

## **Derek M. Heeren, Ph.D., P.E.**

Associate Professor and Irrigation Engineer  
Daugherty Water for Food Global Institute Faculty Fellow  
Biological Systems Engineering, University of Nebraska–Lincoln  
239 L.W. Chase Hall; Lincoln, NE 68583  
<https://bse.unl.edu/faculty/derek-heeren>

### **Section 1 Education and Employment History**

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#### **Section 1.1 Education History**

- Ph.D., Biosystems Engineering, Oklahoma State University (July 2012)  
Dissertation: Subsurface phosphorus transport and scale dependent phosphorus leaching in alluvial floodplains  
Advisors: Garey A. Fox and Daniel E. Storm
- M.S., Engineering, South Dakota State University (May 2008)  
Emphasis: Agricultural and Biosystems Engineering  
Thesis: Evaluation of deficit irrigation strategies for corn  
Advisors: Hal D. Werner and Todd P. Trooien
- B.S., Agricultural and Biosystems Engineering, South Dakota State University, May 2004  
Emphasis: Soil and Water Resources Engineering

#### **Section 1.2 Engineering Licensure**

Professional Engineer in State of Oklahoma, 2012-present (PE No.: 25541)

#### **Section 1.3 Employment History**

##### University of Nebraska – Lincoln

- *Associate Professor and Irrigation Engineer*, Department of Biological Systems Engineering (2018 – present), 58% Research, 40% Teaching, 2% Service
- *Daugherty Water for Food Global Institute (DWFII) Faculty Fellow* (2014 – present)
- *Assistant Professor and Irrigation Engineer*, Department of Biological Systems Engineering (2012 – 2018), 58% Research, 40% Teaching, 2% Service

##### Oklahoma State University

- *Research Engineer*, Department of Biosystems and Agricultural Engineering (2008 – 2012)

##### South Dakota State University

- *Graduate Research Assistant*, Department of Agricultural and Biosystems Engineering (2006 – 2008)

##### SCI Engineering, Inc., St. Charles, MO

- *Laboratory Supervisor* (2005 – 2006)
- *Engineering Field Technician* (2004 – 2005)

## Section 1.4 Career Summary

### Research

- Overarching goal: Improve both the sustainability of water resources and the profitability of agricultural production in Nebraska and internationally
- Current research interests: Irrigation management in the Great Plains, sprinkler irrigation, variable rate irrigation, irrigation management based on remote sensing and machine learning, international irrigation development, and vadose zone hydrology
- Previous research interests: Subsurface phosphorus transport, streambank erosion, surface water-groundwater interaction, and deficit irrigation management
- 60 refereed journal articles
- 1,693 citations; h-index = 25 (Google Scholar)
- 30k downloads (UNL Digital Commons)

### Teaching

- Overarching goal: Prepare students to be wise managers of irrigation, agricultural systems technology, and water resources
- Focus: Irrigation management in the Great Plains, including undergraduate and graduate programs
- 1 textbook and 1 instructor kit (<https://asabe.org/ism>)
- Courses taught currently: Irrigation Systems Management, Advanced Irrigation Management, Irrigation Laboratory and Field Course, and Equipment Systems
- Courses taught previously: Modeling Vadose Zone Hydrology, Soil Conservation and Watershed Management, Fluvial Hydraulics, and Mechanics of Materials
- Global engagement: Irrigation and Agricultural Water Management (IAWM) Education Coordinator (DWFI) to make our educational programs available to an international audience
- Founded and advised the UNL Fountain Wars student club, which won two national championships

## **Section 2 Research Accomplishments**

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### **Section 2.1 Publication Record**

*The following superscripts are used to indicate student co-authors*

*1: Undergraduate Research Assistant under my supervision*

*2: M.S. student under my supervision*

*3: Ph.D. student under my supervision*

*4: Post-Doctoral Research Associate under my supervision*

#### Section 2.1.1 Peer-Reviewed Journal Publications in Print

1. Bhatti<sup>3</sup>, S., Heeren, D. M., O'Shaughnessy, S. A., Neale, C. M. U., LaRue, J. L., Melvin, S. R., Wilkening<sup>1</sup>, E. J., & Bai, G. 2023. Toward automated irrigation management with integrated crop water stress index and spatial soil water balance. *Precision Agriculture*. <https://doi.org/10.1007/s11119-023-10038-4>
2. Gonzalez, H. A., Qiao, X., D'Alessio, M., Dissanayake, D. M. P. B., Heeren, D. M., Biswas, S., Williams, C. F., & Ray, C. 2023. Growing corn and sugar beet with feedlot effluent, air injection, and subsurface drip irrigation system in Western Nebraska. *Journal of Irrigation and Drainage Engineering* 149(3): 04023001. <https://doi.org/10.1061/JIDEDH.IRENG-9949>

3. Timilsina, A. P., Baigorria, G.A., Wilhite, D., Shulski, M., Heeren, D. M., Romero, C., & Fenstereifer, C. 2023. Soybean response under climatic scenarios with changed mean and variability under rainfed and irrigated conditions in major soybean growing states of the United States. *Journal of Agricultural Science* 1–18. <https://doi.org/10.1017/S0021859623000011>
4. Katimbo, A., Rudnick, D. R., Zhang, J., Ge, Y., DeJonge, K. C., Franz, T. E., Shi, Y., Liang, W., Qiao, X., Heeren, D. M., Kabenge, I., Nakabuye, H. N., & Duan, J. 2023. Evaluation of artificial intelligence algorithms with sensor data assimilation in estimating crop evapotranspiration and crop water stress index for precision irrigation water management. *Smart Agricultural Technology* 4. <https://doi.org/10.1016/j.atech.2023.100176>
5. Koehler-Cole, K., Elmore, R. W., Blanco, H., Francis, C. A., Shapiro, C. A., Proctor, C., Ruis, S., Irmak, S., & Heeren, D. M. 2023. Cover crop planting practices determine their performance in USA Corn Belt systems. *Agronomy Journal*. <https://doi.org/10.1002/agj2.21247>
6. Nakabuye, H. N., Rudnick, D. R., DeJonge, K. C., Lo, T., Heeren, D. M., Qiao, X., Franz, T. E., Katimbo, A., & Duan, J. 2022. Real-time irrigation scheduling of maize using Degrees Above Non-Stressed (DANS) Index in semi-arid environment. *Agricultural Water Management* 274. <https://doi.org/10.1016/j.agwat.2022.107957>
7. Bhatti<sup>3</sup>, S., Heeren, D. M., Evett, S. R., O’Shaughnessy, S. A., Neale, C. M. U., Rudnick, D. R., Franz, T. E., & Ge, Y. 2022. Crop response to thermal stress without yield loss in irrigated maize and soybean in Nebraska. *Agricultural Water Management* 274. <https://doi.org/10.1016/j.agwat.2022.107946>
8. Maguire, M. S., Neale, C. M. U., Woldt, W. E., & Heeren, D. M. 2022. Managing spatial irrigation using remote-sensing-based evapotranspiration and soil water adaptive control model. *Agricultural Water Management* 272. <https://doi.org/10.1016/j.agwat.2022.107838>
9. Bhatti<sup>3</sup>, S., Heeren, D. M., O’Shaughnessy, S. A., Evett, S. R., Maguire, M. S., Kashyap<sup>2</sup>, S. P., & Neale, C. M. U. 2022. Comparison of stationary and mobile canopy sensing systems for irrigation management of maize and soybean in Nebraska. *Applied Engineering in Agriculture* 38(2): 331-342. <https://doi.org/10.13031/aea.14945>
10. Singh<sup>3</sup>, J., Ge, Y., Heeren, D. M., Walter-Shae, E., Neale, C. M. U., Irmak, S., & Maguire, M. S. 2022. Unmanned aerial system-based data ferrying over a sensor node station network in maize. *Sensors* 22: 1863. <https://doi.org/10.3390/s22051863>
11. Abimbola, O. P., Franz, T. E., Rudnick, D. R., Heeren, D. M., Yang, H., Wolf, A., Katimbo, A., & Nakabuye, H. N. 2022. Improving crop modeling to better simulate maize yield variability under different irrigation managements. *Agricultural Water Management* 262. <https://doi.org/10.1016/j.agwat.2021.107429>
12. Heeren, D. M., Guertault, L., & Mankin, K. R. 2021. Preferential flow in riparian buffers: Current research and future needs. Perspective article. *Transactions of the ASABE* 64(6): 1907-1911. <https://doi.org/10.13031/trans.14732>
13. Singh<sup>3</sup>, J., Ge, Y., Heeren, D. M., Walter-Shea, E. A., Neale, C. M. U., Irmak, S., Woldt, W. E., Bai, G., Bhatti, S., & Maguire, M. M. 2021. Inter-relationships between water depletion and temperature differential in row crop canopies in a sub-humid climate. *Agricultural Water Management* 256. <https://doi.org/10.1016/j.agwat.2021.107061>
14. Zhang, J., Guan, K., Peng, B., Pan, M., Zhou, W., Jiang, C., Kimm, H., Franz, T. E., Grant, R., Yang, Y., Rudnick, D. R., Heeren, D. M., Suyker, A., Bauerle, W., & Miner, G. 2021. Sustainable irrigation based on co-regulation of soil water supply and atmospheric

- evaporative demand. *Nature Communications* 12:5549. <https://doi.org/10.1038/s41467-021-25254-7>
15. Zhang, J., Guan, K., Peng, B., Pan, M., Zhou, W., Grant, R., Franz, T. E., Rudnick, D. R., Heeren, D. M., Suyker, A., Yang, Y., & Wu, G. 2021. Assessing different plant-centric water stress metrics for irrigation efficacy using soil-plant-atmosphere-continuum simulation. *Water Resources Research* 57. <https://doi.org/10.1029/2021WR030211>
  16. Liang, W., Qiao, X., Possignolo, I. P., DeJonge, K. C., Irmak, S., Heeren, D. M., & Rudnick, D. R. 2021. Utilizing digital image processing and two source energy balance model for the estimation of evapotranspiration of dry edible beans in western Nebraska. *Irrigation Science* 39: 617-631. <https://doi.org/10.1007/s00271-021-00721-7>
  17. Zhang, J., Guan, K., Peng, B., Jiang, C., Zhou, W., Yang, Y., Pan, M., Franz, T. E., Heeren, D. M., Rudnick, D. R., Abimbola, O., Kimm, H., Caylor, K., Good, S., Khanna, M., Gates, J., & Cai, Y. 2021. Challenges and opportunities in precision irrigation decision-support systems for center pivots. *Environmental Research Letters* 16: 053003. <https://doi.org/10.1088/1748-9326/abe436>
  18. Evett, S. R., Colaizzi, P. D., Lamm, F. R., O'Shaughnessy, S. A., Heeren, D. M., Trout, T. J., Kranz, W. L., & Lin, X. 2020. Past, present and future of irrigation on the U.S. Great Plains. *Transactions of the ASABE* 63(3): 703-729. <https://doi.org/10.13031/trans.13620>
  19. Chavez, J. L., Torres-Rua, A. F., Woldt, W. E., Zhang, H., Robertson, C., Marek, G. W., Wang, D., Heeren, D. M., Taghvaeian, S., & Neale, C. M. U. 2020. A decade of unmanned aerial systems in irrigated agriculture in the Western U.S. *Applied Engineering in Agriculture* 36(4): 423-436. <https://doi.org/10.13031/aea.13941>
  20. Lo, T., Rudnick, D. R., DeJonge, K. C., Bai, G., Nakabuye, H. N., Katimbo, A., Ge, Y., Franz, T. E., Qiao, X., & Heeren, D. M. 2020. Differences in soil water changes and canopy temperature under varying water  $\times$  nitrogen sufficiency for maize. *Irrigation Science* 38: 519-534. <https://doi.org/10.1007/s00271-020-00683-2>
  21. Barker<sup>4</sup>, J. B., Woldt, W. E., Wardlow, B. D., Maguire, M. S., Leavitt, B. C., Neale, C. M. U., & Heeren, D. M. 2020. Calibration of a common shortwave multispectral camera system for quantitative agricultural applications. *Precision Agriculture* 21: 922-935. <https://doi.org/10.1007/s11119-019-09701-6>
  22. Bhatti<sup>2</sup>, S., Heeren, D. M., Barker<sup>4</sup>, J. B., Neale, C. M. U., Woldt, W. E., Maguire, M. S., & Rudnick, D. R. 2020. Site-specific irrigation management in a sub-humid climate using a spatial evapotranspiration model with satellite and airborne imagery. *Agricultural Water Management* 230. <https://doi.org/10.1016/j.agwat.2019.105950>
  23. Singh<sup>3</sup>, J., Heeren, D. M., Rudnick, D. R., Woldt, W. E., Bai, G., Ge, Y., & Luck, J. D. 2020. Soil structure and texture effects on the precision of soil water content measurements with a capacitance-based electromagnetic sensor. *Transactions of the ASABE* 63(1): 141-152. <https://doi.org/10.13031/trans.13496>
  24. Franz, T. E., Pokal, S., Gibson, J. P., Zhou, Y., Gholizadeh, H., Tenorio, F. A., Rudnick, D. R., Heeren, D. M., McCabe, M., Ziliani, M., Jin, Z., Guan, K., Pan, M., Gates, J., & Wardlow, B. D. 2020. The role of topography, soil, and remotely sensed vegetation condition towards predicting crop yield. *Field Crops Research* 252. <https://doi.org/10.1016/j.fcr.2020.107788>
  25. Lo, T., Rudnick, D. R., Singh, J., Nakabuye, H. N., Katimbo, A., Heeren, D. M., & Ge, Y. 2020. Field assessment of interreplicate variability from eight electromagnetic soil moisture sensors. *Agricultural Water Management* 231. <https://doi.org/10.1016/j.agwat.2019.105984>

26. Koehler-Cole, K., Elmore, R. W., Blanco-Canqui, H., Francis, C. A., Shapiro, C. A., Proctor, C. A., Ruis, S., Heeren, D. M., Irmak, S., & Ferguson, R. B. 2020. Cover crop productivity and subsequent soybean yield in the Western Corn Belt. *Agronomy Journal* 112: 2649–2663. <https://doi.org/10.1002/agj2.20232>
27. Barker<sup>4</sup>, J. B., Bhatti<sup>2</sup>, S., Heeren, D. M., Neale, C. M. U., & Rudnick, D. R. 2019. Variable rate irrigation of maize and soybean in West-Central Nebraska under full and deficit irrigation. *Frontiers in Big Data* 2(34). <https://doi.org/10.3389/fdata.2019.00034>
28. Halihan, T., Miller, R. B., Correll, D., Heeren, D. M., & Fox, G. A. 2019. Field evidence of a natural capillary barrier in a gravel alluvial aquifer. *Vadose Zone Journal* 18:180008. <https://doi.org/10.2136/vzj2018.01.0008>
29. O’Shaughnessy, S. A., Evett, S. R., Colaizzi, P. D., Andrade, M. A., Marek, T. H., Heeren, D. M., Lamm, F. R., & LaRue, J. L. 2019. Identifying advantages and disadvantages of variable rate irrigation – an updated review. *Applied Engineering in Agriculture* 35(6): 837-852. <https://doi.org/10.13031/aea.13128>
30. Lo, T., Rudnick, D. R., Krienke, B. T., Heeren, D. M., Ge, Y., & Shaver, T. M. 2019. Water effects on optical canopy sensing for late-season site-specific nitrogen management of maize. *Computers and Electronics in Agriculture* 162: 154-164. <https://doi.org/10.1016/j.compag.2019.04.006>
31. Mendes, W. R., Araújo, F. M. U., Dutta, R., & Heeren, D. M. 2019. Fuzzy control system for variable rate irrigation using remote sensing. *Expert Systems with Applications* 124: 13-24. <https://doi.org/10.1016/j.eswa.2019.01.043>
32. Finkenbinder, C. E., Franz, T. E., Gibson, J. P., Heeren, D. M., & Luck, J. D. 2019. Integration of hydrogeophysical datasets and empirical orthogonal functions for improved irrigation water management. *Precision Agriculture*, 20(1): 78-100. <https://doi.org/10.1007/s11119-018-9582-5>
33. Barker<sup>3</sup>, J. B., Heeren, D. M., Neale, C. M. U., & Rudnick, D. R. 2018. Evaluation of variable rate irrigation using a remote-sensing-based model. *Agricultural Water Management* 203: 63-74. <https://doi.org/10.1016/j.agwat.2018.02.022>
34. Barker<sup>3</sup>, J. B., Neale, C. M. U., Heeren, D. M., & Suyker, A. E. 2018. Evaluation of a hybrid reflectance-based crop coefficient and energy balance evapotranspiration model for irrigation management. *Transactions of the ASABE* 61(2): 533-548. <https://doi.org/10.13031/trans.12311>
35. Barker<sup>3</sup>, J. B., Heeren, D. M., Koehler-Cole, K., Shapiro, C. A., Blanco-Canqui, H., Elmore, R. W., Proctor, C. A., Irmak, S., Francis, C. A., Shaver, T. M., & Mohammed, A. T. 2018. Cover crops have negligible impact on soil water in Nebraska maize-soybean rotation. *Agronomy Journal* 110: 1-13. <https://doi.org/10.2134/agronj2017.12.0739>
36. Freiberger<sup>2</sup>, R. P., Heeren, D. M., Eisenhauer, D. E., Mittelstet, A. R., & Baigorria, G. A. 2018. Tradeoffs in model performance and effort for long-term phosphorus leaching based on in situ field data. *Vadose Zone Journal* 17:170216. <https://doi.org/10.2136/vzj2017.12.0216>
37. Miller, K. A., Luck, J. D., Heeren, D. M., Lo<sup>2</sup>, T., Martin, D. L., & Barker<sup>2</sup>, J. B. 2018. A geospatial variable rate irrigation control scenario evaluation methodology based on mining root zone available water capacity. *Precision Agriculture*. <https://doi.org/10.1007/s11119-017-9548-z>
38. Lo<sup>2</sup>, T., Heeren, D. M., Mateos, L., Luck, J. D., Martin, D. L., Miller, K. A., Barker<sup>3</sup>, J. B., & Shaver, T. M. 2017. Field characterization of field capacity and root zone available water

- capacity for variable rate irrigation. *Applied Engineering in Agriculture* 33(4): 559-572. <https://doi.org/10.13031/aea.11963>
39. Barker<sup>3</sup>, J. B., Franz, T. E., Heeren, D. M., Neale, C. M. U., & Luck, J. D. 2017. Soil water content monitoring for irrigation management: A geostatistical analysis. *Agricultural Water Management* 188: 36-49. <https://doi.org/10.1016/j.agwat.2017.03.024>
  40. Heeren, D. M., Fox, G. A., Penn, C. J., Halihan, T., Storm, D. E., & Haggard, B. E. 2017. Impact of macropores and gravel outcrops on phosphorus leaching at the plot scale in silt loam soils. *Transactions of the ASABE* 60(3): 823-835. <https://doi.org/10.13031/trans.12015>
  41. Lo<sup>2</sup>, T., Heeren, D. M., Martin, D. L., Mateos, L., Luck, J. D., & Eisenhauer, D. E. 2016. Pumpage reduction by using variable rate irrigation to mine undepleted soil water. *Transactions of the ASABE* 59(5): 1285-1298. <https://doi.org/10.13031/trans.59.11773>
  42. Miller, R. B., Heeren, D. M., Fox, G. A., Halihan, T., & Storm, D. E. 2016. Heterogeneity influences on stream water-groundwater interactions in a gravel-dominated floodplain. *Hydrological Sciences Journal* 61(4): 741-750. <https://doi.org/10.1080/02626667.2014.992790>
  43. Heeren, D. M., Fox, G. A., & Storm, D. E. 2015. Heterogeneity of infiltration rates in alluvial floodplains as measured with a berm infiltration technique. *Transactions of the ASABE* 58(3): 733-745. <https://doi.org/10.13031/trans.58.11056>
  44. Heeren, D. M., Fox, G. A., & Storm, D. E. 2014. Technical note: Berm method for quantification of infiltration at the plot scale in high conductivity soils. *Journal of Hydrologic Engineering* 19(2): 457-461. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0000802](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000802)
  45. Penn, C. J., Heeren, D. M., Fox, G. A., & Kumar, A. 2014. Application of isothermal calorimetry to the study of phosphorus sorption onto soils in a flow-through system. *Soil Science Society of America Journal* 78(1): 147-156. <https://doi.org/10.2136/sssaj2013.06.0239>
  46. Heeren, D. M., Fox, G. A., Fox, A. K., Storm, D. E., Miller, R. B., & Mittelstet, A. R. 2014. Divergence and flow direction as indicators of subsurface heterogeneity and stage-dependent storage in alluvial floodplains. *Hydrological Processes* 28(3): 1307-1317. <https://doi.org/10.1002/hyp.9674>
  47. Miller, R. B., Heeren, D. M., Fox, G. A., Halihan, T., Storm, D. E., & Mittelstet, A. R. 2014. The hydraulic conductivity structure of gravel-dominated vadose zones within alluvial floodplains. *Journal of Hydrology* 513: 229-240. <https://doi.org/10.1016/j.jhydrol.2014.03.046>
  48. Midgley, T. L., Fox, G. A., Wilson, G. V., Heeren, D. M., Langendoen, E., & Simon, A. 2013. Seepage-induced streambank erosion and instability: In situ constant-head experiments. *Journal of Hydrologic Engineering* 18(10): 1200-1210. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0000685](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000685)
  49. Midgley, T. L., Fox, G. A., Wilson, G. V., Felice, R. M., & Heeren, D. M. 2013. *In situ* soil pipeflow experiments on contrasting streambank soils. *Transactions of the ASABE* 56(2): 479-488. <https://doi.org/10.13031/2013.42685>
  50. Heeren, D. M., Mittelstet, A. R., Fox, G. A., Storm, D. E., Al-Madhhachi, A. T., Midgley, T. L., Stringer, A. F., Stunkel, K. B., & Tejral, R. D. 2012. Using rapid geomorphic assessments to assess streambank stability in Oklahoma Ozark streams. *Transactions of the ASABE* 55(3): 957-968. <https://doi.org/10.13031/2013.41527>

51. Midgley, T. L., Fox, G. A., & Heeren, D. M. 2012. Evaluation of the Bank Stability and Toe Erosion Model (BSTEM) for predicting lateral retreat on composite streambanks. *Geomorphology* 145-146: 107-114. <https://doi.org/10.1016/j.geomorph.2011.12.044>
52. Penn, C. J., McGrath, J. M., Fox, G. A., Rounds, E. W., & Heeren, D. M. 2012. Trapping phosphorus in runoff with a phosphorus removal structure. *Journal of Environmental Quality* 41(3): 672-679. <https://doi.org/10.2134/jeq2011.0045>
53. Heeren, D. M., Trooien, T. P., Werner, H. D., & Klocke, N. L. 2011. Development of deficit irrigation strategies for corn using a yield ratio model. *Applied Engineering in Agriculture* 27(4): 605-614. <https://doi.org/10.13031/2013.38207>
54. Heeren, D. M., Fox, G. A., Miller, R. B., Storm, D. E., Mittelstet, A. R., Fox, A. K., Penn, C. J., & Halihan, T. 2011. Stage-dependent transient storage of phosphorus in alluvial floodplains. *Hydrological Processes* 25(20): 3230-3243. <https://doi.org/10.1002/hyp.8054>
55. Mittelstet, A. R., Heeren, D. M., Storm, D. E., Fox, G. A., White, M. J., & Miller, R. B. 2011. Comparison of subsurface and surface runoff phosphorus transport rates in alluvial floodplains. *Agriculture, Ecosystems and Environment* 141: 417-425. <https://doi.org/10.1016/j.agee.2011.04.006>
56. Miller, R. B., Heeren, D. M., Fox, G. A., Storm, D. E., & Halihan, T. 2011. Design and application of a direct-push vadose zone gravel permeameter. *Ground Water* 49(6): 920-925. <https://doi.org/10.1111/j.1745-6584.2010.00796.x>
57. Fox, G. A., Heeren, D. M., Miller, R. B., Mittelstet, A. R., & Storm, D. E. 2011. Flow and transport experiments for a streambank seep originating from a preferential flow pathway. *Journal of Hydrology* 403: 360-366. <https://doi.org/10.1016/j.jhydrol.2011.04.014>
58. Fox, G. A., Heeren, D. M., & Kizer, M. A. 2011. Evaluation of a stream-aquifer analysis test for deriving reach-scale streambed conductance. *Transactions of the ASABE* 54(2): 473-479. <https://doi.org/10.13031/2013.36450>
59. Heeren, D. M., Miller, R. B., Fox, G. A., Storm, D. E., Halihan, T., & Penn, C. J. 2010. Preferential flow effects on subsurface contaminant transport in alluvial floodplains. *Transactions of the ASABE* 53(1): 127-136. <https://doi.org/10.13031/2013.29511>
60. Fox, G. A., Heeren, D. M., Wilson, G. V., Langendoen, E. J., Fox, A. K., & Chu-Agor, M. L. 2010. Numerically predicting seepage gradient forces and erosion: Sensitivity to soil hydraulic properties. *Journal of Hydrology* 389(3-4): 354-362. <https://doi.org/10.1016/j.jhydrol.2010.06.015>

#### Section 2.1.2 Peer-Reviewed Journal Publications Accepted for Publication With or Without Revision

1. None at this time.

#### Section 2.1.3 Peer-Reviewed Journal Publications in Review or Revisions

1. Kashyap<sup>2</sup>, S. P., Heeren, D. M., Maguire, M. S., Woldt, W. E., Irmak, S., Bhatti<sup>3</sup>, S., Singh<sup>3</sup>, J., Shi, Y., & Neale, C. M. U. 2023. Diurnal soybean water stress computed using statistical-based thermal indices with high-frequency unmanned aircraft flights. *Journal of Natural Resources and Agricultural Ecosystems*.
2. Chandra<sup>2</sup>, A., Heeren, D. M., Odhiambo, L., & Brozovic, N. 2023. Water-energy-food linkages in shared smallholder irrigation schemes. *Agricultural Water Management*.

#### Section 2.1.4 Conference Proceedings Papers

1. Li, J., Ge, Y., Puntel, L., Heeren, D. M., Balboa, G. R., & Shi, Y. 2023. Combining machine learning with a mechanistic model to estimate maize nitrogen content from UAV-acquired hyperspectral imagery. SPIE Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping VIII conference, Tallahassee, Fla. 7 pages.  
<http://dx.doi.org/10.1117/12.2663817>
2. Hillyer, C. C., Peters, R. T., Qiao, X., Heeren, D. M., LaRue, J. L., Prestwich, C., & Bhatti<sup>3</sup>, S. 2021. Sprinkler irrigation system field checklist. Joint ASABE and Irrigation Association (IA) Decennial National Irrigation Symposium, Paper No. 20-061, San Diego, Calif. 4 pages. Available at: <https://digitalcommons.unl.edu/biosysengfacpub/779/>.
3. Wilkening<sup>1</sup>, E. J., Heeren, D. M., Hallum, D., Schellpeper, J., & Martin, D. L. 2021. Impact of irrigation technologies on withdrawals and consumptive use of water. ASABE Annual International Meeting (virtual), Paper No. 2101114. 11 pages. Available at: <https://digitalcommons.unl.edu/biosysengfacpub/765/>.
4. Singh<sup>3</sup>, J., Heeren, D. M., Ge, Y., Bai, G., Neale, C. M. U., Maguire, M. S., & Bhatti<sup>3</sup>, S. 2021. Sensor-based irrigation of maize and soybean in East-Central Nebraska under a sub-humid climate. ASABE Annual International Meeting (virtual), Paper No. 21001044. 12 pages. Available at: <https://digitalcommons.unl.edu/biosysengfacpub/763/>.
5. Banda<sup>2</sup>, M. M., Heeren, D. M., Martin, D. L., Munoz-Arriola, F., & Hayde, L. G. 2019. Economic analysis of deficit irrigation in sugarcane farming: Nchalo Estate, Chikwawa District, Malawi. ASABE Annual International Meeting, Paper No. 1900852, Boston, Mass. 19 pages. Available at: <https://digitalcommons.unl.edu/biosysengfacpub/607/>.
6. Martin, D. L., Heeren, D. M., Melvin, S. R., & Ingram, T. 2019. Effect of limited water supplies on center pivot performance. Central Plains Irrigation Association (CPIA) Central Plains Irrigation Conference, Kearney, Nebr. 27 pages. Available at: <https://digitalcommons.unl.edu/biosysengpres/76/>.
7. Li<sup>2</sup>, J., Zang, W., Li, Y., Heeren, D. M., & Yan, H. 2018. Comparison of nitrogen fertigation management strategies for center-pivot irrigated maize in the sub-humid area of China. ASABE Annual International Meeting, Paper No. 1801036, Detroit, Mich. 9 pages.
8. Woldt, W. E., Neale, C. M. U., Heeren, D. M., Frew, E., & Meyer, G. E. 2018. Improving agricultural water efficiency with unmanned aircraft. Association for Unmanned Vehicle Systems International (AUVSI) XPONENTIAL trade show and conference, Denver, Colo. 8 pages.
9. Barker<sup>3</sup>, J. B., Heeren, D. M., & Neale, C. M. U. 2016. Perspectives on VRI prescription map development with satellite imagery. CPIA Central Plains Irrigation Conference, Kearney, Nebr. 9 pages.
10. Lo<sup>2</sup>, T., Heeren, D. M., & Luck, J. D. 2016. Spatial mapping of root zone water holding capacity for site-specific management. CPIA Central Plains Irrigation Conference, Kearney, Nebr. 7 pages.
11. Barker<sup>3</sup>, J. B., Neale, C. M. U., & Heeren, D. M. 2015. Evaluation of a hybrid remote sensing evapotranspiration model for variable rate irrigation management – revised. Joint ASABE and Irrigation Association (IA) Irrigation Symposium, Paper No. 2147813, Long Beach, Calif. 10 pages.
12. Lo<sup>2</sup>, T. H., Heeren, D. M., Mateos, L., Luck, J. D., Martin, D. L., & Eisenhauer, D. E. 2015. Potential irrigation reductions from increasing precipitation utilization with variable rate irrigation. Joint ASABE and Irrigation Association (IA) Irrigation Symposium, Paper No. 152141446, Long Beach, Calif. 13 pages.

13. Freiburger<sup>2</sup>, R. P., Heeren, D. M., Fox, G. A., Penn, C. J., & Eisenhauer, D. E. 2014. Finite element modeling of long-term phosphorus leaching through macropores in the Ozark ecoregion. ASABE Annual International Meeting, Paper No. 141897543, Montreal, Quebec, Canada. 20 pages.
14. Lo<sup>2</sup>, T. H., Mateos, L., Heeren, D. M., & Luck, J. D. 2014. The applicability of VRI for managing variability in infiltration capacity and plant-available water: A preliminary discussion and GIS study. ASABE Annual International Meeting, Paper No. 141897710, Montreal, Quebec, Canada. 8 pages.
15. Miller, K. A., Lo<sup>2</sup>, T. H., Luck, J. D., & Heeren, D. M. 2014. Combining site specific data with geospatial analysis to identify variable rate irrigation opportunities in irrigated agricultural fields. ASABE Annual International Meeting, Paper No. 141896808, Montreal, Quebec, Canada. 8 pages.
16. Freiburger<sup>2</sup>, R. P., Heeren, D. M., & Fox, G. A. 2013. Finite element modeling of phosphorus leaching through floodplain soils dominated by preferential flow pathways. ASABE Annual International Meeting, Paper No. 1583250, Kansas City, Mo. 9 pages.
17. Heeren, D. M., Fox, G. A., Storm, D. E., Haggard, B. E., Penn, C. J., & Halihan, T. 2013. Impact of Measurement Scale on Infiltration and Phosphorus Leaching in Ozark Floodplains. ASABE Annual International Meeting, Paper No. 1621213, Kansas City, Mo. 16 pages.
18. Penn, C. J., Heeren, D. M., & Fox, G. A. 2013. Phosphorus sorption and desorption from soils under flow-through conditions: An investigation of the use of thermal heat patterns as indicators of the degree, mechanisms, and kinetics of sorption reactions. ASABE Annual International Meeting, Paper No. 1621201, Kansas City, Mo. 14 pages.
19. Heeren, D. M., Fox, G. A., Storm, D. E., Storm, P. Q., Haggard, B. E., Halihan, T., & Miller, R. B. 2012. Quantification and heterogeneity of infiltration and transport in alluvial floodplains. ASABE Annual International Meeting, Paper No. 121337097, Dallas, Tex. 20 pages.
20. Heeren, D. M., Fox, G. A., & Storm, D. E. 2012. New berm method to quantify infiltration and transport rates at the plot scale for high hydraulic conductivity soils. ASABE Annual International Meeting, Dallas, Tex. 10 pages.
21. Midgley, T. L., Fox, G. A., Wilson, G. V., Heeren, D. M., Simon, A., & Langendoen, E. J. 2011. Stream bank erosion and instability induced by groundwater seepage: Little Topashaw Creek watershed field experiments. ASABE Annual International Meeting, Louisville, Ky. 21 pages.
22. Heeren, D. M., Mittelstet, A. R., Fox, G. A., & Storm, D. E. 2011. Assessing streambank stability of Oklahoma Ozark streams with rapid geomorphic assessments. ASCE World Environmental and Water Resources Congress, Palm Springs, Calif. 10 pages.
23. Midgley, T. L., Fox, G. A., & Heeren, D. M. 2011. Evaluation of the Bank Stability and Toe Erosion Model (BSTEM) for predicting lateral streambank retreat in Ozark streams. ASCE World Environmental and Water Resources Congress, Palm Springs, Calif. 10 pages.
24. Al-Madhhachi, A. T., Hamad, S. N., & Heeren, D. M. 2011. A new technique to improve the emission uniformity for trickle irrigation systems. ASCE World Environmental and Water Resources Congress, Palm Springs, Calif. 10 pages.
25. Mittelstet, A. R., Heeren, D. M., Storm, D. E., Fox, G. A., White, M. J., & Miller, R. B. 2010. Comparison of subsurface and surface runoff phosphorus transport capacities in alluvial floodplains. ASABE TMDL Meeting, Baltimore, Md. 9 pages.

26. Heeren, D. M., Miller, R. B., Fox, G. A., Storm, D. E., Mittelstet, A. R., & Penn, C. J. 2010. Impact of preferential flow paths on alluvial groundwater flow patterns and phosphorus transport. ASABE Annual International Meeting, Paper No. 1008729, Pittsburgh, Pa. 16 pages.
27. Miller, R. B., Heeren, D. M., Fox, G. A., Storm, D. E., Halihan, T., & Mittelstet, A. R. 2010. Geophysical mapping of preferential flow paths across multiple floodplains. ASABE Annual International Meeting, Paper No. 1008730, Pittsburgh, Pa. 22 pages.
28. Heeren, D. M., Miller, R. B., Fox, G. A., Storm, D. E., Fox, A. K., & Mittelstet, A. R. 2010. Impact of preferential flow paths on stream and alluvial groundwater interaction. ASCE World Environmental and Water Resources Congress, Providence, R.I. 12 pages.
29. Miller, R. B., Heeren, D. M., Fox, G. A., Halihan, T., Storm, D. E., & Mittelstet, A. R. 2010. Use of multi-electrode resistivity profiling to estimate saturated- and vadose-zone hydraulic properties of preferential flow paths in alluvial floodplains. ASCE World Environmental and Water Resources Congress, Providence, R.I. 11 pages.
30. Fox, G. A., Heeren, D. M., & Kizer, M. A. 2010. Evaluation of alluvial well depletion analytical solutions from a stream-aquifer analysis test along the North Canadian River in Oklahoma. ASCE World Environmental and Water Resources Congress, Providence, R.I. 10 pages.
31. Heeren, D. M., Miller, R. B., Fox, G. A., Storm, D. E., Penn, C. J., & Halihan, T. 2009. Preferential flow path effects on subsurface contaminant transport in alluvial floodplains. ASABE Annual International Meeting, Paper No. 095995, Reno, Nev. 10 pages.
32. Heeren, D. M., Fox, G. A., Chu-Agor, M., & Wilson, G. V. 2009. Predicting streambank seepage flows: Sensitivity to soil properties and layering. ASCE EWRI World Environmental and Water Resources Congress, Kansas City, Mo. 10 pages.
33. Heeren, D. M., Werner, H. D., & Trooien, T. P. 2008. Evaluation of deficit irrigation strategies for corn. IA Show, Anaheim, Calif. 15 pages.
34. Heeren, D. M., Werner, H. D., & Trooien, T. P. 2007. Evaluation of irrigation strategies with the DSSAT Cropping System Model. ASABE North Central Intersectional Conference, Paper No. RRV-07132, Fargo, N.D. 13 pages.

#### Section 2.1.5 Conference Presentations without a Proceedings Paper (since 2018)

1. Wilkening<sup>2</sup>, E. J., Heeren, D. M., Shi, Y., Katimbo, A., Amori, P. N., Balboa, G. R., Puntel, L. A., Zhang, K., & Rudnick, D. R. July 9-12, 2023. Development of a scalable edge-cloud computing based variable rate irrigation scheduling framework. ASABE Annual International Meeting, Omaha, Nebr. Poster presentation.
2. Katimbo, A., Rudnick, D. R., DeJonge, K. C., Taghvaeian, S., Qiao, X., & Nakabuye, H. N. July 9-12, 2023. A Step towards employing machine learning in developing decision support systems for real-time irrigation scheduling. ASABE Annual International Meeting, Omaha, Nebr.
3. Li, J., Ge, Y., Bai, G., Luck, J. D., Puntel, L. A., Balboa, G. R., Gamon, J. A., Arkebauer, T. J., & Shi, Y. July 9-12, 2023. Advancing the use of UAS-based hyperspectral imaging for nitrogen content estimation and stress detection. ASABE Annual International Meeting, Omaha, Nebr.
4. Wang, L., Li, J., Zhao, B., Baenziger, P. S., Puntel, L. A., K. Frels, Heeren, D. M., Ge, Y., & Shi, Y. July 17-20, 2022. Improve leaf area index estimation with multimodal UAV-derived plant traits. ASABE Annual International Meeting, Houston, Tex.

5. Bhatti<sup>3</sup>, S., Heeren, D. M., S. O'Shaughnessy, A., Neale, C. M. U., LaRue, J., Melvin, S. R., Wilkening, E. J., & Bai, G. July 17-20, 2022. Application of a decision support system and spatial evapotranspiration model for site-specific irrigation management of corn and soybean in Nebraska. ASABE Annual International Meeting, Houston, Tex.
6. Wilkening<sup>1</sup>, E. J., Heeren, D. M., & Boldt, A. L. July 17-20, 2022. Cyclic failure of water pressure regulators in variable rate irrigation applications. ASABE Annual International Meeting, Houston, Tex.
7. Nakabuye, H. N., Rudnick, D. R., DeJonge, K. C., Lo, T., Franz, T. E., Qiao, X., Heeren, D. M., Katimbo, A., & Duan, J. July 17-20, 2022. Machine learning derived non-stressed canopy temperature for thermal baseline development and irrigation management of maize in semi-arid environments. ASABE Annual International Meeting, Houston, Tex.
8. Lamm, F. R., Aguilar, J. P., Porter, D. O., & Heeren, D. M. July 17-20, 2022. Subsurface drip irrigation, mobile drip irrigation, and the legacy of Freddie Lamm. ASABE Annual International Meeting, Houston, Tex.
9. Kashyap<sup>2</sup>, S. P., Heeren, D. M., Woldt, W. E., Irmak, S., Shi, Y., Neale, C. M. U., Maguire, M. S., Bhatti<sup>3</sup>, S., & Singh<sup>2</sup>, J. October 19, 2021. High-frequency unmanned aircraft flights for crop canopy imaging during diurnal moisture stress. South Dakota Student Water Conference, Brookings, S.D.
10. Bhatti<sup>3</sup>, S., Heeren, D. M., O'Shaughnessy, S. A., Neale, C. M. U., Dorsey, N., Ge, Y., Woldt, W. E., & Maguire, M. S. July 12-14, 2021. Comparison of stationary and mobile canopy sensing systems for irrigation management of corn and soybean in Nebraska. ASABE Annual International Meeting (virtual).
11. Singh<sup>3</sup>, J., Ge, Y., Heeren, D. M., Bai, G., Neale, C. M. U., Woldt, W. E., Maguire, M. S., & Kashyap<sup>1</sup>, S. P. July 12-14, 2021. Unmanned aerial vehicle data mule over a sensor node station network in maize and soybean. ASABE Annual International Meeting (virtual).
12. Wilkening<sup>1</sup>, E. J., Heeren, D. M., Ingram, T., Melvin, S. R., Nygren, A., Martin, D. L., Rudnick, D. R., Burr, C., & Mamo, M. July 13-15, 2020. Analyzing operating pressure and application uniformity of center pivot irrigation systems. ASABE Annual International Meeting (virtual). Poster presentation.
13. Singh<sup>3</sup>, J., Ge, Y., Bai, G., Heeren, D. M., Walter-Shea, E. A., Neale, C. M. U., Irmak, S., Bhatti<sup>3</sup>, S., Woldt, W. E., & Maguire, M. S. July 13-15, 2020. Capturing variability in maize and soybean stress using infrared thermometers and soil water content sensors. ASABE Annual International Meeting (virtual).
14. Bhatti<sup>3</sup>, S., Goncalves, I. Z., Neale, C. M. U., & Heeren, D. M. July 13-15, 2020. Forecasting irrigation management using spatial evapotranspiration model in maize fields in Nebraska. ASABE Annual International Meeting (virtual). Poster presentation.
15. Richardson<sup>1</sup>, J. L., Eisenhauer, D. E., Boldt, A. L., Heeren, D. M., Martin, D. L., Maguire, M. S., Wilkening<sup>1</sup>, E. J., Bhatti<sup>3</sup>, S., Hayde, L., & Singh<sup>2</sup>, J. July 13-15, 2020. Comparing uniform and variable catch can spacing for uniformity tests on center pivot sprinkler systems. ASABE Annual International Meeting (virtual). Poster presentation.
16. Chandra<sup>2</sup>, A., Brozovic, N., Odhiambo, L., & Heeren, D. M. July 13-15, 2020. Water-energy linkage in smallholder shared center pivot irrigation: A case study in Rwanda. ASABE Annual International Meeting (virtual).
17. Abimbola, O., Franz, T. E., Heeren, D. M., & Rudnick, D. R. July 13-15, 2020. Developing a scalable real-time sensing and decision-support cyber-physical system for irrigation management. ASABE Annual International Meeting (virtual).

18. Abimbola, O., Franz, T. E., Heeren, D. M., Rudnick, D. R., & Wolf, A. July 13-15, 2020. Simulating maize yield response to irrigation and nitrogen using crop modeling. ASABE Annual International Meeting (virtual).
19. Nakabuye, H. N., Rudnick, D. R., Lo, T., Katimbo, A., Heeren, D. M., DeJonge, K. C., Franz, T. E., & Qiao, X. July 13-15, 2020. Canopy temperature based irrigation scheduling for maize in West Central Nebraska. ASABE Annual International Meeting (virtual).
20. Uwase, E., Heeren, D. M., Odhiambo, L., & Chandra, A. February 18-19, 2020. Evaluating evapotranspiration values in Rwanda while using the Turc and Hargreaves-Samani equations. CPIA Central Plains Irrigation Conference, Burlington, Colo. Poster presentation.
21. Bhatti<sup>3</sup>, S., Heeren, D. M., Barker<sup>4</sup>, J. B., Neale, C. M. U., Woldt, W. E., Maguire, M. S., & Rudnick, D. R. December 9-13, 2019. Site-specific irrigation management in a sub-humid climate using a spatial evapotranspiration model with satellite and airborne imagery. American Geophysical Union (AGU) Fall Meeting, San Francisco, Calif.
22. Kantarama, D., Singh, J., Bhatti, S., Heeren, D. M., & Franz, T. E. August 23, 2019. Arable Mark: A solution to managing weather risks and crop health. CUSP Experiential Learning Expo, Lincoln, Nebr. Poster presentation.
23. Guertault, L., Fox, G. A., Munoz-Carpena, R., Halihan, T., Heeren, D. M., & Gao, B. July 7-10, 2019. Preferential flow in vegetative filter strips and riparian buffers: Experimentation and numerical modeling. ASABE Annual International Meeting, Boston, Mass.
24. Bhatti<sup>3</sup>, S., Kumari, A., Sarangi, A., Kaur, R., Heeren, D. M., Singh, M., Neale, C. M. U., & Martin, D. L. July 7-10, 2019. Integrated soil moisture and canopy temperature sensing system for irrigation scheduling. ASABE Annual International Meeting, Boston, Mass.
25. Singh<sup>3</sup>, J., Heeren, D. M., Ge, Y., Barker, J. B., Woldt, W. E., Neale, C. M. U., Bai, G., Rudnick, D. R., Luck, J. D., & Meyer, G. E. July 7-10, 2019. Soil structure and soil texture effects on soil water content measurements by a capacitance based electromagnetic sensor. ASABE Annual International Meeting, Boston, Mass.
26. Banda<sup>2</sup>, M. M., Heeren, D. M., Munoz-Arriola, F., Martin, D. L., & Hayde, L. G. April 29-30, 2019. Economic analysis of deficit irrigation of sugarcane farming: A case study of Nchalo Estate, Chikwawa District in Malawi. DWFI Water for Food Global Conference, Lincoln, Nebr. Poster presentation.
27. Bhatti<sup>3</sup>, S., Kumari, A., Sarangi, A., Kaur, R., Heeren, D. M., Singh, M., Neale, C. M. U., & Martin, D. L. April 29-30, 2019. Integrated soil moisture and canopy temperature sensing system for irrigation scheduling. DWFI Water for Food Global Conference, Lincoln, Nebr. Poster presentation.
28. Singh, J., Ge, Y., Bai, G., Barker<sup>4</sup>, J. B., Heeren, D. M., & Neale, C. M. U. April 29-30, 2019. In-field soil and plant sensor network to improve variable rate irrigation decision-making. DWFI Water for Food Global Conference, Lincoln, Nebr. Poster presentation.
29. Guertault, L., Fox, G. A., Munoz-Carpena, R., & Heeren, D. M. December 12, 2018. Meso-scale infiltration experiments and modeling of preferential flow in macroporous soils. AGU Fall Meeting, Washington, D.C.
30. Bhatti<sup>2</sup>, S., Barker<sup>4</sup>, J. B., Heeren, D. M., Neale, C. M. U., Rudnick, D. R., Woldt, W. E., & Boldt, A. L. October 24-26, 2018. Variable rate irrigation with spatial evapotranspiration model using imagery from satellite and unmanned aerial systems. Nebraska Water Center (NWC) Great Plains Regional Water Symposium, Lincoln, Nebr. Poster presentation.

31. Li<sup>2</sup>, J., Barker<sup>4</sup>, J. B., Bhatti<sup>2</sup>, S., Possignolo, I. P., Heeren, D. M., Boldt, A. L., & Yan, H. October 24-26, 2018. Comparison of methods for calculating deep percolation. NWC Great Plains Regional Water Symposium, Lincoln, Nebr. Poster presentation.
32. Singh, J., Ge, Y., Bai, G., Barker<sup>4</sup>, J. B., Heeren, D. M., & Neale, C. M. U. October 24-26, 2018. In-field soil and plant sensor network to improve variable rate irrigation decision-making. NWC Great Plains Regional Water Symposium, Lincoln, Nebr. Poster presentation.
33. Banda<sup>2</sup>, M. M., Heeren, D. M., Munoz-Arriola, F., Martin, D. L., & Hayde, L. G. October 24-26, 2018. Economic analysis of deficit irrigation of sugarcane farming: A case study of Nchalo Estate, Chikwawa District in Malawi. NWC Great Plains Regional Water Symposium, Lincoln, Nebr. Poster presentation.
34. Bhatti<sup>2</sup>, S., Heeren, D. M., Barker<sup>4</sup>, J. B., Neale, C. M. U., Rudnick, D. R., Woldt, W. E., Ge, Y., Luck, J. D., Meyer, G. E., Munoz-Arriola, F., Boldt, A. L., & Maguire, M. S. July 29-August 1, 2018. Variable rate irrigation management using a spatial evapotranspiration model. ASABE Annual International Meeting, Detroit, Mich.
35. Barker<sup>4</sup>, J. B., Maguire, M. S., Neale, C. M. U., Woldt, W. E., Wardlow, B. D., Leavitt, B. C., & Heeren, D. M. July 29-August 1, 2018. Calibration of an unmanned-aircraft-mounted shortwave multispectral camera system for use in evapotranspiration modeling. ASABE Annual International Meeting, Detroit, Mich.
36. Guertault, L., Fox, G. A., Munoz-Carpena, R., Gao, B., & Heeren, D. M. June 7, 2018. Meso-scale experiments and modeling of macropore flow. ASCE World Environmental and Water Resources Congress, Minneapolis, Minn.
37. Li<sup>2</sup>, J., Barker<sup>4</sup>, J. B., Possignolo, I. P., Heeren, D. M., Boldt, A. L., Bhatti<sup>2</sup>, S., & Yan, H. June 6, 2018. Comparison of methods for calculating deep percolation. Marena Oklahoma In Situ Sensor Testbed (MOISST) Workshop, Lincoln, Nebr. Poster presentation.
38. Barker<sup>4</sup>, J. B., Bhatti<sup>2</sup>, S., Heeren, D. M., & Neale, C. M. U. May 8, 2018. Irrigation management using remote-sensing-based spatial evapotranspiration modeling in maize and soybean in Nebraska, USA. International Association of Hydrological Sciences (IAHS) Remote Sensing and Hydrology Symposium, Cordoba, Spain.

#### Section 2.1.6 Invited Talks or Keynote Speeches (since 2018)

1. Heeren, D. M. May 10, 2023. Panelist. Sustainable intensification of smallholder irrigation. DWFI Water for Food Global Conference, Lincoln, Nebr.
2. Wilkening, E. J., Heeren, D. M., & Bhatti, S. December 5-9, 2022. Triggering irrigation events using pivot-mounted sensors. In Nebraska's Water Balance Story: A Microcosm for Advancing Water Management. Irrigation Association (IA) Irrigation Show and Education Week, Las Vegas, Nev.
3. Heeren, D. M., & Taghvaeian, S. December 2, 2022. Irrigation across the Great Plains. Agronomy and Horticulture Seminar, Lincoln, Nebr.
4. Heeren, D. M., & Bhatti<sup>3</sup>, S. August 11, 2022. Pivot automation and early stress detection. DWFI Water for Food from the Field workshop, Paulman Farms, Sutherland, Nebr.
5. Heeren, D. M., & Bhatti<sup>3</sup>, S. October 15, 2021. Technology toward pivot automation. DWFI Water for Food Global Forum (virtual).
6. Heeren, D. M. August 21, 2021. Irrigation technology and variable rate irrigation. Presentation to Ukrainian Minister of Agrarian Policy and Food, Lincoln, Nebr.

7. Heeren, D. M., Barker<sup>4</sup>, J. B., Bhatti<sup>3</sup>, S., Rudnick, D. R., & Munoz-Arriola, F. February 26-27, 2019. Impact of variable rate irrigation (VRI) on consumptive use of water resources. CPIA Central Plains Irrigation Conference, Kearney, Nebr.
8. Heeren, D. M., Barker<sup>4</sup>, J. B., Bhatti<sup>2</sup>, S., Maguire, M. S., Woldt, W. E., & Neale, C. M. U. September 14, 2018. Variable rate irrigation (VRI): Benefits, limitations, and management practices. Delegation from Irrigation New Zealand, Lincoln, Nebr.
9. Neale, C. M. U., Kaur, R., Hayes, M. J., Heeren, D. M., Kilic, A., Khanna, M., Sarangi, A., Sehgal, V. K., & Sahoo, R. N. July 29-August 1, 2018. Improving water management, agricultural production, and food security in drought-prone areas. ASABE Annual International Meeting, Detroit, Mich.
10. Barker<sup>4</sup>, J. B., S. Bhatti<sup>2</sup>, Heeren, D. M., & Neale, C. M. U. June 6, 2018. VRI irrigation scheduling. Marena Oklahoma In Situ Sensor Testbed (MOISST) Workshop, Lincoln, Nebr.
11. Heeren, D. M., Barker<sup>4</sup>, J. B., Bhatti<sup>2</sup>, S., Maguire, M. S., Woldt, W. E., & Neale, C. M. U. April 4, 2018. Variable rate irrigation (VRI): Benefits, limitations, and management practices. Nebraska Water Center (NWC) Water Seminar, Lincoln, Nebr.
12. Heeren, D. M. March 7, 2018. Vadose zone modeling with HYDRUS. Nebraska Association of Resource Districts (NARD) Workshop, Kearney, Nebr.
13. Barker<sup>4</sup>, J. B., Neale, C. M. U., & Heeren, D. M. February 21, 2018. Using remote sensing to improve irrigation uniformity. CPIA Central Plains Irrigation Conference, Colby, Kans.
14. Heeren, D. M., Barker<sup>4</sup>, J. B., Maguire, M. S., Woldt, W. E., & Neale, C. M. U. January 15, 2018. Drones are buzzing toward increased crop production. IHE Delft Lunch Seminar, Delft, Netherlands.

#### Section 2.1.7 Extension Publications: Peer-Reviewed

1. Heeren, D. M., Wilkening<sup>2</sup>, E. J., Hallum, D., McCullough, C., Keshwani, J., & Schellpeper, J. 2023. [Impact of irrigation technologies on water use: Clarifying water withdrawals and consumptive use](#). NebGuide g2345, Nebraska Extension, with video trailer (3k impressions and 58 reactions on LinkedIn).
2. Lo, T., Rudnick, D. R., Ge, Y., Heeren, D. M., Irmak, S., Barker, J. B., Qiao, X., & Shaver, T. M. 2018. [Ground-based thermal sensing of field crops and its relevance to irrigation management](#). NebGuide G2301, Nebraska Extension.
3. Lo<sup>2</sup>, T., Heeren, D. M., Luck, J. D., Martin, D. L., Mateos, L., & Eisenhauer, D. E. 2016. Map for VRI pumping reduction: Potential pumping reductions by using VRI to mine undepleted soil water. Extension website, available at <http://heeren.unl.edu/map>.

#### Section 2.1.8 Extension Publications: Other than Peer-Reviewed

1. Bhatti<sup>3</sup>, S., Heeren, D. M., Melvin, S. R., Franz, T. E., Wilkening<sup>2</sup>, E. J., & Neale, C. M. U. 2022. [Sensors on the pivot for automated irrigation scheduling in the Great Plains](#). UNL CropWatch, with video trailer (4k impressions and 107 reactions on LinkedIn).
2. Heeren, D. M., Melvin, S. R., Bhatti<sup>3</sup>, S., Wilkening<sup>1</sup>, E. J., & Neale, C. M. U. 2021. [New article traces aspects of the history of irrigation in the Great Plains and water productivity](#). UNL Water. (Reprinted on UNL CropWatch along with video trailer; 3k impressions and 96 reactions on LinkedIn).
3. Heeren, D. M., Melvin, S. R., Nygren, A., & Wilkening<sup>1</sup>, E. J. 2020. [Now is the time of year to check pivot performance](#). Online extension article, UNL Water.

4. Ingram, T., Heeren, D. M., Melvin, S. R., Wilkening<sup>1</sup>, E. J., Nygren, A., Martin, D. L., Rudnick, D. R., Burr, C., & Mamo, M. 2019. [Problems regarding operating pressure and uniformity](#). Online extension article, UNL Water.
5. Melvin, S. R., Heeren, D. M., Ingram, T., Nygren, A., Martin, D. L., Mamo, M., Wilkening<sup>1</sup>, E. J., & Pitla, S. 2019. [Safety concerns with center pivot irrigation systems](#). Online extension article, UNL Water.
6. Heeren, D. M., Barker<sup>4</sup>, J. B., Lo, T. H., Melvin, S. R., Martin, D. L., & Luck, J. D. 2017. [Considerations in adopting variable rate irrigation](#). Online extension article, UNL Water.
7. Koehler-Cole, K., Elmore, R. W., Blanco, H., Francis, C. A., Shapiro, C. A., Shaver, T. M., Stockton, M., Ferguson, R. B., Irmak, S., & Heeren, D. M. 2016. [Implementation of cover crops in corn and soybean systems in Nebraska](#). Online extension article, UNL CropWatch.
8. Koehler-Cole, K., Elmore, R. W., Blanco, H., Francis, C. A., Heeren, D. M., Irmak, S., Proctor, C., Shapiro, C. A., Shaver, T. M., & Stockton, M. 2016. [Biomass production of winter annual cover crops in corn and soybean](#). Online extension article, UNL CropWatch.
9. Fox, G. A., Heeren, D. M., & Kizer, M. A. 2010. Oklahoma Stream Depletion Factor (OSDF) Worksheet. Documented use in N.H., Nebr., Minn., Mont., Okla., Wash., & Scotland.

#### Section 2.1.9 Extension Presentations

1. Heeren, D. M., Melvin, S. R., & Burr, C. February 28, 2023. Center pivot performance: Impacts during a dry year. Central Plains Irrigation Conference, Kearney, Nebr.
2. Heeren, D. M., Melvin, S. R., & Burr, C. January 10 & 12, 2023. Irrigation scheduling tendencies in wet vs. dry years. Nebraska Extension Crop Production Clinics, Norfolk & Beatrice, Nebr.
3. Heeren, D. M., Melvin, S. R., & Burr, C. January 10 & 12, 2023. Center pivot performance and how a dry year can affect it. Nebraska Extension Crop Production Clinics, Norfolk & Beatrice, Nebr.
4. Heeren, D. M., Bathke, K., & Hanson, E. 2022. [Irrigation in the age of digital ag](#). Podcast interview. Nebraska Extension FarmBits Podcast (3k impressions and 65 reactions on LinkedIn).
5. Heeren, D. M., Melvin, S. R., & Ingram, T. January 29, 2019. Trends in technology for irrigation scheduling. Nebraska Crop Management Conference, Kearney, Nebr.
6. Lo<sup>3</sup>, T., D. R. Rudnick, D. M. Heeren, J. D. Luck, and T. M. Shaver. February 21-22, 2017. Fundamentals of variable rate irrigation (VRI). Central Plains Irrigation Conference, Burlington, Colo.
7. Heeren, D. M., Barker<sup>3</sup>, J. B., and Neale, C. M. U. February 2, 2017. Managing variable rate irrigation for spatial variability in evapotranspiration using remote sensing. Nebraska Agriculture Technologies Association (NeATA) Conference, Lincoln, Nebr.
8. Heeren, D. M., Werner, H. D., and Trooien, T. P. February 26-27, 2013. Optimizing cropping systems under limited water conditions. Central Plains Irrigation Conference, Kearney, Nebr.

## Section 2.2 Grantsmanship Record

### Section 2.2.1 Internally Funded Research Grants

| <i>Project Title</i>   | <i>Sponsor</i>            | <i>Role</i>  | <i>Dates</i> | <i>Total Amount</i> |
|--|---------------------------|--------------|--------------|---------------------|
| Near Earth Sensing of Crop Canopy at Production Field Scale Enabled by Unmanned Aircraft                                   | DWFI Grad Student Support | PI           | 2020-2021    | 17,500              |
| Sensor-Based Irrigation Management for Maize and Soybean in the Great Plains   | DWFI Grad Student Support | PI           | 2018-2021    | 51,000              |
| Integrated Crop and Soil Water Sensor Network to Assist UAS and Soil Water Simulation Modeling in Variable Rate Irrigation | DWFI Grad Student Support | Collaborator | 2017-2020    | 51,000              |
| Impact of Variable Rate Irrigation on Consumptive Use of Water Resources   | USGS 104(b)               | PI           | 2017-2019    | 20,000              |
| Field Testing Variable Rate Irrigation (VRI) for Managing Spatial Variability in Soils and Evapotranspiration              | DWFI Grad Student Support | PI           | 2016-2018    | 33,500              |

### Section 2.2.2 Externally Funded Research Grants and Contracts

| <i>Project Title</i>   | <i>Sponsor</i>          | <i>Role</i>  | <i>Dates</i> | <i>Total Amount</i> |
|--|-------------------------|--------------|--------------|---------------------|
| Field Evaluation of Irrigation Scheduling  | AgriThority / Irriga    | PI           | 2022         | 18,519              |
| Enhancing the Efficiency of Irrigation Systems Using Innovative Materials                          | Pacific Engineering     | PI           | 2022         | 39,914              |
| Towards Pivot Automation with Proximal Sensing for Maize and Soybean in the Great Plains (renewal) | IIC / Valmont           | PI           | 2021-2023    | 55,000              |
| CPS-Enabled Variable Rate Technology   | USDA CPS                | Collaborator | 2021-2024    | 1,199,687           |
| Development of Research and Demonstration Sites in the BGMA for Nitrate Reduction                  | NET / Lower Elkhorn NRD | Co-PI        | 2021-2022    | 272,574             |

|   |  |       |           |         |
|---|--|-------|-----------|---------|
| Improved Irrigation Scheduling Combining Soil Water Supply and Atmospheric Evaporative Demand   | IIC / Industry   | Co-PI | 2021-2023 | 197,333 |
| Towards Pivot Automation with Proximal Sensing for Maize and Soybean in the Great Plains  | IIC / Valmont  | PI    | 2020-2021 | 94,659  |
| Building NRCS Technical Capacity in Irrigation Water Management for Variable Rate Irrigation  | USDA NRCS  | Co-PI | 2020-2023 | 64,640  |
| Row Unit Evaluation in Wet Soils  | John Deere   | Co-PI | 2020      | 35,000  |
| A Scalable Real-Time Sensing and Decision-Making System for Field-Level Row-Crop Irrigation Management  | USDA / NSF CPS   | Co-PI | 2019-2022 | 319,994 |
| SENSE Nitrogen Management: Promoting Adoption of Sensor-Based Nitrogen Fertilization of Corn through the Nebraska On-Farm Research Network                  | Corn Board   | Co-PI | 2019-2021 | 277,785 |
| Irrigation Innovation Consortium  | U.S. Foundation for Food and Agric. Research                 | Co-PI | 2018-2023 | 675,000 |
| Improving Variable Rate Irrigation Efficiency Using a Real-Time Soil Water Adaptive Control Model Informed by Sensors Deployed on Unmanned Aircraft Systems | USDA Foundational Program                                    | Co-PI | 2017-2021 | 499,978 |
| Improving Water Management, Agricultural Production and Food Security in Drought-Prone Areas  | Indo-U.S. 21st Century Knowledge Initiative                  | Co-PI | 2016-2019 | 182,804 |
| Influence of Preferential Flow on Coupled Colloid, Nitrogen, and Phosphorus Transport through Riparian Buffers  | USDA Foundational Program                                    | Co-PI | 2016-2019 | 499,200 |
| Selection and Design of Irrigation Systems in Zambia  | Zambia Agricultural Research Institute (ZARI) and World Bank | Co-PI | 2016-2017 | 36,074  |
| Sustainable Corn and Soybean Production   | Nebraska Soybean and Corn Boards                             | Co-PI | 2014-2018 | 600,000 |

|   |  |              |           |           |
|---|--|--------------|-----------|-----------|
| Improving Irrigation Water and Energy Use Efficiency through Accurate Spatial and Temporal Management | Nebraska Center for Energy Sciences Research (NCESR) | Collaborator | 2013-2015 | 129,200   |
| Developing CornSoyWater: A Web-based Irrigation Decision Aid for Corn and Soybean in Nebraska         | Nebraska Center for Energy Sciences Research (NCESR) | Collaborator | 2013-2015 | 122,000   |
| Phosphorus Leaching in Riparian Floodplains: Preferential Flow and Scale                              | EPA STAR Fellowship                                  | PI           | 2011-2012 | 42,000    |
| Cow Creek Streambank Stabilization Project  | American Recovery and Reinvestment Act               | Co-PI        | 2009-2012 | 2,000,000 |

### Section 2.3 Research Awards

#### Section 2.3.1 National and International Research Awards and Recognition

1. Heermann Sprinkler Irrigation Award. 2023. ASABE Annual International Meeting, Omaha, Nebr.
2. ASABE Superior Paper Award, 2016, for the refereed journal article: Heeren, D. M., Fox, G. A., & Storm, D. E. 2015. Heterogeneity of infiltration rates in alluvial floodplains as measured with a berm infiltration technique. *Transactions of the ASABE* 58(3): 733-745.
3. U.S. EPA Science to Achieve Results (STAR) Fellow. 2011-2012.
4. New Faces of Engineering. 2012. ASABE.
5. Second place, Boyd-Scott Graduate Research Award. 2011. ASABE Annual International Meeting, Louisville, Ky.

#### Section 2.3.2 Regional and Local Research Awards and Recognition

1. Research Excellence Award. 2021. UNL College of Engineering. Research Recognition Reception, Lincoln, Nebr.
2. Honoree, recognized for performing highly impactful research. 2017. UNL College of Engineering. Research Recognition Reception, Lincoln, Nebr.
3. First place, Graduate Paper Presentation Contest. 2011. OSU Research Symposium.

## Section 3 Teaching Accomplishments

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### Section 3.1 Courses Taught

1. MSYM 855, Advanced Irrigation Management. 2015, 2017, 2019, 2020, 2023 (co-taught with Saleh Taghvaeian).
2. MSYM 452/852, Irrigation Systems Management. 2015-2019, 2021-2022.
3. AGEN/MSYM 854, Irrigation Laboratory and Field Course. 2014, 2016, 2018 (co-taught with Dean Eisenhauer); 2022 (co-taught with Ali Mohammed).
4. MSYM 462, Equipment Systems. 2018-2023. Co-taught with Rick Stowell.
5. AGEN/BSEN 957, Modeling Vadose Zone Hydrology. 2014 (co-taught with Dean Eisenhauer), 2016, 2018 (co-taught with Tiffany Messer), 2021.
6. MSYM 354, Soil Conservation and Watershed Management. 2012-2014.

7. BAE 6333, Fluvial Hydraulics. 2010. Oklahoma State University.
8. EM 321, Mechanics of Materials. 2007. South Dakota State University.

## Section 3.2 Publications Related to Teaching and Learning

### Section 3.2.1 Textbook

1. Eisenhauer, D. E., Martin, D. L., Heeren, D. M. (General Editor), & Hoffman, G. J. 2021. *Irrigation Systems Management*. ASABE: St. Joseph, Mich. 347 pages. Open access: CC BY-NC-ND 4.0. <https://doi.org/10.13031/ISM.2021>. More information, including PowerPoint presentations for each chapter, available at: <https://asabe.org/ISM>. (20k impressions and 269 reactions on LinkedIn.)

### Section 3.2.2 Instructor Resources

1. Heeren, D. M., & Eisenhauer, D. E. 2022. *Irrigation Systems Management: Instructor Kit*. ASABE: St. Joseph, Mich. Laboratory/homework assignments with keys, readiness tests (quizzes) with keys, exams with keys, in-class problems, and lecture notes. Includes both a USCS version and an SI version. Available for purchase at: <https://asabe.org/ISM>. (4k impressions and 72 reactions on LinkedIn.)
2. Heeren, D. M., & Eisenhauer, D. E. 2021. Modeling Vadose Zone Hydrology: Lecture Notes. Department of Biological Systems Engineering, University of Nebraska-Lincoln. 44 pages. Open access: CC BY-NC 4.0. Available at: <https://digitalcommons.unl.edu/oerengineering/2/>.

### Section 3.2.3 Conference Proceedings Papers

1. Heeren, D. M., Hayde, L. G., Eisenhauer, D. E., McCornick, P. G., Mohammed, A. T., Mittelstet, A. R., Boldt, A. L., Qiao, X., Mabie, D. M., & Munoz-Arriola, F. 2023. A graduate-level field course in irrigation and agricultural water management for an immersive learning experience. ASABE Annual International Meeting, Paper No. 2301165, Omaha, Nebr. 17 pages. Available at: <https://digitalcommons.unl.edu/biosysengfacpub/852/>.

### Section 3.2.4 Conference Presentations without a Proceedings Paper

1. Amori, P. N., Mabie, D. M., & Heeren, D. M. 2023. Improving efficiency in curriculum through course content entropy mapping. ASABE Annual International Meeting, Omaha, Nebr.

### Section 3.2.5 Invited Talks or Keynote Speeches

1. Heeren, D. M. October 19, 2021. Before we get started, does anyone want to get out? Courage and creativity for career challenges. South Dakota Student Water Conference, Brookings, S.D. Keynote address.
2. Heeren, D. M. April 5, 2013. Perspectives on different phases of a water career. OSU Student Water Conference, Stillwater, Okla. Keynote address.

### Section 3.2.6 Other Oral Presentations

1. Heeren, D. M. February 24, 2022. Natural resources and irrigation engineers. ASABE Student Branch, Lincoln, Nebr.
2. Heeren, D. M. November 12, 2021. Before we get started, does anyone want to get out? Courage and creativity for career challenges. Annual Meeting, Nebraska Section of ASABE, Norfolk, Nebr.

**Section 3.3 Creative Development of Course Materials**

Section 3.3.1 Course Portfolios and Reports

1. Heeren, D. M., & Taghvaeian, S. 2023. Peer review of teaching: ET theory, deficit irrigation and consumptive use. BSE Peer Review of Teaching. Department of Biological Systems Engineering, University of Nebraska-Lincoln. Available at: <https://digitalcommons.unl.edu/biosysengpres/77/>.
2. Heeren, D. M. May 16, 2016. Increasing student attentiveness and engagement in growing Mechanized Systems Management courses. UNL CASNR Instructional Improvement Plan. Final report. Presented at the BSE Annual Undergraduate Curriculum Workshop, Lincoln, Nebr. Available at: <https://digitalcommons.unl.edu/biosysengpres/70/>.

Section 3.3.2 Other Course Development

1. MSYM/AGEN 232 Power and Machinery Principles. 2021-2022. Developed new course material and a lecture/lab on irrigation pump energy use.
2. AGEN/BSEN/CIVE/GEOL 957 Modeling Vadose Zone Hydrology. 2021. Converted the course to a flipped class format, including high-quality video lectures. Added lab tours which complimented lecture content.
3. MSYM 855 Advanced Irrigation Management. 2019. Updated course content based on stakeholder input and current technology/research. Due to increased student demand, recorded video of lectures in 2019 and offered course in a flipped-class format in spring 2020 (before the pandemic required non-traditional course delivery).
4. AGEN/MSYM 854 Irrigation Laboratory and Field Course. 2018. Formalized the course, which previously had been taught without a unique course number. Added a discussion and assignment focused on the linkages among industry, government, farmers, and research and educational institutions, within the context of irrigated crop production.
5. MSYM 855 Advanced Irrigation Management. 2015. Developed new material on sensors and management practices. Created new quizzes, homework assignments, and exams. Added a journal article discussion which required students to comprehend, critique, and engage current literature in irrigation management.
6. BSEN 998 Modeling Vadose Zone Hydrology. 2014. Developed new material on solute transport, which complemented the existing focus on unsaturated flow in porous media. Subsequently formalized the course as AGEN/BSEN/CIVE/GEOL 957 Modeling Vadose Zone Hydrology.

**Section 3.4 Funding Related to Teaching and Learning**

Section 3.4.1 Funded Grants and Donations

| <i>Project Title</i>   | <i>Sponsor</i>   | <i>Role</i> | <i>Dates</i> | <i>Total Amount</i> |
|--|------------------|-------------|--------------|---------------------|
| Graduate-Level Irrigation Workforce Development in Support of Agricultural Transformation in Sudan | Valmont / Zadna  | PI          | 2022-2024    | 600,000             |
| Publication of Irrigation Systems Management Textbook  | ASABE Foundation | PI          | 2020-2021    | 9,000               |

### **Section 3.5 Postdoctoral Researchers**

#### Section 3.5.1 Post-Doctoral Researchers Supervised

1. J. Burdette Barker. Start date: June 2017. Completion date: November 2018. Co-supervisors: Christopher Neale & Derek Heeren. Research focus: Irrigation management using a real-time soil water adaptive control model informed by sensors deployed on unmanned aircraft systems. Currently Assistant Professor, Utah State University, Logan, UT.

### **Section 3.6 PhD Students**

#### Section 3.6.1 PhD Students Supervised

1. Sandeep Bhatti. Major: Biological Engineering. Dissertation: Thermal sensing for automated irrigation management of maize and soybean in Nebraska. Graduated: May 2022. Advisor: Derek Heeren. Currently Post-Doctoral Research Associate, University of Massachusetts.
2. Jasreman Singh. Major: Biological Engineering. Dissertation: Design and evaluation of unmanned aerial system based wireless sensor network for irrigation management. Graduated: December 2021. Co-advisors: Yufeng Ge & Derek Heeren. Currently Data Scientist—Global Economic Analysis, Bunge Limited, Chesterfield, MO.
3. Tsz Him Lo. Major: Biological Engineering. Dissertation: Water and nitrogen interactions in maize production. Graduated: December 2018. Research advisor: Daran Rudnick; academic advisor: Derek Heeren. Currently Assistant Extension/Research Professor, Mississippi State University, Stoneville, MS.
4. J. Burdette Barker. Major: Biological Engineering. Dissertation: Spatial irrigation management using remote sensing water balance modeling and soil water content monitoring. Graduated: May 2017. Co-advisors: Derek Heeren & Christopher Neale. Currently Assistant Professor, Utah State University, Logan, UT.

#### Section 3.6.2 PhD Students Currently in Progress

1. Precious N. Amori. Major: Biological Engineering. Expected graduation: December 2025. Co-advisors: Derek Heeren & Daran Rudnick.
2. Tom Riley. Major: Biological Engineering. Expected graduation: 2025. Co-advisors: Derek Heeren & Dean Eisenhauer.
3. Jamie Duan. Major: Biological Engineering. Expected graduation: May 2024. Co-advisors: Daran Rudnick & Derek Heeren.

#### Section 3.6.3 PhD Student Committees

1. Chuyang Liu. 2022. Major: Civil Engineering.
2. Hope Nakabuye. 2022. Major: Biological Engineering.
3. Abia Katimbo. 2022. Major: Biological Engineering.
4. Mitchell S. Maguire. 2021. Major: Biological Engineering.
5. Justin P. Gibson. 2018. Major: Natural Resources Sciences.
6. Amit Timilsina. 2017. Major: Natural Resources Sciences.
7. James Chengchou Han. 2016. Major: Agronomy and Horticulture.

### **Section 3.7 MS Students**

#### Section 3.7.1 MS Students Supervised (Option A)

1. Suresh Pradhyun Kashyap. Major: Agricultural and Biological Systems Engineering. Thesis: High-frequency unmanned aircraft flights for crop canopy imaging during diurnal moisture

- stress. Graduated: December 2021. Co-advisors: Derek Heeren & Wayne Woldt. Currently a GIS Specialist for the On-Farm Research Network at UNL.
2. Ankit Chandra. Major: Agricultural and Biological Systems Engineering. Thesis: Water-energy-food linkages in shared smallholder irrigation schemes. Graduated: August 2020. Co-advisors: Nick Brozovic & Derek Heeren. Currently a Program Associate at the Daugherty Water for Food Global Institute.
  3. Jingjing Li. Major: Hydraulic Engineering, China Agricultural University, including a one-year visit at UNL. Thesis: Effect of different nitrogen fertigation managements on crop growth, water and nitrogen movement for center pivot irrigated maize in the sub-humid area of Northeast China. Graduated: June 2019. Co-advisors: Haijun Yan (CAU Advisor) & Derek Heeren (UNL Advisor). Currently at Intellectual Property Office, Henan Province, China.
  4. Sandeep Bhatti. Major: Agricultural and Biological Systems Engineering. Thesis: Variable rate irrigation using a spatial evapotranspiration model with remote sensing imagery and soil water content measurements. Graduated: December 2018. Advisor: Derek Heeren. Currently Post-Doctoral Research Associate, University of Massachusetts.
  5. Tsz Him Lo. Major: Agricultural and Biological Systems Engineering. Thesis: Preliminary quantification of variable rate irrigation benefits. Graduated: August 2015. Advisor: Derek Heeren. Currently Assistant Extension/Research Professor, Mississippi State University, Stoneville, MS.
  6. Ryan P. Freiberger. Major: Agricultural and Biological Systems Engineering. Thesis: Single- and dual-porosity calibration and long-term modeling of highly conductive floodplain soils in the Ozark ecoregion. Graduated: December 2014. Advisor: Derek Heeren. Currently Environmental Engineer, AECOM, Omaha, Nebr.

#### Section 3.7.2 MS Students Supervised (Option B)

1. Mavuto M. Banda. Major: Mechanized Systems Management. Applied research thesis: Economic analysis of deficit irrigation in sugarcane farming: Nchalo Estate, Chikwawa District in Malawi. Graduated: May 2019. Advisor: Derek Heeren. Double degree program with the DWFI and IHE Delft. Currently Ph.D. Student, Cranfield University, England.
2. Mumba R. Mwape. Major: Mechanized Systems Management. Applied research thesis: Selection and design of irrigation systems in Zambia. Graduated: May 2017. Advisor: Derek Heeren. Double degree program with the DWFI and IHE Delft. Currently Agricultural Research Officer, Ministry of Agriculture, Lusaka, Zambia.

#### Section 3.7.3 MS Students Currently in Progress (Option A)

1. Eric J. Wilkening. Major: Agricultural and Biological Systems Engineering. Expected graduation: December 2023. Advisor: Derek Heeren.
2. Moaz N. A. Ishag. Major: Mechanized Systems Management. Expected graduation: August 2024. Advisor: Aaron Mittelstet; coadvisor: Derek Heeren.

#### Section 3.7.4 MS Students Currently in Progress (Option B)

1. Suhib O. F. Hamid. Major: Mechanized Systems Management. Expected graduation: August 2024. Advisor: Derek Heeren.
2. Abdalhakam M. Z. Almagzooq. Major: Mechanized Systems Management. Expected graduation: August 2024. Advisor: Derek Heeren.

### Section 3.7.5 MS Student Committees

1. Osman M. A. Adam. Expected graduation: December 2024. Major: Mechanized Systems Management.
2. Henry A. Gonzalez. 2022. Major: Mechanized Systems Management.
3. Isabella P. Possignolo. 2020. Major: Mechanized Systems Management.
4. Mitchell S. Maguire. 2018. Major: Agricultural and Biological Systems Engineering.
5. Moussa Guira. 2018. Major: Earth and Atmospheric Sciences.
6. Xiaochen Dong. 2017. Major: Natural Resources Sciences.
7. Catie E. Finkenbiner. 2017. Major: Natural Resources Sciences.
8. Keith A. Miller. 2015. Major: Agricultural and Biological Systems Engineering.
9. Gustavo Bosch-Rubia. 2015. Major: Mechanized Systems Management.
10. Evordius Rulazi. 2015. Major: Agricultural and Biological Systems Engineering.

### Section 3.7.6 Total Number of Graduate Students

Total of 19 graduate students advised (12 graduated and 7 in progress)

## Section 3.8 Undergraduate Students

### Section 3.8.1 Undergraduate Students Supervised in Research Study (since 2018)

1. Zach Anderson. 2023-current.
2. Jenny Goesch. 2023-current.
3. David Heeren. 2021-2023.
4. Jacob Stover. 2022.
5. Aaron Chin. 2021-2022.
6. Eric Wilkening. 2019-2021.
7. Nathan Turner. 2021.
8. Elizabeth Uwase. 2019-2021.
9. Divine Kantarama. 2019-2020.
10. Jacob Richardson. 2019.
11. Troy Nelson. 2018.
12. Joviale Uwase. 2018.
13. Tonny Ruhinda. 2018.

### Section 3.8.2 Academic Advising

Average of 11 undergraduate academic advisees per semester in Mechanized Systems Management from 2014 to 2021 (subsequently transitioned to a different advising model).

### Section 3.8.3 Engineering Senior Design Projects Advised (since 2018)

1. Grant Gaspers, Jack Moore, Zhenghao Pan, Kevin Sousek, & Yifei Zhang. 2019-2020. BSE Hydraulics Lab renovation design. Coadvisors: Derek Heeren & Alan Boldt.
2. Paulina Guzek, Ben Everswick, Conner Christensen, & Gabe Cohen. 2017-2018. Fountain Wars. Coadvisors: Derek Heeren & David Mabie.

## Section 3.9 Staff Supervision

1. Alan Boldt. Research Engineer II and Laboratory Manager. 2015-present.

## Section 3.10 Teaching Awards and Recognition

### Section 3.10.1 International and National Teaching Awards and Recognition

1. A. W. Farrall Young Educator Award. 2018. ASABE Annual International Meeting, Detroit, Mich.

### Section 3.10.2 Regional, Local and University Teaching Awards and Recognition

1. Distinguished Alumnus Award. 2017. SDSU Department of Agricultural and Biosystems Engineering. In recognition of significant contributions to society and accomplishments which have brought credit to the department. Banquet of Excellence, Brookings, S.D.

## **Section 3.11 Other Teaching Accomplishments**

### Section 3.11.1 Guest Lectures (since 2018)

1. Lecture. Decision support systems for irrigation. MSYM 316 Technologies and Techniques in Digital Agriculture. 2023.
2. Lecture. Sensors and IoT in irrigation. MSYM 316 Technologies and Techniques in Digital Agriculture. 2023.
3. Lecture. Natural resources and irrigation engineers. AGEN 100 Introduction to Biological Engineering and Agricultural Engineering. 2018-2020, 2022.
4. Lecture and lab. Irrigation data techniques. MSYM 492/892 Technologies and Techniques in Digital Agriculture. 2020, 2022.
5. Lecture and lab. Pumping and pipeline systems. MSYM 162 Introduction to Mechanized Systems Management. 2018, 2022.
6. Lecture and lab. Mechanized irrigation equipment. MSYM 232 Power and Machinery Principles. 2021-2022.
7. Lecture and lab. Soil hydraulic conductivity. AGEN/BSEN 225 Engineering Properties of Biological Materials. 2018-2019, 2021-2022.

### Section 3.11.2 International Activities

1. Partnership Coordinator, DWFI and the IHE Delft Institute for Water Education, Delft, the Netherlands (2019-current).
2. Advised two past and two current project-based M.S. students with applied irrigation projects in their home countries (Zambia, Malawi, Sudan).
3. Co-taught a graduate-level irrigation field course (AGEN 854) four times. Students included M.Sc. students from IHE Delft, project-based M.S. students from UNL, and research-based graduate students from UNL, with a total of 57 students from 18 countries.

## **Section 4 Service Accomplishments**

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### **Section 4.1 Professional Service**

#### Section 4.1.1 Proposal Review Panels

1. Research Steering Committee, Irrigation Innovation Consortium (2019-2022).

#### Section 4.1.2 Associate Editor Positions

1. Associate Editor, *Journal of the ASABE* and *Applied Engineering in Agriculture* (2021-current).
2. Guest Associate Editor, *Transactions of the ASABE* and *Applied Engineering in Agriculture* (2020-2021). Special collection on Preferential Flow and Piping in Riparian Buffers.

#### Section 4.1.3 Journal Manuscripts Reviewed (since 2018)

1. *Agricultural Water Management* (2023 [3], 2021 [3], 2020, 2019 [2], 2018 [2])
2. *Journal of the ASABE* (2022 [2], 2020 [2], 2019 [3], 2018 [2])
3. *Applied Engineering in Agriculture* (2022)
4. *Journal of the American Water Resources Association* (2022)
5. *Computers and Electronics in Agriculture* (2021 [2])
6. *Hydrology and Earth System Sciences* (2021, 2020)
7. *Soil Science Society of America Journal* (2020)
8. *Journal of Hydrology* (2019, 2018)
9. *Journal of Irrigation and Drainage Engineering* (2019 [2])
10. *Water Resources Research* (2019 [2])
11. *Sensors* (2018 [2])
12. *Agriculture and Environment Letters* (2018)

#### Section 4.1.4 Leadership Positions in International and National Organizations

##### American Society of Agricultural and Biological Engineers (ASABE)

1. NRES-07 Nomenclature
  - Chair (2022-present)
2. P-515 Teaching and Learning Resources
  - Chair (2022-present), Vice Chair (2021-2022)
3. NRES-24 Irrigation Group
  - Past Chair (2022-present), Chair (2020-2022), Vice Chair (2018-2020)
4. Fellowship of Christian Agricultural and Biological Engineers
  - Program Coordinator, Prayer Breakfast (2013-present)
5. M-162 Heermann Sprinkler Irrigation Award Committee
  - Past Chair (2019-2021), Chair (2017-2019)
6. M-115 Farrall Young Educator Award Committee
  - Past Chair (2020-2021), Chair (2019-2020)
7. NRES-241 Sprinkler Irrigation Committee
  - Past Chair (2017-2019), Chair (2015-2017), Vice Chair (2013-2015)
8. NRES-253 Riparian Zones, Floodplains, and Wetlands Committee
  - Past Chair (2014-2016), Chair (2012-2014), Vice Chair (2011-2012)

#### Section 4.1.5 Leadership Positions in Regional and Local Organizations

1. Nebraska Section of the ASABE
  - Program Chair (2022-present), Chair (2021-2022), Program Chair (2020-2021), Secretary-Treasurer / Membership Chair (2019-2020), Publications Chair (2018-2019)
2. Junior Advisor to UNL Mechanized Systems Management (MSYM) Student Club (2018-present)
3. Founder and Faculty Advisor of the UNL Fountain Wars Student Club (2013-2018)
  - Placed 1<sup>st</sup> (2014), 2<sup>nd</sup> (2015), 1<sup>st</sup> (2016), 2<sup>nd</sup> (2017), and 2<sup>nd</sup> (2018) at the national Fountain Wars competition (held at the ASABE Annual International Meeting)

#### Section 4.1.6 Memberships in Professional Organizations (since 2018)

1. Central Plains Irrigation Association  
*Member (2019 – present)*

2. Nebraska Section of the ASABE  
*Member (2013 – present)*
3. Soil Science Society of America (SSSA)  
*Member (2010 – present)*
4. American Society of Agricultural and Biological Engineers (ASABE)  
*Member (2006 – present)*
  - i. NRES-07 Nomenclature (2022-present)
  - ii. P-515 Teaching and Learning Resources (2021-present)
  - iii. EOPD-205 Engineering Technology & Management Education (2021-present)
  - iv. NRES-02 Steering Committee (2019-present)
  - v. NRES-24 Irrigation Group (2014-present)
  - vi. NRES-241 Sprinkler Irrigation Committee (2011-present)
  - vii. NRES-04 Program Committee (2020-2022)
  - viii. NRES-21 Hydrology Group (2010-2013, 2019-2022)
  - ix. M-115 Farrall Young Educator Award Committee (2018-2021)
  - x. M-162 Heermann Sprinkler Irrigation Award Committee (2016-2021)

## **Section 4.2 College Service**

### Section 4.2.1 Leadership Positions

1. Irrigation and Agricultural Water Management (IAWM) Education Coordinator, Daugherty Water for Food Global Institute, University of Nebraska (2019-present)

### Section 4.2.2 Membership Positions on College-Wide Committees

1. Daugherty Water for Food Global Institute Search Advisory Committee for research assistant professor (2021-2022)
2. UNL College of Engineering (CoE) Environmental Engineering Graduate Committee (2014-present)
3. UNL Institute of Agriculture and Natural Resources (IANR) Search Advisory Committee for two hydrologist faculty positions (2014-2015)

## **Section 4.3 Unit Service**

### Section 4.3.1 Leadership Positions on Unit (BSE) Committees

1. Undergraduate Education Committee
  - Chair (2022-present)
2. Search Advisory Committee for Irrigation and Water Resources Engineer faculty position
  - Chair (2021-2022)
3. Soil and Water Curriculum Subcommittee
  - Co-chair (2019-2022)

### Section 4.3.2 Membership Positions on Unit (BSE) Committees

1. Undergraduate Education Committee (2022-present)
2. Promotion and Tenure Committee (2020-present)

3. Search Advisory Committee for Irrigation Engineering and Management Specialist faculty position (2021-2022)
4. Graduate Education Committee (2019-2022)
5. Facilities, Infrastructure, and Technology Committee (2018-2020)
6. Undergraduate Education Committee (2015-2020)
7. Scholarship Committee (2013-2019)

#### **Section 4.4 Other Service Accomplishments**

##### Section 4.4.1 Professional Outreach Activities (since 2018)

1. Judge for graduate student oral and poster presentations, ASABE Annual International Meeting. 2021, 2022.
2. External reviewer for a dossier for promotion to associate professor with tenure. 2019.
3. External reviewer for USGS 104(g) proposal. 2019.
4. External reviewer for United States-Israel Binational Agricultural Research and Development Fund proposal. 2018.
5. Judge for ASABE Fountain Wars undergraduate competition. 2018.

##### Section 4.4.2 Community Service

1. Co-leader, small group Bible study. 2017-present. Lincoln, Nebr.
2. Heeren, D. 2023. Ethnic heritage of the families from East Friesland (Northwest Germany) who migrated to the American Midwest. White paper for descendants of East Frisian immigrants. Available at: <https://digitalcommons.unl.edu/genealogy/2/>.
3. Invited presentation for student club. February 9, 2022. UNL chapter of Ratio Christi. Lincoln, Nebr.
4. Sunday school teacher. 2013-2015. St. John's Reformed Church, Lincoln, Nebr.
5. Sunday school teacher. 2009-2011. Stillwater Reformed Presbyterian Church, Stillwater, Okla.
6. Sunday school teacher. 2006-2008. Calvary Presbyterian Church, Volga, S.D.