)

Center for Great Plains Studies (Fellow)

CURRENT GRANTS

Improving Water Management, Agricultural Production and Food Security in Drought-Prone Areas. PI: C. M. U. Neale. Co-I: R. Kaur, T. Clemente, M. J. Hayes, D. M. Heeren, M. D.

Svoboda, T. Tadesse, and H. Walia. Indo-U.S. 21st Century Knowledge Initiative. \$171,000. 7/1/2016 to 6/30/2019.

Enhancing Drought Early Warning Capabilities for Agricultural and Tribal Stakeholders in the Missouri River Basin Using Fast Response Drought Indicators. PI. T. Haigh. Co-I: M. Hayes and T. Mucia. NOAA. \$34,607. 7/1/2016 to 6/30/2018.

Development of the MENA Regional Drought Management System. PI: M. Hayes. I: M. Svoboda, C. Neale, B. Wardlow, D. Wilhite and C. Knutson. International Center for Biosaline Agriculture. \$1,025,440. 1/1/2016 to 3/31/2017.

Drought Information Services. PI: M. Hayes. I: M. Svoboda and B. Fuchs. USDA-Office of the Chief Economist, \$839,442. 9/30/2015 to 1/29/2017.

Providing Drought Information Services for the Nation: The National Drought Mitigation Center. PI: M. Hayes. Co-PI: M. Svoboda, C. Knutson, T. Tadesse, D. Bathke, and B. Fuchs. NOAA/SARP, \$2,400,000. 6/1/2015 to 5/31/2018.

Platte River-High Plains Aquifer LTAR. PIs: T. Awada and B. Wienhold. Co-PIs: T. Arkebauer, R. Ferguson, M. Hayes, M. Shulski, A. Suyker, B. Wardlow, B. Woodbury. Collaborators: G. Baigorria, D. Adams, D. Billesbach, X.-H. Chen, G. Erickson, G. Hergert, S. Irmak, V. Jin, A. Kilic, M. Kuzila, D. Martin, G. Varvel, E. Walter-Shea, W. Schacht, D. Wedin, and A. Zygielbaum. USDA-ARS-Long-term Agroecosystem Research (LTAR) Network, \$0.00. 2/1/2014 to 1/31/2017.

Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa under Evolving Climate Conditions to Support Adaptation Strategies. PI: T. Tadesse. Co-Is: B. Zaitchik, S. Habib, Chris Funk, G. Senay, T. Dinku, F. Policelli, P. Block, G. Baigorria, S. Beyene, B. Wardlow, and M. Hayes. NASA. \$1,625,032. 01/01/2014 - 2/31/2017.

The Quick Drought Response Index (QuickDRI): an Integrated Approach to Maximizing the Use of NASA Data Sets for Rapid Response Drought Monitoring. B. Wardlow, M. Svoboda, M. Hayes (Co-I), T. Tadesse, M. Anderson, M. Rodell, D. Mocko, J. Brown, C. McNutt, M. Brewer, and C. Hain. NASA. \$1,150,701. 8/14/2012 to 8/13/2017.

RECENT GRANTS

Drought Monitoring for MENA. PI: M. Hayes. I: M. Svoboda, B. Fuchs, T. Tadesse, and K. Smith. Development Alternatives Inc., \$40,052. 2/11/2015 to 1/29/2016.

Drought Risk Management for the U.S. PI: M. Hayes. Co-PIs: M. Svoboda, C. Knutson, B. Fuchs, T. Tadesse, and D. Bathke. University of Oklahoma, \$693,696. 9/1/2014 to 8/31/2016.

Drought Monitoring System for Austrian Agriculture. PI: J. Eitzinger. Co-PIs: S. Thaler, J. Schaumberger, W. Loiskandl, P. Macaigne, G. Bodner, A. Schaumberger, E. Murer, C. Wittman, A. Kann, B. Bica, F. Weidle, M. Trnka, P. Hlavinka, J. Balek, D. Semeradova, Z. Zalud, and M. Hayes. Austrian Climate Research Program, \$394,990. 6/1/13 to 5/31/16.

Drought Early Warning and Policy in the Eastern Caribbean. PI: B. Fuchs. Co-I: M. Hayes, C. Knutson, M. Svoboda, and T. Tadesse. Organization of Eastern Caribbean States. \$49,227. 1/22/2016 to 5/20/2016.

Center for Agricultural and Food Industrial Organization—Policy Research Group (CAFIO-PRG). PI: K. Giannakas. Co-Is: J. Anderson, M. Burbach, P. Calow, L. Fulginiti, M. Hayes, B. Lubben, G. Lynne, R. Perrin, K. Schoengold, E. Thompson, and A. Yiannaka. US Department of Agriculture-NIFA, \$766,166. 4/15/12 to 4/14/16.

Improving U.S. Drought Monitoring. PI: M. Hayes. Co-PIs: M. Svoboda, B. Fuchs, and T. Tadesse. USDA-OCE, \$150,000. 10/31/2014 to 1/31/2016.

Improving U.S. Drought Monitoring – Integrating Soil Moisture Data and Developing a Drought Blends Portal. PI: M. Hayes. Co-PIs: M. Svoboda and B. Fuchs. USDA-OCE, \$240,000. 7/16/2014 to 1/15/2016.

Drought Information Services in Support of the National Integrated Drought Information System. PI: M. Hayes. Co-PIs: M. Svoboda, C. Knutson, B. Fuchs, T. Tadesse, and D. Bathke. NOAA-NIDIS. \$739,803. 10/1/2013 to 9/30/2015.

SBES Medium: Investigating the Role of Distrust in Unauthorized Online Activities Using an Integrated Sociotechnical Approach. PI: L. Pytlik-Zillig. Co-Is: M. Hayes, A. Samal, L.-K. Soh, and A. Tomkins. NSF. \$490,758. 9/1/12 to 8/31/15.

Enhancing Decision Support for Drought Risk in the United States: the Drought Risk Atlas. M. Svoboda, M. Hayes (co-PI), B. Fuchs, M. Shulski, M. Timofeyeva, and M. Brewer. NOAA-OAR-CPO. \$273,822. 8/1/2012 to 7/31/2015.

Drinking Water Utilities. PI: C. Knutson. Co-PIs: M. Svoboda and M. Hayes. Cadmus Group Inc., \$17,072. 9/25/2014 to 6/15/2015.

Climate Masters of Nebraska Revised. PI: M. Hayes. Co-PIs: T. Bernadt, T. Pathak, and N. Umphlett. Nebraska Department of Environmental Quality, \$31,847. 1/1/2014 to 6/30/2015.

Regional Climate Services Support in the High Plains Region. PI: B. Fuchs. Co-PIs: M. Svoboda and M. Hayes. NOAA, \$265,000. 10/1/2013 to 3/31/2015.

NDMC Drought Information Services for Agriculture. PI: M. Hayes. Co-PIs: M. Svoboda and B. Fuchs. U.S. Department of Agriculture. \$200,000. 9/28/2013 to 2/28/2015.

Technical Assistance on Drought Preparedness. PI: M. Hayes. Co-PIs: M. Svoboda, C. Knutson, B. Fuchs, and K. Smith. The World Bank. \$70,000. 10/3/2013 to 6/30/2015.

Implications of Climate Change in Nebraska. Co-PIs: D. Wilhite and M. Shulski. Co-Is: C. Rowe, R. Oglesby, and M. Hayes. IANR, \$20,000. 12/1/2013 to 10/1/2014.

Drought in the Great Plains Symposium. Co-PIs: D. Wilhite and M. Hayes. IANR and Daugherty Water for Food Institute. \$50,000. 7/1/2012 to 6/30/2014.

Transition of an Interactive Drought Management Database for the Identification and Comparison of Drought Mitigation and Response Strategies. C. Knutson, M. Hayes (Investigator), K. Smith, M. Widhalm, J. Nothwehr, and T. Haigh. NOAA Climate Program Office. \$209,685. 9/1/2011 to 8/31/2013.

Forty-first Parallel Agro-Ecosystem Sustainability and Productivity. L. Fulginiti, T. Powers, D. Walters, S. Verma, K. Cassman, R. Perrin, T. Awada, F. E. Harvey, A. Liska, B. Oglesby, and M. Hayes (co-PI). IANR. \$373,720. 7/1/2010 to 6/30/2013.

The Support of a Global Drought Information System Workshop. PI: M. Hayes. NASA, \$29,343. 5/7/12 to 5/6/13.

Regional Climate Service Support in the High Plains Region. M. Shulski, M. Svoboda, M. Hayes, and D. Bathke. NOAA. \$830,000. 9/1/2011 to 3/31/2013.

The Role of Science in the Policy Process: Responding to Drought in Australia and the USA. L. Botterill, D. Wilhite, and M. Hayes (Investigator). The Australian National University. \$62,000. 10/26/2009 to 10/25/2012.

Drought Mitigation, Nebraska. M. Hayes (PI), M. Svoboda, C. Knutson, and B. Wardlow. USDA-CSREES. \$558,401. 8/1/2010 to 7/31/2012.

NIDIS Portal Content Development and Help Desk Support. M. Svoboda and M. Hayes (co-PI). NOAA. \$162,221. 8/15/2009 to 8/14/2012.

Development of a Pilot Drought Information System for National Drought Disaster Reduction. J. Ryu and M. Hayes (Co-PI). Kongju National University in Korea. \$70,000. 10/1/2008 to 12/31/2011.

Hawaii Drought Plan. M. Hayes (Co-PI), M. Svoboda, Y. Ding, K. Smith, S. Scott, and M. Widhalm. Commission on Water Resource Management, State of Hawaii. \$100,000. 6/23/2008 to 6/30/2012.

Drought Mitigation, Nebraska. M. Hayes (PI), M. Svoboda, C. Knutson, and B. Wardlow. USDA-CSREES. \$437,243. 8/1/2009 to 7/31/2011.

Transitioning the Drought Impact Reporter into an Operational System. PI: M. Hayes. Co-PIs: D. Wilhite, M. Svoboda, G. Garfin, C. Knutson, D. Wood, and M. Higgins. NOAA's Transition of Research Applications to Climate Services Program. \$453,523. 8/1/2007 to 7/31/2011.

Estimating the Impacts of Complex Climatic Events: the Economic Costs of Drought in Colorado, Nebraska, and New Mexico. Co-PIs: D. Wilhite, R. Pulwarty, M. Hayes, R. Supalla,

and C. Howe. NOAA Climate Program Office. \$328,971. 8/1/2006 to 7/31/2011.

Drought Mitigation, Nebraska. M. Hayes (PI), M. Svoboda, C. Knutson, and B. Wardlow. USDA-CSREES. \$347,246. 7/15/2008 to 7/14/2011.

Colorado Drought Planning Assistance. M. Hayes (PI), C. Knutson, D. Bathke, and M. Widhalm. Colorado Water Conservation Board. \$12,000. 11/1/2009 to 9/30/2010.

Rangeland and Forage Geospatial Decision Support System for Drought Risk Management. Co-PIs: D.A. Wilhite, K. Hubbard, M. Svoboda, T. Tadesse, J. Brown, M. Hayes, C. Knutson, J. Volesky, and M. Tooze. USDA/RMA. \$1,023,038. 10/1/2005 to 9/30/2010.

Drought Risk, Impact, and Mitigation Information System. Co-PIs: S. Goddard and D. Wilhite. Collaborators: M. Hayes, M. Svoboda, T. Tadesse, C. Knutson, K. Schoengold, and K. Hubbard. USDA/RMA. \$6,407,472. 9/1/2005 to 8/31/2010.

Low Flow Impact Study for the Upper Colorado. M. Hayes (Co-PI), M. Svoboda, C. Knutson, and D. Woudenberg. NOAA. \$87,000. 10/01/2008 to 3/1/2010.

Low Flow Project in the Alabama, Coosa, and Tallapoosa (ACT) River Basins, and the Appalachian, Chattahoochee, and Flint (ACF) River Basins. M. Hayes (Co-PI), M. Svoboda, C. Knutson, D. Woudenberg, M. Widhalm. NWS Southern Region Headquarters. \$24,999. 9/15/2008 to 9/14/2010.

An Assessment of Decadal Drought Information Needs of Stakeholders and Policymakers in the Missouri River Basin for Decision Support. V. Mehta, N. Rosenberg, M. J. Hayes (Co-PI), C. L. Knutson and J. R. Olsen. NOAA. \$294,111. 5/1/2008 to 4/30/2010.

Developing a Drought Preparedness Framework for Tribal Governments: Moving From Crisis to Risk-Based Management. M. J. Hayes (PI), C. L. Knutson and M. D. Svoboda. United States Bureau of Indian Affairs. \$160,000. 10/19/2007 to 10/18/2008.

An Assessment of the Hydrologic Vulnerability of the Missouri River Basin to Climate Variability at Interannual to Decadal Timescales. PIs: V. Mehta and N. Rosenberg. Collaborators: M. Hayes and C. Knutson. Advisor: D. Wilhite. NOAA-OGP. \$300,000. 10/1/2005 – 9/30/2008.

Climate and Soil Risk Information System. Co-PIs: S. Goddard and D. Wilhite. Collaborators: M. Hayes, M. Svoboda, and C. Knutson. USDA/RMA. \$1,212,055. 6/1/2005 to 5/31/2008.

Engaging Agricultural Communities in the Great Plains of the U.S. with the Application and Development of Climate Prediction and Information. PI: Steven Hu. Co-PIs: Gary Lynne, William Waltman, D.A. Wilhite, K.G. Hubbard, M.J. Hayes. NOAA Office of Global Programs. \$432,916. 5/1/02 to 7/31/06.

Sustainable Adaptation to Drought and Climate Variability in Agricultural Production Systems

Across Nebraska. Co-PIs: M. Hayes, C. Knutson, R. Hitchcock, W. Waltman, J. Peake, and M. Kleinschmit. NOAA Office of Global Programs. \$107,909. 7/1/04 to 6/30/06.

Mitigating the Economic Risk of Stock Reduction During Drought: an Adoption Support Tool for Cattle Producers. Co-PIs: T. Buman and R. Buman. Collaborators: J. Ridgely, S. Buman, P. Mitchell, J. Hatfield, C. Knutson, and M. Hayes. USDA/RMA, \$576,136. 9/1/03 to 8/30/06.

National Drought Impacts Tool. Co-PIs: D.A. Wilhite and M.J. Hayes. Office of Global Programs/NOAA. \$24,380. 10/1/04 to 9/30/05.

Risk Assessment and Exposure Analysis on the Agricultural Landscape: A Holistic Approach to Spatio-Temporal Models and Tools for Agricultural Risk Assessment and Exposure Analysis. PIs: S. Goddard, D.A. Wilhite, J. Deogun, M. Hayes, K. Hubbard, H. Jose, S. Reichenbach, W. Waltman, and M. Svoboda. USDA Risk Management Agency, \$1,086,623. 10/1/02 to 3/31/05.

Improving Drought Monitoring through the Integration of Climate and Satellite-Based Data. Co-PIs: D.A. Wilhite, K.G. Hubbard, and M.J. Hayes. USGS, \$241,000. 7/1/02 to 6/30/05.

Improved Hydrologic Data Collection Systems for Drought Monitoring. Co-PIs: D.A. Wilhite, K.G. Hubbard, M.J. Hayes, and M.D. Svoboda. Nebraska Dept. of Natural Resources/Bureau of Reclamation. \$25,000. 2005.

Drought Risks and Mitigation on the Agricultural Landscape: A Series of Risk Analysis, Management, and Mitigation Workshops for Nebraska Farmers and Ranchers. PI: D.A. Wilhite. Co-PIs: M.J. Hayes, H.D. Jose, W.J. Waltman, K.G. Hubbard, Q.S. Hu, and M.D. Svoboda. USDA Risk Management Agency, \$95,198. 10/1/02 to 9/30/04.

Digital Government: A Decision Support System for Drought Risk Management. Co-PIs: S. Reichenbach, S. Goddard, W. Waltman, J. Deogun, D. Wilhite, P. Revesz, K. Hubbard, and M. Hayes. National Science Foundation, \$1,103,643. 5/1/01 to 4/30/04.

PENDING GRANTS

Building Public Health Capacity for Drought Response. PI: M. Hayes. Co-PI: D. Bulling. Centers for Disease Control (CDC). \$141,893. 9/1/2016 to 8/31/2021.

USAID Sustainable Water Partnership. PI: C. Neale. Co-I: M. Hayes, R. Oglesby, C. Ray, C. Rowe, D. Snow, and T. Tadesse. Catholic Relief Services. \$1,572,769. 10/1/2016 to 9/30/2021.

RECENT PUBLICATIONS (2001-Current)

Journal Articles

Brown, J., D. Kluck, C. McNutt, and M. Hayes, 2016. A socioecological approach to drought. *Rangelands*, 38(4): 162-168. <http://dx.doi.org/10.1016/j.rala.2016.06.007>

Choi, Y-S., H-J. Gim, C-H. Ho, S-J. Jeong, S. K. Park, and M. Hayes, 2016. Climatic influence on corn sowing date in the Midwestern United States. Accepted to *International Journal of Climatology*.

Feng, S., M. Trnka, M. Hayes, and Y. Zhang, 2016. Why different drought indices show distinct future drought risk outcomes in the U.S. Great Plains? Accepted to *Journal of Climate*.

Finnessey, T., M. Hayes, J. Lukas, M. Svoboda, 2016. Using Climate Information for Drought Planning. Accepted to *Climate Research*.

Nam, W.-H., T. Tadesse, B. Wardlow, M. Hayes, M. Svoboda, and M.-W. Jang, 2016. Developing the Vegetation Drought Response Index for South Korea (VegDRI-SKorea) to assess the vegetation conditions during drought events. Submitted to *Remote Sensing of Environment*.

Zeng, L., B. D. 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. <http://dx.doi.org/10.1016/j.rse.2016.03.039>

Büntgen, U., W. Tegel, M. Carrer, P. J. Krusic, M. Hayes, J. Esper, 2015. Commentary to Wetter et al. (2014): Limited tree-ring evidence for a 1540 European 'Megadrought'. *Climatic Change* 131(2): 183-190. DOI: 10.1007/s10584-015-1423-1.

Gustafson, D., M. Hayes, E. Janssen, D. Lobell, S. Long, G. Nelson, H. Pakrasi, P. Raven, G. P. Robertson, R. Robertson, and D. Wuebbles, 2015. Pharaoh's Dream Revisited: An Integrated U.S. Midwest Field Research Network for Climate Adaptation. *BioScience*, DOI: 10.1093/biosci/biv164.

Nam, W.-H., M. J. Hayes, M. D. Svoboda, T. Tadesse, and D. A. Wilhite, 2015. Drought Hazard Assessment in the Context of Climate Change for South Korea. *Agricultural Water Management*, 160: 106-117. DOI: 10.1016/j.agwat.2015.06.029.

Nam, W.-H., M. Hayes, D. Wilhite, and M. Svoboda, 2015. Projection of Temporal Trends on Drought Characteristics using the Standardized Precipitation Evapotranspiration (SPEI) Index in South Korea. *Journal of the Korean Society of Agricultural Engineers*. 57(1): 37-45. (Korean)

Nam, W.-H., T. Kim, E.-M. Hong, M. Hayes, and M. Svoboda, 2015. Water Supply Risk Assessment of Agricultural Reservoirs using Irrigation Vulnerability Model and Cluster Analysis. *Journal of the Korean Society of Agricultural Engineers*. 57(1): 59-67. (Korean)

Tadesse, T., B. D. Wardlow, J. Brown, M. Svoboda, M. Hayes, B. Fuchs, and D. Gutzmer. 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.

Trnka, M., R. Brazdil, M. Mozny, P. Stepanek, P. Dobrovolný, P. Zahradnicek, J. Balek, D. Semerádová, M. Dubrovsky, P. Hlavinka, J. Eitzinger, B. Wardlow, M. Svoboda, M. Hayes, Z. Zalud, 2015. Soil moisture trends in the Czech Republic between 1961 and 2012. *International Journal of Climatology*, 35(13): 3721-4056. DOI: 10.1002/joc.4242.

Vido, J., T. Tadesse, Z. Šustek, R. Kandřík, M. Hanzelová, J. Škvarenina, J. Škvareninová, and M. Hayes, 2015. Drought occurrence in central European mountainous region (Tatra National Park, Slovakia) within the period 1961-2010. *Advances in Meteorology*, 2015. DOI: 10.1155/2015/248728.

You, J., K. G. Hubbard, M. Shulski, M. Svoboda, M. Hayes, 2015. Development of a Long-Term (1884-2006) Serially Complete Dataset of U.S. Temperatures and Precipitation for Climate Services. *Journal Service Climatology*, 8(1): https://www.stateclimate.org/sites/default/files/upload/pdf/journal-articles/2015_You_et_al_2015.pdf.

Zeng, L., B. Wardlow, T. Tadesse, J. Shan, M. Hayes, D. Li, and D. Xiang, 2015. Estimation of daily air temperature based on MODIS land surface temperature products over the Corn Belt in the U.S. *Remote Sensing*, 7, 951-970. DOI:10.3390/rs70100951.

Hunt, E., M. Svoboda, B. Wardlow, K. Hubbard, M. Hayes, and T. Arkebauer. 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, [10.1016/j.agrformet.2014.02.001].

Nam, W.-H., M. Hayes, D. Wilhite, T. Tadesse, M. Svoboda, and C. Knutson, 2014. Drought management and policy based on risk assessment in the context of climate change. *Journal of the Korean Society of Agricultural Engineers*, 56, 2-15. (Korean)

PytlíkZillig, L., S. Wang, L-K. Soh, A. J. Tomkins, A. Samal, T. K. Bernadt, and M. Hayes. 2014. Exploring Reactions to Hacktivism Among STEM College Students: A Preliminary Model of Hacktivism Support and Resistance. *Social Science Computer Review*. DOI: 10.1177/0894439314546815.

Smith, K. H., M. Svoboda, M. Hayes, H. Reges, N. Doesken, K. Lackstrom, K. Dow, and A. Brennan. 2014. The Drought Impact Reporter Can Support Citizen Science Initiatives. *Bulletin of the American Meteorological Society*. 95(11): 1659-1662.

Trnka, M., R. Brázdil, J. Balek, D. Semerádová, P. Hlavinka, M. Mozny, P. Stepanek, P. Dobrovolný, P. Zahradnicek, M. Dubrovsky, J. Eitzinger, B. Fuchs, M. Svoboda, M. Hayes, Z. Zalud, 2014. Drivers of soil drying in the Czech Republic between 1961 and 2012. *International Journal of Climatology*. DOI: 10.1002/joc.4167.

Yu, M., Q. Li, M. Hayes, M. Svoboda, and R. Heim, 2014. Are droughts becoming more frequent or severe in China based on the Standardized Precipitation Evapotranspiration Index (SPEI): 1951-2010? *International Journal of Climatology*, 34(3), 545-558, [10.1002/joc.3701].

Zhao, L., A. Lu, M. Hayes, Z. Tang, B. He, J. Liu, and M. Liu, 2013. The impact of meteorological drought on streamflow in the Jinghe River Basin of China. Submitted to *Water Resources Research*.

Buentgen, U., F. Martinez-Pena, J. Aldea, A. Rigling, E. Fischer, J. J. Camarero-Martinez, M. Hayes, V. Fatton, and S. Egli, 2013. Declining pine growth in Central Spain coincides with increasing Diurnal Temperature Range since the 1970s. *Global and Planetary Change*, 107, 177-185. [DOI: 10.1016/j.gloplacha.2013.05.013]

Dubrovsky, M., M. Hayes, P. Duce, M. Trnka, M. Svoboda, and P. Zara, 2013. Multi-GCM projections of future drought and climate variability indicators for the Mediterranean region. *Regional Environmental Change*, [DOI: 10.1007/s101113-013-0562-z].

Mehta, V., C. Knutson, N. Rosenberg, J. R. Olsen, M. Hayes, N. Wall, and T. Bernadt, 2013. Decadal climate information needs of stakeholders for decision support in water and agriculture production sectors: a case study in the Missouri River Basin. *Weather, Climate, and Society*, 5(1): 27-42. [<http://dx.doi.org/10.1175/WCAS-D-11-00063.1>]

Swain, S., B. 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. [DOI: 10.1080/01431161.2012.750020].

Trnka, M., C. Kersenbaum, J. Eitzinger, M. Hayes, P. Hlavinka, M. Svoboda, M. Dubrovsky, D. Semeradova, B. Wardlow, E. Pokorný, M. Mozny, D. Wilhite, and Z. Zalud, 2013. Consequences of climate change for the soil climate in central Europe and central U.S. *Climatic Change*, 120: 405-418. [DOI 10.1007/s10584-013-0786-4].

Botterill, L. C. and M. Hayes, 2012. Drought triggers and declarations: science and policy considerations for drought risk management. *Natural Hazards*, 64: 139-151.

Fontaine, M., A. Steinemann, and M. Hayes. 2012. State drought programs and plans: survey of the western U.S. *Natural Hazards Review*, doi: 10.1061/(ASCE)NH.1527-6996.0000094.

Ding Y., M Hayes, and M. Widhalm. 2011. Measuring economic impacts of drought: a review and discussion. *Disaster Prevention and Management*, 20(4): 434-446.

Hayes, M., M. Svoboda, N. Wall, and M. Widhalm. 2011. The Lincoln Declaration on Drought Indices: Universal meteorological drought index recommended. *Bulletin of the American Meteorological Society*, 92(4): 485-488.

Hlavinka, P., M. Trnka, J. Balek, D. Semeradova, M. Hayes, M. Svoboda, J. Eitzinger, M. Mozny, M. Fischer, E. Hunt, and Z. Zalud. 2011. Development and evaluation of the SoilClim model for water balance and soil climate estimates. *Agricultural Water Management*, 98(8): 1249-1261.

Knutson, C. L., T. Haigh, M. Hayes, M. Widhalm, J. Nothwehr, and M. Kleinschmidt. 2011. Farmer perceptions of sustainable agriculture practices and drought risk reduction in Nebraska, USA, *Journal of Renewable Agriculture and Food Systems*, 26(3): 255-266.

- Tadesse, T., B. Wardlow, M. Hayes, M. Svoboda, and J. Brown. 2010. The Vegetation Condition Outlook (VegOut): a new method for predicting vegetation seasonal greenness. *GIScience and Remote Sensing* 47 (1): 25-52.
- Wardlow, B., M. Hayes, M. Svoboda, T. Tadesse, and K. Smith. 2009. Sharpening the focus on drought: new monitoring and assessment tools at the National Drought Mitigation Center. *Earthzine*, unpaginated, <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/>.
- 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.
- Dubrovsky, M., M. D. Svoboda, M. Trnka, M. J. Hayes, D. A. Wilhite, Z. Zalud, and P. Hlavinka. 2008. Application of relative drought indices in assessing climate change impacts on drought conditions in Czechia. *Theoretical and Applied Climatology* 96 (1-2): 155-171. DOI: 10.1007/s00704-008-0020-x.
- Trnka, M., M. Dubrovsky, M. D. Svoboda, D. Semeradova, M. J. Hayes, Z. Zalud, and D. A. Wilhite. 2008. Developing a regional drought climatology for the Czech Republic. *International Journal of Climatology*. 29: 863-883. DOI: 10.1002/joc.1745.
- Wilhelmi, O. V, M. J. Hayes, and D. S. K. Thomas, 2008. Managing drought in mountain resort communities: Colorado's experiences. *Disaster Prevention and Management*. 15(5):672-680.
- Woudenberg, D. L., D. A. Wilhite, and M. J. Hayes. 2008. Perception of drought hazard and its sociological impacts in South-Central Nebraska. *Great Plains Research*, 18(1): 93-102.
- Knutson, C. L., M. J. Hayes, and M. D. Svoboda. 2007. Case study of tribal drought planning: the Hualapai Tribe. *Natural Hazards Review*, 8(4): 125-131.
- Wilhite, D. A., M. D. Svoboda, and M. J. Hayes. 2007. Understanding the complex impacts of drought: a key to enhancing drought mitigation and preparedness. *Journal of Water Resources Management*, 21(5): 763-774.
- Wu, H., M. D. Svoboda, M. J. Hayes, D. A. Wilhite, and F. Wen. 2007. Appropriate application of the Standardized Precipitation Index in arid locations and dry seasons. *International Journal of Climatology*, 27: 65-79.
- Artikov, I., S. J. Hoffman, G. D. Lynne, L. M. PytlikZillig, Q. Hu, A. J. Tomkins, K. G. Hubbard, M. J. Hayes, and W. J. Waltman. 2006. Understanding the influence of climate forecasts on farmer decisions as planned behavior. *Journal of Applied Meteorology and Climatology*, 45(9): 1202-1214.
- Hu, Q., L. M. Pytlik Zillig, G. D. Lynne, A. J. Tomkins, W. J. Waltman, M. J. Hayes, K. G. Hubbard, I. Artikov, S. J. Hoffman, and D. A. Wilhite. 2006. Understanding farmers' forecast

use from their beliefs, values, social norms, and perceived obstacles. *Journal of Applied Meteorology and Climatology*, 45(9): 1190-1201.

Cooter, E., B. Eder, C. Rosenzweig, B. Lynn, R. Goldberg, C. Knutson, M. Hayes, D. Wilhite, J. DeCarolis, and T. Barnett. 2005. Effects of climate change on weather and water. *Environmental Management*, October: 32-35.

Tadesse, T., J. Brown, and M. Hayes. 2005. A new approach for predicting drought-related vegetation stress: integrating satellite, climate, and biophysical data over the U.S. central plains. *ISPRS Journal of Photogrammetry and Remote Sensing*, 59(4): 244-253.

Tadesse, T., D. Wilhite, M. Hayes, S. Harms, and S. Goddard. 2005. Discovering associations between climatic and oceanic parameters to monitor drought in Nebraska using data-mining techniques. *Journal of Climate*, 18(10): 1541-1550.

Wu, H., M. Hayes, D. Wilhite, and M. Svoboda. 2005. The effect of the length of record on the Standardized Precipitation Index calculation. *International Journal of Climatology*, 25: 505-520.

Hayes M., O. Wilhelmi, and C. Knutson. 2004. Reducing drought risk: bridging theory and practice. *Natural Hazards Review*, 5(2): 106-113.

Tadesse, T., D.A. Wilhite, S.K. Harms, M.J. Hayes, and S. Goddard. 2004. Drought monitoring using data mining techniques: A case study for Nebraska, U.S.A. *Natural Hazards*, 33(1):137-159.

Wells, N., S. Goddard, and M. Hayes. 2004. A self-calibrating Palmer Drought Severity Index. *Journal of Climate*, 17(12): 2335-2351.

Hayes, M. 2002. How drought impacts U. S. industry. *U. S. Industry Today*, 5(6): 16-17.

Peters, A. J., E. A. Walter-Shea, L. Ji, A. Viña, M. Hayes, and M. D. Svoboda. 2002. Drought monitoring with NDVI-Based Standardized Vegetation Index. *Photogrammetric Engineering and Remote Sensing*, 68(1): 71-76.

Seiler, R. A., M. Hayes, and L. Bressan. 2002. Using the Standardized Precipitation Index for flood risk monitoring. *International Journal of Climatology*, 22: 1365-1376.

Svoboda, M., M. Hayes, and D. Wilhite. 2002. The role of integrated drought monitoring in drought mitigation planning. *Annals of Arid Zone*, 40(1):1-11.

Svoboda, M., D. LeComte, M. Hayes, R. Heim, K. Gleason, J. Angel, B. Rippey, R. Tinker, M. Palecki, D. Stooksbury, D. Miskus, and S. Stevens. 2002. An introduction to the Drought Monitor. *The Bulletin of the American Meteorological Society*, 83(8): 1181-1190.

Wu, H., M. Hayes, A. Weiss, and Q. Hu. 2001. An evaluation of the Standardized Precipitation Index, China-Z Index, and statistical Z-Score. *International Journal of Climatology*, 21: 745-758.

Edited Book

Trnka, M. and M. Hayes, co-editors, 2015. Evaluation of Drought and Drought Impacts through Interdisciplinary Methods. The Global Change Research Center, Brno, Czech Republic, 99 pp. ISBN: 978-80-87902-12-7.

Chapters in Books and Technical Reports

Hayes, M., M. López Pérez, J. Andreu, M. Svoboda, B. Fuchs, N. Engle, 2016. Perspectives from the Outside: Contributions to the Drought Paradigm Shift in Brazil from Spain, Mexico, and the United States. In: E. DeNys, N. Engle, A. Magalhães, eds., Drought in Brazil: Proactive Management and Policy, Taylor and Francis Publishers, pp. 81-90.

Heim R., M. Brewer, R. Pulwarty, D. Wilhite, M. Hayes, and M. Sivakumar, 2016. Drought Early Warning and Information Systems. In: S. Eslamian, ed., Handbook of Drought and Water Scarcity, Taylor and Francis (In Press).

Okalebo, J. A., Oglesby, R. J., Feng, S., Hubbard, K., Kilic, A., Hayes, M., Hays, C., 2016. An Evaluation of the Community Land Model [Version 3.5] and Noah Land Surface Models for Temperature and Precipitation over Nebraska [Central Great Plains]: Implications for Agriculture in Simulations of Future Climate Change and Adaptation. In: Filho, W. L., H. Musa, G. Cavan, P. O'Hare, and J. Seixas, eds., Innovation in Climate Change Adaptation, Springer International Publishing, pp. 21-34.

Smith, K, C. Stiles, M. Hayes, and C. Carparelli, 2016. Support for Drought Response and Community Preparedness: Filling the Gaps between Plans and Action. In: K. Miller, A. Hamlet, D. Kenney, K. Redmond, eds., Western Water Policy and Planning in a Variable and Changing Climate, Taylor and Francis, pp. 123-139.

Wall, N., and M. Hayes, 2016. Drought and Health in the Context of Public Engagement. In: S. Steinberg and W. Sprigg, eds., Extreme Weather, Health and Communities: Interdisciplinary Engagement Strategies, Springer, pp. 219-244.

Hayes, M., 2015. Recent Lessons in Drought Risk Management. In: M. Trnka and M. Hayes, eds., Evaluation of Drought and Drought Impacts through Interdisciplinary Methods. The Global Change Research Center, Brno, Czech Republic, pp. 69-76.

Fuchs, B., M. Svoboda, D. Wilhite, and M. Hayes. 2014. Drought Indices for Drought Risk Assessment in a Changing Climate. In: Handbook of Engineering Hydrology Vol. 2: Modeling Climate Changes and Variability, S. Eslamian, ed., Taylor and Francis, pp. 217-232.

McNutt, C., M. Hayes, L. Darby, J. Verdin, and R. Pulwarty. 2013. Developing Early Warning and Drought Risk Reduction Strategies. In: L. Botterill and G. Cockfield, eds., Science for Decision Making Under Uncertainty: Drought Risk Management and Policy, CRC Press/Taylor and Francis Publishers, pp. 151-170.

Hayes, M. 2012. The Drought Risk Management Paradigm in the Context of Climate Change. In: *Climate Change Impacts, Vulnerability, and Adaptation in the Midwest*, S. Pryor, ed., University of Indiana Press, pp. 212-225.

Hayes, M. J., M. D. 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*, B. Wardlow, M. Anderson, and J. Verdin, eds., Taylor and Francis, pp. 1-19.

Tadesse, T., B. D. Wardlow, M. D. Svoboda, M. J. Hayes. 2012. Predicting Remote Sensing Based Seasonal Greenness: the Vegetation Outlook (VegOut). In: *Remote Sensing of Drought: Innovative Approaches to Monitoring*, B. Wardlow, M. Anderson, and J. Verdin, eds., Taylor and Francis, pp. 75-94.

Wilhite, D. A., M. J. Hayes, and M. Svoboda. 2012. Drought. *Encyclopedia of Environmetrics*. Abdel H. El-Shaarawi and Walter P. Piegorsch, editors. John Wiley and Sons (In Press).

Ferguson, D., C. Alvord, M. Crimmins, M. H. Redsteer, M. Hayes, C. McNutt, R. Pulwarty, M. Svoboda. 2011. Drought Preparedness for Tribes in the Four Corners Region. Report from April 2010 Workshop. Tucson, AZ: Climate Assessment for the Southwest.

Hayes, M., D. Wilhite, M. Svoboda, and M. Trnka. 2011. Investigating the Connections between Climate Change, Drought, and Agricultural Production. In: *Handbook on Climate Change and Agriculture*, R. Mendelsohn and A. Dinar, eds., Edward Elgar Publishing Ltd., pp. 73-86.

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. NASA White Paper, NASA Headquarters, Hydrology and Agricultural Applications Branch, Washington, D.C.

Tadesse, T., B. D. Wardlow, and M. J. Hayes. 2009. The application of data mining for drought monitoring and prediction. pp. 280-291. In H. Rahman (ed.) *Data Mining Applications for Empowering Knowledge Societies*. Information Science Reference (IGI Global), Hershey, PA.

Hayes, M. and M. Svoboda. 2008. An assessment of drought management activities in Morocco prepared for USAID's Integrated Agriculture and Agribusiness Project. Office of Economic Growth, USAID Morocco.

Hayes, M., C. Alvord, and J. Lowrey. 2007. Drought indices. Intermountain West Climate Summary, 3(6): 2-6.

Hayes, M. and M. Svoboda. 2007. An assessment of drought management activities in Morocco prepared for USAID's Integrated Agriculture and Agribusiness Project. Office of Economic Growth, USAID Morocco.

Rosenberg, N., V. Mehta, M. Hayes, C. Knutson, and M. Sittler. 2007. Decadal climate information needs of stakeholders and policymakers in the Missouri River Basin: a report of the elicitation trip to Nebraska, 11-14 December 2006. NOAA Climate Program Office, Sectoral Applications Research Program.

Rosenberg, N., V. Mehta, R. Olsen, H. Von Storch, M. Hayes, and D. Wilhite. 2007. Societal adaptation to decadal climate variation in the U.S. *Eos* 88(43): October 2007.

Tadesse, T., B. Wardlow, and M. Hayes. 2007. The application of data mining for drought monitoring and prediction. In: *Data Mining Applications for Empowering Knowledge Societies*, H. Rahman, ed., Idea Group, Inc., Hershey, PA.

Knutson, C.L., M.J. Hayes, R. K. Hitchcock, J. Peake, and M. Kleinschmit. 2006. Sustainable adaptations to drought and climate variability in agricultural production systems across Nebraska: Final Report to NOAA's Human Dimensions of Global Change Research (HDGCR) Program. Grant Number NA040AR4310080.

Knutson, C.L., M.D. Svoboda, and M.J. Hayes. 2006. Analyzing Tribal Drought Management: A Case Study of the Hualapai Tribe. Quick Response Report #183, Natural Hazards Research and Applications Information Center, University of Colorado, Boulder [<http://www.colorado.edu/hazards/research/qr/qr183/qr183.html>].

Tadesse, T., D.A. Wilhite, M.J. Hayes, J.F. Brown, and C.L. Knutson. 2006. Modern drought monitoring tool for decision support system. In: A. Anttiroiko and M. Malkia (eds.) *Encyclopedia of Digital Government*, Volume 3. pp. 1212 – 1218. Idea Group Reference. Hershey, PA.

Thomas D., O.V. Wilhelmi, and M.J. Hayes. 2006. Disaster reduction, drought, and the mountain resort community. In: T. Clark, A. Gill, and R. Hartmann (eds.) *Mountain Resort Planning and Development in an Era of Globalization*. pp.221-233. Cognizant Communication Corporation. New York.

Hayes, M. J., C. L. Knutson, and Q. Hu. 2005. Multiple-year droughts in Nebraska. NebGuide. University of Nebraska Cooperative Extension Service.

Hayes, M., M. Svoboda, D. LeComte, K. Redmond, and P. Pasteris. 2005. Drought Monitoring: New Tools for the 21st Century. In: *Drought and Water Crises: Science, Technology, and Management Issues*, D. Wilhite, ed., CRC Press.

Knutson, C., M. Hayes, and T. Tadesse. 2005. Stakeholder Group Discussions for Evaluation of the USGS Drought Monitoring Website and VegDRI Mapping Tool. NDMC Report to the USGS/EROS Data Center, Sioux Falls, SD.

Steinemann, A., M. Hayes, and L. Cavalcanti. 2005. Drought Indicators and Triggers. In: *Drought and Water Crises: Science, Technology, and Management Issues*, D. Wilhite, ed., CRC Press.

Wilhelmi, O.V., D. S. K. Thomas, and M. J. Hayes. 2005. Colorado Resort Communities and the 2002-2003 Drought: Impacts and Lessons Learned. Quick Response Report #174, Natural Hazards Research and Applications Information Center, University of Colorado, Boulder [<http://www.colorado.edu/hazards/research/qr/qr174/qr174.html>].

Wilhite, D. A., M. J. Hayes, and C. Knutson. 2005. Drought Preparedness Planning: Building Institutional Capacity. In: *Drought and Water Crises: Science, Technology, and Management Issues*, D. Wilhite, ed., CRC Press.

Wilhite, D. A., M. D. Svoboda, and M. J. Hayes. 2005. Monitoring Drought in the United States: Status and Trends. In: *Monitoring and Predicting Agricultural Drought: A Global Study*, V. J. Boken, A. P. Cracknell, and R. L. Heathcote, eds., Oxford University Press.

Hayes, M. and D. Wilhite. 2003. Drought Management. In: *Encyclopedia of Water Science*, B.A. Stewart and T.A. Howell, eds., Marcel Dekker, Inc., New York, pp. 170-172. (Invited, peer-reviewed).

Knutson, C. and M. Hayes. 2001. South Carolina drought mitigation and response assessment: 1998-2000 drought. Quick Response Report #136, Natural Hazards Research and Applications Information Center, University of Colorado, Boulder [<http://www.colorado.edu/UCB/Research/IBS/hazards/qr/qr136/qr136.html>].

Conference Proceedings and Poster Presentations

Okalebo, J., B. Wienhold, A. Suyker, G. Erickson, M. Hayes, T. Awada, 2015. "The Platte River –High Plains (PR-HPA) Long-Term Agro-Ecosystem Research (LTAR) Network –Data and Technological Resources to Address Current and Emerging Issues in Agroecosystems.," AGU, San Francisco, California, December 18, 2015.

Okalebo J., K. Hubbard, A. Kilic, R. Oglesby, and M. Hayes, 2015. An Evaluation of In-Season Water Stress Sensitivity Using a Multiplicative Evapotranspiration - Grain Yield Model for *Zea mays* L. Growing in Mead, Nebraska. American Water Resources Association. 2015 Summer Specialty Conference. Climate Change Adaptation, New Orleans, Louisiana, June 15 - 17, 2015.

Okalebo J., Hubbard K., Kilic A., Oglesby R. and M. Hayes. 2013. In-season water stress sensitivity of *Zea mays* L. Mead NE. Poster presentation: Too Hot, Too Wet, Too Dry: Building Resilient Agroecosystems May 5-8 at the 2013 Water for Food Conference, Lincoln, NE.

Hayes, M. 2011. Delivering Drought Information Services to the Great Plains and the World. Proceedings of the UNL Climate, Water and Ecosystems: Shaping the Great Plains Conference, October 11, 2011.

Hayes, M. 2011. Delivering Drought Information Services to the World: Activities of the National Drought Mitigation Center. Proceedings of COST 734 Final Conference, Topolcianky, Slovakia, May 4-5, 2011.

Hayes, M. 2011. The Drought Interest Group: Lessons Learned from 16 Years of Delivering Drought Information Services to the World. Proceedings of the Open Science Conference of the World Climate Research Program, Denver, CO, October 24-28, 2011.

Hayes, M., C. Bergman, D. Bathke, J. Nothwehr, N. Wall, M. Svoboda, T. Bernadt, and J. Robine, 2011. Engaging Drought Decision-Makers across the United States. Proceedings of COST 734 Final Conference, Topolciansky, Slovakia, May 4-5, 2011.

Knutson, C. L., V. M. Mehta, N. Rosenberg, J. R. Olsen, N. A. Wall, T. K. Bernadt, and M. J. Hayes. 2011. Potential Applications of Decadal Climate Predictions in Water and Agriculture Sectors in the Missouri River Basin, Proceedings of the UNL Climate, Water and Ecosystems: Shaping the Great Plains Conference, October 11, 2011.

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.

Tadesse, T., B. D. Wardlow, M. J. Hayes, M. D. Svoboda, J. Li, C. C. Poulsen, and K. Callahan. 2010. Predicting general vegetation condition using different scenarios over the central U.S. Second Annual International Conference of "Water for Food: Growing More with Less", May 2-5, 2010, Lincoln, Nebraska.

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.

Tadesse, T., 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. 90th Annual American Meteorological Society Annual Meeting, Atlanta, GA, January 17-21.

Dubrovsky, M., M. Trnka, P. Hlavinka, M. Hayes, M. Svoboda, and Z. Zalud. 2009. Development and Use of the Stochastic Climate Change Scenario Generator. *American Geophysical Union Annual Meeting*, San Francisco, CA, December 14-18, 2009.

Hayes, M.. 2009. Corn and Climate Report. B. Jordan, D. Kluck, D. Mock, P. Schulz, G. Takle, and S. Wash, eds. *Corn and Climate Workshop*, Ames, IA, September 10, 2008.

Hayes, M., M. Svoboda, B. Fuchs, S. Scott, K. Smith, C. Knutson, and B. Wardlow. 2009. Drought Services: Activities and Tools at the National Drought Mitigation Center. *American Meteorological Society's 18th Conference on Applied Climatology*. January 17-21, 2010, Atlanta, GA.

Hlavinka, P., M. Trnka, J. Balek, Z. Zalud, M. Hayes, M. Svoboda, and J. Eitzinger. 2009. Modeling of Soil Water Content and Soil Temperature at Selected U.S. and Central

European Stations Using SoilClim Model. European Geophysical Union General Assembly, Vienna, Austria, April 19-24, 2009.

Svoboda, M.D., M.J. Hayes, C. Knutson, and B.D. Wardlow. 2009. A Look into the National Drought Mitigation Center: Providing 15 Years of "Drought Services". American Geophysical Union Annual Meeting, San Francisco, CA, December 14-18.

Zalud, Z., M. Trnka, P. Hlavinka, M. Svoboda, M. Hayes, M. Dubrovsky, D. Semeradova, E. Hunt, and J. Eitzinger. 2009. Soil Climate over U.S. High Plains and Central Europe During 21st Century--Trends and Consequences. American Geophysical Union Annual Meeting, San Francisco, CA, December 14-18, 2009.

Dubrovsky, M., M. Hayes, M. Svoboda, M. Trnka, D. Wilhite, and Z. Zalud. 2008. Future global drought conditions in terms of the Palmer Drought Indices. European Geophysical Union Annual Meetings, Vienna, Austria, April.

Dubrovsky, M., M. Trnka, M. Hayes, M. Svoboda, D. Semeradova, L. Metelka, and P. Hlavinka. 2008. Performance of an interpolated stochastic weather generator in Czechia and Nebraska. American Geophysical Union Annual Meetings, San Francisco, CA, December.

Svoboda, M., K. Smith, M. Sittler, S. Scott, J. Li, M. Hayes, D. Wood, D. Gutzmer, and M. Melvin. 2008. Drought impact reporting in the United States: giving the Drought Impact Reporter a face lift. *American Meteorological Society. Proceedings of the 17th Conference on Applied Climatology*, Whistler, British Columbia, Canada, August.

Trnka, M., M. Svoboda, M. Hayes, P. Hlavinka, M. Dubrovsky, D. Semeradova, and E. Hunt, 2008. Projections of soil climate during the 21st Century over the United States High Plains region with a focus on Nebraska. American Geophysical Union Annual Meetings, San Francisco, CA, December.

Dubrovsky, M., M. Svoboda, M. Trnka, M. Hayes, D. Wilhite, and Z. Zalud. 2007. Multi-GCM projections of global drought conditions with the use of the Palmer Drought Indices. American Geophysical Union Annual Meetings, San Francisco, CA, December.

Hayes, M., M. Trnka, M. Svoboda, P. Hlavinka, J. Balek, M. Dubrovsky, D. Wilhite, E. Pokorny, L. Bartosova, and J. Eitzinger. 2007. Understanding regional climate change consequences through the changes in soil moisture regimes. American Geophysical Union Annual Meetings, San Francisco, CA, December.

Higgins, M., M. Hayes, M. Svoboda, D. Wilhite, and D. Wood. 2006. The Drought Impact Reporter: A web-based national drought impacts reporting tool. *AWRA Spring Specialty Conference*, Houston, TX, May 8-10, 2006.

Trnka, M., M. Dubrovsky, D. Semeradova, Z. Zalud, M. Svoboda, M. Hayes, and D. Wilhite. 2006. Assessment of regional drought climatology: the Czech Republic as a case study. *Proceedings of the European Geophysical Union*. Vienna, Austria, April 1.

Brown, J., T. Tadesse, and M. Hayes. 2005. The Role of Remote Sensing in Improving Drought Decision Support. Proceedings of the Pecora Conference, Sioux Falls, SD, October 25.

Hayes, M., M. Dubrovsky, M. Trnka, M. Svoboda, D. Wilhite, Z. Zalud, and D. Semeradova. 2005. Application of Drought Indices for the Changed Climate. Proceedings of the American Geophysical Union, San Francisco, CA, December 7.

Hayes, M. M. Svoboda, M. Higgins, D. Wilhite, and D. Wood. 2005. The Drought Impact Reporter: A Web-based Drought Impacts Reporting Tool. Proceedings of the American Geophysical Union, San Francisco, CA, December 7.

Dubrovsky, M., M. Trnka, M. Svoboda, M. Hayes, D. Wilhite, Z. Zalud, and D. Semeradova. 2005. Drought Conditions in the Czech Republic in Present and Changed Climate. Proceedings of the European Geophysical Union, Vienna, Austria, June 15.

Dubrovsky, M., M. Trnka, M. Svoboda, M. Hayes, D. Wilhite, Z. Zalud, and D. Semeradova. 2005. Application of Three Drought Indices to Assess Impact of Climate Change on Drought Conditions. Proceedings of the European Meteorological Society, Utrecht, Netherlands, September 15.

Svoboda, M. and M. Hayes. 2005. A Web-based National Drought Impacts Reporting Tool. Proceedings of the 15th Conference on Applied Climatology, Savannah, GA, June 14.

Trnka, M., Z. Zalud, D. Semeradova, M. Dubrovsky, M. Svoboda, M. Hayes, D. Wilhite, and M. Mozny. 2005. Drought Occurrence Under Present and Future Climate. Proceedings of the Water and Plants: Challenges for Improved Production Conference, Stuttgart, Germany, September 27-29, p. 215-216.

Wilhite D. and M. Hayes. 2005. Drought Management: Moving from Crisis to Risk Management. Proceedings of the Rocky Mountain Mineral Law Foundation, Portland, OR, July 23.

Zalud, Z., M. Trnka, M. Dubrovsky, M. Svoboda, M. Hayes, M. Mozny, D. Semeradova, and P. Hlavinka. 2005. Methodology for Assessment of Drought Episodes Under Present and Expected Climate Conditions. Proceedings of the 15th Czech Bioclimatological Conference, Kotiny-Brno, Czech Republic, September 12-14, p. 91.

Hayes, M. J., M. D. Svoboda, C. L. Knutson, and D. A. Wilhite. 2004. Estimating the Economic Impacts of Drought. Proceedings of the 14th Conference on Applied Climatology, Seattle, WA, January 11-15.

Svoboda, M. D., M. J. Hayes, D. A. Wilhite, and T. Tadesse. 2004. Recent Advances in Drought Monitoring. Proceedings of the 14th Conference on Applied Climatology, Seattle, WA, January 11-15.

Svoboda, M. D. and M. J. Hayes. 2004. Drought Assessment: The U.S. Drought Monitor and Beyond. Proceedings of the International Conference on Drought and Drought Monitoring in Agriculture, Vienna, Austria, June 7.

Tadesse, T., J. F. Brown, and M. J. Hayes. 2003. Assessing and Monitoring Drought with Climate, Satellite, and Other Geophysical Data Sets Using Data Mining Techniques. Proceedings of the 30th International Symposium on Remote Sensing of Environment, Honolulu, HI, November 10-14.

Tadesse, T., J. F. Brown, and M. J. Hayes. 2003. Modeling Drought with Climate, Satellite, and Other Land Data Sets Using Data Mining Techniques. Proceedings of the 7th World Multi-Conference on Systemics, Cybernetics, and Informatics, Orlando, FL, July 27-30, p. 198-201.

Waltman, W. J., S. Goddard, S. E. Reichenbach, M. D. Svoboda, M. J. Hayes, and J. S. Peake. 2003. Patterns and Trends of Soil Climate Regimes and Drought Events in the Northern Great Plains. Papers of the Applied Geography Conferences, 26: 333-342.

Hayes, M. 2002. Public Health Impacts of Drought. Proceedings of the 16th International Conference on Biometeorology, Kansas City, MO, October 28-November 1, 2002.

Hayes, M. and M. Svoboda. 2002. Determining Drought Severity and Extent: the U. S. National Drought Monitor. Proceedings of the 16th International Conference on Biometeorology, Kansas City, MO, October 28-November 1, 2002.

Hayes, M., M. Svoboda, W. Waltman, S. Goddard, and K. Hubbard. 2002. Monitoring Droughts with Improved Resolution. Proceedings of the 13th Conference on Applied Climatology, Portland, OR, May 13-16, 2002, p. 207-208.

Svoboda, M., M. Hayes, and R. Tinker. 2002. Three Years and Counting: What's New with the Drought Monitor? Proceedings of the 13th Conference on Applied Climatology, Portland, OR, May 13-16, 2002, p. 223-226.

Tadesse, T., M. Hayes, D. Wilhite, and S. Harms. 2002. Data Mining and Knowledge Discovery of Drought in Nebraska. Proceedings of the 16th International Conference on Biometeorology, Kansas City, MO, October 28-November 1, 2002.

Hayes, M. 2001. Equipping Your Personal Drought Monitoring Tool Box. Proceedings of the American Society of Civil Engineers Conference, Houston, TX, October 11-13, 2001.

STATION PROJECTS

M. Shulski, M. Hayes, and D. Wilhite. Development of a Climate Impact Reporter for the U.S. Great Plains. 2013-2018. NEB 38-097.

D. Wilhite and M. Hayes. Drought Management: Mitigation, Planning, and Policy Options. 2007-2012. NEB-38-054.

D. Wilhite and M. Hayes. Drought: Response and Policy Implications. 2001-2006. NEB-27-007.

PRESENTATIONS

2015

18 “invited” presentations

8 volunteer presentations

2014

17 “invited” presentations

3 volunteer presentations

2013

32 “invited” presentations

2012

21 “invited” presentations

2011

19 “invited” presentations

3 conference poster presentations

2010

19 “invited” presentations

2 volunteer presentations

1 conference poster presentation

2009

14 “invited” presentations

1 volunteer presentation

2008

16 “invited” presentations

3 NDMC-organized workshop presentations

2 volunteer presentations

1 conference poster presentation

2007

12 “invited” presentations

2 drought workshop presentations (organized by the Mni Sose Intertribal Water Rights Coalition)

2006

11 “invited” presentations

12 NDMC-organized workshop presentations

4 conference poster presentations

2005

16 “invited” presentations
4 NDMC-organized workshop presentations
2 conference oral presentations

2004

12 “invited” presentations
4 NDMC-organized workshop presentations
2 conference oral presentations

NDMC-ORGANIZED WORKSHOPS (NATIONAL)*

2011

Chicago, IL: June 8-9

2010

Lincoln, NE: November 15-16

2009

Kansas City, MO: April 27-28

Helena, MT: June 24-25

Austin, TX: October 7-8

Lincoln, NE: December 8-11

2008

Kansas City, MO: June 18-19

Maui, HI: June 24

Hawaii, HI: June 26

Lincoln, NE: October 20-24

2007

Rapid City, SD: April 11

Portland, OR: October 10-11

2006

El Reno, OK: March 8-9

DeKalb, IL: March 13-14

Roswell, NM: May 23

North Platte, NE: June 5

Chadron, NE: June 6

2005

Billings, MT: February 22-23

Kansas City, MO: March 24

Washington, D.C.: March 28

2004

Flagstaff, AZ: June 29-30

*Includes my involvement with organization and participation

INTERNATIONAL PROGRAM ACTIVITIES

Drought Planning/Policy Workshops

Dresden, Germany, 11/16*
Basseterre, St. Kitts, 3/16*
St. Johns, Antigua and Barbuda, 2/16*
Castries, Saint Lucia, 1/16*
Budapest, Hungary, 9/97
Cuernavaca, Mexico, 10/98*
Recife, Brazil, 12/98
Fortaleza, Brazil, 12/98
Budapest-Felsögöd, Hungary, 4/00
Culiacán, Mexico, 5/00*
Rabat, Morocco, 2/01
Prague, Czech Republic, 5/03
Vienna, Austria, 6/04
Bamako, Mali, 9/09*

*Workshops organized by the NDMC

Visiting Scientists

Since the beginning of 2009, the NDMC has hosted visiting scientists for extended stays from Japan, Korea, China, India, Ethiopia, Australia, Slovakia, Czech Republic, Spain, and the Netherlands.

Recent International Travel

- 2016. **Germany.** Worked with the German Weather Service to organize and conduct a drought workshop for central Europe in Dresden in November.
- 2016. **Lebanon.** Worked with the International Centre for Biosaline Agriculture to organize and conduct stakeholder engagement meetings in Beirut in October.
- 2016. **Jordan.** Worked with the International Centre for Biosaline Agriculture to organize and conduct stakeholder engagement meetings in Amman in October.
- 2016. **St. Kitts.** Worked with the Caribbean Institute of Meteorology and Hydrology to organize and conduct a drought policy workshop in March.
- 2016. **Saint Lucia.** Worked with the Caribbean Institute of Meteorology and Hydrology to organize and conduct a drought policy workshop in January.
- 2015. **Austria.** Participated within the AgroDroughtAustria project workshop in November.
- 2015. **Switzerland.** Participated as a member in the Advisory Committee for the Integrated Drought Management Programme in September.
- 2015. **Czech Republic.** Visiting scientist at Mendel University in Brno in February, June, and November, and organizer of the InterDrought Summer School held in Mikoluv in June.
- 2014. **Switzerland.** Participated as a member in the Advisory Committee for the Integrated Drought Management Programme in September.
- 2014. **Brazil.** Invited by Sebrae in Recife, Pernambuco, to make several presentations on drought and meet with drought managers and officials in August.
- 2014. **Czech Republic.** Visiting scientist at Mendel University in Brno, and organizer of the

- InterDrought Summer School held in Mikoluv in June.
2013. **Sweden.** Participated in a World Water Week Seminar sponsored by the Daugherty Water for Food Institute, as well as attended a meeting of the organizing committee for the Integrated Drought Management Programme, held in Stockholm in September.
 2013. **Austria and Czech Republic.** Hosted as a visiting scientist for 10 weeks during May and June at Mendel University in Brno, Czech Republic. Also participated in an interdisciplinary climate change resilience conference hosted by CzechGlobe and participated within the InterDrought Summer School held in Telc.
 2013. **Switzerland.** Made multiple presentations at the High-Level Meeting on National Drought Policy held at the United Nations in Geneva in March.
 2012. **India.** As part of a delegation involving University of Nebraska and Daugherty Water for Food Institute officials, met with officials of the Indian Agricultural Research Institute (IARI) and visited field sites where climate change adaptation projects are taking place, November 12-15.
 2012. **Czech Republic.** Met with scientists involved in the large interdisciplinary drought project (InterDrought), August 27-29.
 2012. **China.** Participated in an international climate change and drought conference and met with officials of several universities and governmental organizations and made multiple presentations, June 1-9.
 2012. **Austria and Czech Republic.** Met with scientists and participated in the Scientific Advisory Board meeting for the interdisciplinary climate change project, CzechGlobe, May 10-16.
 2012. **India.** As part of a delegation involving University of Nebraska and Daugherty Water for Food Institute officials, participated and presented at a meeting taking place at the Indian Agricultural Research Institute (IARI) in Delhi, May 7-8.
 2012. **Italy.** Served on the Steering Committee organizing the Global Drought Information System Workshop held in Frascati and participated within the Workshop, April 11-13.
 2011. **China.** Met with officials of several universities and governmental organizations and made multiple presentations, July 5-8.
 2011. **Australia.** Participated in a drought workshop at the University of Canberra, May 27-28.
 2011. **Slovakia and Czech Republic.** Participated and presented in the COST 734 Final Conference, and met with collaborators at Mendel University in Brno, Czech Republic, May 2-6.
 2010. **Switzerland.** Participated in the Consultation Meeting on the Integrated Drought Management Programme hosted by the World Meteorological Organization and held in Geneva, November 15-16.
 2010. **Brazil.** Attended the Second International Conference on Climate, Sustainability, and Development in Semi-Arid Regions held in Fortaleza, August 16-20.
 2009. **Mali.** Drought Monitor Workshop, Bamako, Mali, September 14-17.
 2008. **Australia.** Joint USA-Australia Drought Workshop: "Drought in a Changing Climate, Sharing Management Approaches", Canberra, Australia, November 17-19.
 2007. **Morocco.** Worked with USAID to make an assessment of Morocco's drought management strategies. Two trips: August 20-29 and December 1-15.
 2006. **Spain.** Participated in the Mediterranean Drought Forum in Madrid, February 14.
 2005. **China.** Participated in the China-U.S. Drought Monitoring and Assessment Workshop in Beijing, November 15-17.

2005. **Bermuda.** Participated in the Workshop on Assessing, Modeling, and Monitoring the Impacts of Extreme Climate Events in Hamilton, October 13-14.
2004. **Austria.** Participated in the “Drought and Drought Monitoring in Agriculture” international workshop in Vienna, June.
2004. **Czech Republic.** Participated in discussions related to the NATO Science Program project with colleagues from Mendel University and had a meeting at the Hydrometeorological Institute in Prague, June.

STUDENTS

Served on M.S. Committees for:

Polly Ann Najarian (2000)
 James George (2001, UNO)
 Melissa Melvin (2006)
 Jeff Nothwehr (2007)
 Prabhakar Shrestha (2009)
 Amir Vafa (2010)
 Jeff Henson (2013)
 Chris Carparelli (2014, advisor)
 Shrikanth Kondabolu (2014, advisor)
 Brian Monk (2015)
 Eric Holley (2016)
 Joe Robine (current, co-advisor)
 Aaron Greuel (current)
 Marketa Podebradska (current, advisor)
 Xeng Du (current)

Served on Ph.D. Committees for:

Olga Wilhelmi (1999)
 Tsegaye Tadesse (2002)
 Hong Wu (2002)
 Patrick Guinan (2004, University of Missouri-Columbia)
 Donna Woudenberg (2006)
 Yacoubou Tawaye (2007)
 Sharmistha Swain (2012)
 George Limpert (2013)
 Hussain Alsarraf (2013)
 Crystal Bergman (2014, advisor)
 Jane Okalebo (2014)
 Eric Hunt (2015)
 Mark Svoboda (2016)
 Matthew Collier (current, University of Oklahoma)
 Nicole Wall (current)
 Juliana Dai (current)
 Natalie Umphlett (current)
 Stonie Cooper (current)
 Zion Schell (current)

Elliot Wickham (current, advisor)
Azar Abadi (current)
Tonya Haigh (current)
Sabrina Jauernic (current)

PROFESSIONAL SERVICE

Member, 2016-present, SNR Teaching Structure Subcommittee.
Member, 2015-present, WMO Commission on Agricultural Meteorology Expert Team.
Member, 2015-present, ARD Advisory Committee.
Chair, 2015-present, National Drought Mitigation Center Director Search Committee.
Member, 2015-present, Daugherty Water for Food Institute Executive Director Search Committee.
Member, 2015-2015, SNR 5-Year Review Planning Committee.
Member, 2014-present, Integrated Drought Management Programme Advisory Committee.
Member, 2013-2014, Daugherty Water for Food Institute 2014 Conference Steering Committee.
Contact, 2013-present, Ph.D. and M.S. Climate Assessment and Impacts Specializations for Natural Resource Sciences.
Member, 2012-2013, NIDIS Carolinas Pilot Steering Committee.
Member, 2012-2013, NIDIS Chesapeake Bay Pilot Steering Committee.
Co-Chair, 2012-2014, Center for Great Plains Studies 2014 Symposium Steering Committee.
Member, 2011-2015, Global Drought Information System Workshops Steering Committee.
Member, 2011-present, Scientific Advisory Board, CzechGlobe project in the Czech Republic.
Co-Chair, 2009-present, National Integrated Drought Information System (NIDIS) Program Implementation Team.
Member, 2009-present, NIDIS Engaging the Preparedness Communities Working Group.
Member, 2009-2013, SCIPP RISA Stakeholder Services Committee.
Member, 2007-present, Nebraska Climate Assessment and Response Committee.
Member, 2013, Micrometeorologist Position Search Committee.
Member, 2012-2013, Daugherty Water for Food Institute 2013 Conference Steering Committee.
Member, 2012-2013, SNR Director Search Advisory Committee.
Leader, 2012, Applied Climate Science Faculty Area.
Member, 2012, National Drought Forum Steering Committee, held in Washington, D.C., December 11-12.
Member, 2012, Global Drought Information System Workshop Steering Committee, held in Frascati, Italy, April 11-13.
Co-Convener, 2010, AGU Fall Meeting Session on Drought and Food Security.
Faculty Member, 2010, Summer Institute on Climate Change held in Lincoln, May 11-13.
Member, 2006-2009, NIDIS Program Implementation Team.
Co-Chair, 2006-2009, NIDIS Engaging the Preparedness Communities Working Group.
Board Member, 2007-2010, Center for Great Plains Studies Board of Governors.
Member, 2009-2010, Nominating Committee, Center for Great Plains Studies.
Member, 2007-2009, Scholarship Committee, Center for Great Plains Studies.
Reviewer, March 2007, National Research Council Review Team for the Climate Change Science Program's Synthesis and Assessment Product 3.3: Weather and Climate Extremes in a Changing Climate.
Co-Chair, 2006-2009, Engaging the Preparedness Communities Working Group, National

Integrated Drought Information System.
Member, 2007-2009, Integration Advisory Team, School of Natural Resources, University of Nebraska-Lincoln.
Member, 2006-2012, Promotion and Tenure Committee, School of Natural Resources, University of Nebraska-Lincoln.
Member, 2001-2008, Outreach Committee, School of Natural Resources, University of Nebraska-Lincoln.
Co-Chair, 2003-2004, Stakeholder Processes and Needs Working Group, WGA/NOAA National Integrated Drought Information System.
Member, 2003-2004, WGA/NOAA National Integrated Drought Information System Core Team.
Member, 2003-2004, WGA/NOAA National Integrated Drought Information System Interdisciplinary Team.
Member, 2001-2005, Web Site Development Subcommittee, Interim National Drought Council.
Member, 2001-2005, Monitoring and Prediction Subcommittee, Interim National Drought Council.
Co-author, 1999-2005, U.S. Drought Monitor (<http://drought.unl.edu/dm/>).
Co-author, 2002-2005, North American Drought Monitor (<http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/>)
Member, 2000-present, Nebraska Risk Assessment Committee.
NDMC Liaison, 1998-present, Nebraska Agriculture, Natural Resources, and Wildlife Subcommittee.
NDMC Liaison, 1998-present, Nebraska Municipal Water Supply, Health, and Energy Subcommittee.
Member, 1996-present, Nebraska Water Availability and Outlook Committee.
Member, 1999-2000, Agriculture Working Group, National Drought Policy Commission.
Member, 1997-1999, Preparedness and Mitigation Working Group, Western Drought Coordination Council.