

**Morgan D. Hayes, PE**  
**University of Illinois**  
**Agricultural and Biological Engineering**  
**Clinical Assistant Professor & Extension Specialist**  
**1304 W Pennsylvania Ave**  
**Urbana, IL 61801**

Phone: (610) 393-7106    Fax: (402) 762-4273    E-mail: [hayesmorgan@gmail.com](mailto:hayesmorgan@gmail.com)

**Education**

<b>Iowa State University</b>	<b>Ames, IA</b>
<b>Doctor of Philosophy</b>	<b>GPA 3.80/4.00</b>
<b>Agricultural and Biosystems Engineering</b>	<b>Graduated August 2012</b>
<b>University of Kentucky</b>	<b>Lexington, KY</b>
<b>Master of Science</b>	<b>GPA 3.65/4.00</b>
<b>Biosystems and Agricultural Engineering</b>	<b>Graduated August 2008</b>
<b>The Pennsylvania State University</b>	<b>University Park, PA</b>
<b>Bachelor of Science</b>	<b>GPA 3.36/4.00</b>
<b>Agricultural and Biological Engineering</b>	<b>Graduated May 2006</b>

**Professional Experience**

- 2014 – Present    *Clinical Assistant Professor*, Department of Agricultural and Biological Engineering, University of Illinois
- Creating livestock facilities/ventilation extension materials
  - Evaluating heat stress of finishing swine
  - Developing wireless environmental sensor networks
- 2012 – 2014    *Post-doctoral Research Engineer*, USDA ARS US Meat Animal Research Center, Clay Center, NE
- Evaluated heat stress of feedlot cattle with and without shade
  - Classified barn-level moisture production of swine by source
- 2008 – 2012    *Graduate Research Assistant*, Department of Agricultural and Biosystems Engineering, Iowa State University
- Intensively monitored commercial aviary laying hen barns for 20 months for environmental, welfare, and production parameters
  - Operated and evaluated hen preference tests for temperature and ammonia
- 2006 – 2008    *Graduate Research Assistant*, Department of Biosystems and Agricultural Engineering, University of Kentucky
- Drew bovine blood samples and developed oximetry tests
  - Utilized thermal imaging to identify surface arterial blood in cattle

### **Funded Work**

Pepple (PI) & Hayes (Co-PI) USDA Sub-Award. Producer Outreach for Updated Swine Ventilation Standards. 2014 (1 year) \$6,000

Felix (PI), Hayes (Co-PI) & Shike (Co-PI). University of Illinois OVCR Equipment Grant. Water Intake System for Cattle. 2015. (1 year) \$71,650

Hayes (PI) & Davidson (Co-PI). National Pork Board. Swine Manure Nutrient Fate and Pathogen Reduction for Midwestern Corn Production with Cover Crop Utilization. 2015 (1 year) \$39,560

Hayes. Illinois Pork Producers and Illinois Soybean Association. Funding for Animal Mortality Composting Workshop. 2015. \$6,440.

### **Graduate Student Advising**

#### ***Advisor***

Yanxi Lu, M.S. 2016 (In Progress). Ventilation Implications of New Heat and Moisture Production Rates of Swine

Eric Dahlke, M.S. 2017 (In Progress, Co-advise). Swine Manure Nutrient Fate and Pathogen Reduction for Midwestern Corn Production with Cover Crop Utilization

#### ***Committee Member***

Aikaterini Kasamati, M.S. 2015. Water Holding Capacity of Beef Manure-Bedding Mixtures and Design Implications

### **Peer Reviewed Papers**

Shepherd, T., Y. Zhao, H. Li, J. Stinn, **M. Hayes**, and H. Xin. 2015. Environmental assessment of three egg production systems – Part II: Ammonia, greenhouse gas, and particulate matter emissions. *Poultry Sci.* 94(3): 534-543.

Zhao, Y., T.A. Shepherd, T.A., H. Li, J.P. Stinn, **M.D. Hayes**, and H. Xin. 2015. Environmental assessment of three laying-hen housing systems—Part I: Monitoring system and indoor air quality. *Poultry Sci.* 94(3): 518-533.

Brown-Brandl, T., **M. Hayes**, H. Xin, J. Nienaber, H. Li, R. Eigenberg, J. Stinn, and T. Shepherd. 2014. Heat and moisture production of modern swine. *Trans ASHRAE* 120(1).

Hales, K.E., S.D. Shackelford, J.E. Wells, D.A. King, **M.D. Hayes**, T.M. Brown-Brandl, L.A. Kuehn, H.C. Freetly, and T.L. Wheeler. 2014. Effects of feeding dry-rolled corn-based diets with and without wet distillers grains with solubles and zilpaterol hydrochloride on performance, carcass characteristics, and heat stress in finishing beef steers. *J. Anim. Sci.* 92(9): 4023-4033.

**Hayes, M. D.**, H. Xin, H. Li, T. A. Shepherd, and J. Stinn. 2014. Electricity and fuel use of aviary laying-hen houses in the Midwestern United States. *Appl Eng Agric.* 30(2): 259-266.

**Hayes, M. D.**, H. Xin, H. Li, T. A. Shepherd, Y. Zhao, and J. Stinn. 2013. Heat and moisture production of Hy-line Brown hens in the Midwestern United States. *Trans ASABE* 56(2): 753-761.

**Hayes, M. D.**, H. Xin, H. Li, T. A. Shepherd, Y. Zhao, and J. Stinn. 2013. Ammonia, greenhouse gas, and particulate matter emissions of aviary layer houses in the Midwestern United States. *Trans ASABE* 56(5): 1921-1932.

Zhao, Y., H. Xin, T. Shepherd, **M. Hayes**, and J. Stinn. 2013. Modeling ventilation rate, balance temperature and supplemental heat need in alternative vs. conventional laying-hen housing systems. *Biosystems Eng* 115: 311-323.

Zhao, Y., H. Xin, T. Shepherd, **M. Hayes**, J. Stinn, and H. Li. 2013. Thermal environment, ammonia concentrations and emissions of aviary houses with white laying hens. *Trans ASABE* 56(3): 1145-1156.

Foth, A., T. Brown-Brandl, H. Freetly, **M. Hayes**, P. Kononoff. 2013. Validation and recovery rates of an indirect calorimetry headbox system used to measure heat production of cattle. *J. Anim. Sci.* 91(E-Suppl. 2): 262.

Kasimati, A., L. M. Pepple, **M. Hayes**, D. Shike, R. S. Gates. Characterizing Water Holding Capacity and Total Solids of Bedding-Manure Mixtures. *Trans ASABE*. Submitted 2015.

Parker, D., **M. Hayes**, T. Brown-Brandl, B. Woodbury, M. Spiehs, J. Koziel. 2015 Topical Application of Soybean Peroxidase and Calcium Peroxide for Reducing Odorous VOC Emissions from Swine Manure Slurry. *Appl Eng Agric*. Submitted 2015.

Shepherd, T., H. Xin, Y. Zhao, J. Stinn, **M. Hayes**, H. Li. Ammonia and Carbon Dioxide Emissions of Three Laying-hen Housing Systems as Affected by Manure Accumulation Time. *Agriculture, Ecosystems and Environment*. Submitted. 2016

### **Technical Papers**

Brown-Brandl, T., **M. Hayes**, G. Rohrer, and R. Eigenberg, Thermal comfort evaluation of three genetic lines of modern pigs using thermal images. In: *Proceeding of the 7<sup>th</sup> European Conference Precision Livestock Farming* Guarino, M. and D. Berckmans (Editors), Milan, Italy, September 15-18, 2015, pp 700.

Kasimati, A., L. M. Pepple, **M. Hayes**, D. Shike, R. S. Gates. Water Holding Capacity of Beef Manure-Bedding Mixtures and Design Implications. American Society of Agricultural and Biological Engineers Annual Meeting Paper #152187784. New Orleans, July 26-29, 2015.

Shepherd, T., H. Xin, Y. Zhao, J. Stinn, **M. Hayes**, H. Li. Ammonia and Carbon Dioxide Emissions of Three Laying-hen Housing Systems as Affected by Manure Accumulation Time. American Society of Agricultural and Biological Engineers Annual Meeting Paper #152189190. New Orleans, July 26-29, 2015.

Shepherd, T., H. Xin, **M. Hayes**, Y. Zhao, J. Stinn, H. Li Electricity and Fuel usage of Three Laying Hen Housing Systems: Conventional Cage, Enriched Colony, and Aviary. American Society of Agricultural and Biological Engineers Annual Meeting Paper #152189210. New Orleans, July 26-29, 2015.

R.S. Gates, Y. Xiong, R. Zimmerman, T. Funk, M. Hayes. Alternative Mechanical Ventilation Strategies for Filtered-air Systems in North American Livestock Barns. American Society of Agricultural and Biological Engineers Annual Meeting Paper #152190012. New Orleans, July 26-29, 2015.

Kasimati, A., L. M. Pepple, **M. Hayes**, R. S. Gates. Evaluating Corn Cob Bedding Water Holding Capacity with Manure Addition. American Society of Agricultural and Biological Engineers Annual Meeting Paper #141888513. Montreal, Quebec, Canada, July 13-16, 2014.

**Hayes, M.**, T. Brown-Brandl, J. Stinn, H. Li, H. Xin, J. Nienaber, T. Shepherd. House-level moisture production of modern swine by age, temperature and source. American Society of Agricultural and Biological Engineers Annual Meeting Paper #131618005, Kansas City, July 21-24, 2013.

Brown-Brandl, T., J. Nienaber, R. Eigenberg, H. Xin, **M. Hayes**. Heat Production of Nursery and Growing Pigs. American Society of Agricultural and Biological Engineers Annual Meeting Paper #131618879, Kansas City, July 21-24, 2013.

Eigenberg, R., T. Brown-Brandl, **M. Hayes**. Shade Structure Design and Evaluation. American Society of Agricultural and Biological Engineers Annual Meeting Paper #131595866, Kansas City, July 21-24, 2013.

**Hayes, M.**, H. Xin, H. Li, T. Shepherd, and J. Stinn., 2012. Electricity and Fuel Usage of Aviary Laying-Hen Houses in the Midwestern United States. American Society of Agricultural and Biological Engineers International Livestock Environment Symposium Paper #. ILES12-1268. Valencia, Spain, July 8-11, 2012.

**Hayes, M.**, H. Xin, H. Li, T. Shepherd, Y. Zhao, and J. Stinn. 2012. Ammonia, Greenhouse Gas, and Particulate Matter Concentrations and Emissions of Aviary Layer Houses in the Midwestern USA. American Society of Agricultural and Biological Engineers International Livestock Environment Symposium Paper #. ILES12-1480. Valencia, Spain, July 8-11, 2012.

**Hayes, M.**, H. Xin, H. Li, T. Shepherd, Y. Chen, J. Stinn, and Y. Zhao. 2012a. Bioenergetics of Hy-Line Brown Hens in Aviary Houses. American Society of Agricultural and Biological Engineers International Livestock Environment Symposium Paper #. ILES12-1481. Valencia, Spain, July 8-11, 2012.

Chen, Y., H. Xin, H. Li, T. Shepherd, **M. Hayes**, J. Stinn, R. Burns, R. Gates, H. Dong. Comparison of Ammonia Emissions from Poultry Houses Based on Diurnal Integration vs. Daily Means of Gas Concentration and Building Ventilation Rate. American Society of Agricultural and Biological Engineers International Livestock Environment Symposium Paper #. ILES12-0965. Valencia, Spain, July 8-11, 2012.

Jenkins, J.D., R.L. Parsons, M. Hayes, H. Xin, S.T. Millman. Litter Use in an Aviary Laying Hen Housing System. *Animal Industry Report*. 658 (1): 52.

**Hayes, M.**, H. Xin, H. Li, T. Shepherd, Y. Zhao, Y. Chen, R. Parsons, S. Millman. 2011. An evaluation of the impacts of the aviary system in the Midwestern United States. A presentation at the International Symposium on Health Environment and Animal Welfare, Rongchang, Sichuan, China, Oct 20-22, 2011.

Parsons, R., **M. Hayes**, H. Xin, S. Millman. 2011. Welfare and behaviour in an aviary laying-hen housing system. In: *Proceeding of the 5<sup>th</sup> International Conference on the Assessment of Animal Welfare at Farm and Group Level*, T. Widowski, P. Lawliss, K. Sheppard (Editors), Guelph, Canada, August 8-11, 2011, pp.98.

**Hayes, M. D.**, H. Xin, H. Li. An Evaluation of Young Laying Hen's Environmental Preference. American Society of Agricultural and Biological Engineers Annual Meeting Paper #1008909, Pittsburgh, PA, June 20-23, 2010.

**Hayes, M. D.**, H. Xin, H. Li. An Evaluation of Pullet and Young Laying Hen Ammonia Aversion Using a Preference Test Chamber. American Society of Agricultural and Biological Engineers Annual Meeting Paper #096132, Reno, Nevada, June 21-24, 2009.

**Hayes, M. D.**, T. S. Stombaugh, E. S. Vanzant, R. S. Gates. Utilizing Thermal Imaging to Locate Blood Flow in the Bovine Ear. American Society of Agricultural and Biological Engineers Annual Meeting Paper # 084075, Providence, Rhode Island, June 29-July 2, 2008.

**Hayes, M. D.**, T. S. Stombaugh, E. S. Vanzant, R. S. Gates. Comparison of Bovine Blood Absorption Coefficients to Human Curves. American Society of Agricultural and Biological Engineers International Livestock Environment Symposium Paper # PAP0253, Iguassu Falls, Brazil, Aug 31-Sept 4, 2008.

**Hayes, M. D.**, T. S. Stombaugh, E. S. Vanzant, R. S. Gates. Thermal Imaging to Determine Optimal Placement of Ear Tag Temperature Sensor and Correlation to Core Body Temperature. American Society of Agricultural and Biological Engineers Annual Meeting. Minneapolis, MN, June 17-20, 2007.

### **Honors and Awards**

2013 ASABE Outstanding Reviewer Structures and Environment Division  
 2014 ASHRAE Technical Paper Award  
 2014 ASHRAE Willis H. Carrier Award  
 2015 New Face of ASABE

### **Extension Activities**

#### ***Outreach Presentations/Workshops***

<b>Location</b>	<b>Date</b>	<b>Involvement</b>	<b>Event</b>	<b>Topic</b>
St Paul, MN	March 2013	Presentation	Midwest Poultry Federation Convention	Natural Ventilation in Organic Poultry Houses in Cold Weather
Urbana, IL	June 2014	Presentation	University of Illinois Swine Manure Management Short Course	Updated Swine Heat and Moisture Production Rates
Illinois	February 2015	Interview	II Field & Bean	What's In Manure
Peoria, IL	February 2015	Presentation	Illinois Pork Expo	Managing Ventilation for Your Barn
Peoria, IL	February 2015	Presentation	Illinois Pork Expo	Pit Foaming, Manure Management and the Other Latest Research from University of Illinois Extension
Urbana, IL	March 2015	Presentation	Beef and Beyond Conference	Confinement Cow-Calf Operations: Spacing and Ventilation
Sterling, IL	August 2015	Coordination & Demonstration	Animal Mortality Composting Workshop	Carbon Sources, Moisture Management
IL/IA	October 2015	Interview	Living the Country Life	Heating for Barns

Illinois	November 2015	Article	IL Land Contactors of America Newsletter	Liquid Manure Application to Tile Drained Fields
8 locations in IL	Winter 2015-2016	Coordination & Presentation	Certified Livestock Manager Training (Assist)	Nutrient Management Planning and Best Management Practices
Springfield, IL	February 2016	Presentation	Illinois Pork Expo	Value of Manure
Columbus, IN	February 2016	Presentation	Midwest Women in Agriculture Conference	Farmstead Planning
Freeport and Effingham, IL	March 2016	Coordination & Presentation	IL Extension Cattle Ventilation Workshops	Improving ventilation in a beef or dairy barn

### ***Individual Outreach***

<b>Client</b>	<b>Date</b>	<b>Concern</b>	<b>Response</b>
University of Illinois Swine Farm	February-December 2014	Poorly functioning naturally ventilated barn	Provide design options for retrofitting and testing of mechanical ventilation
University of Illinois South Farms	March 2014	Feasibility study of anaerobic digester	Provide written and verbal comments addressing concerns with the report
Wagner Historic Farm	September and October 2014	Considering expansion with public scrutiny	Site visit, Provide report with possible barn options and recognized issues
Carthage Veterinary Services	October & December 2014, October 2015	Independent assessment of new design positive pressure filtered barn	Discussion, site visit during construction and after operation
Shanks Farm	April 2015	Retrofitting a beef handling/hay storage barn with large I-beams to remove columns	Provide structural references and general information, encourage using structural engineer for further design work
McClune Farm	August 2015	Odor at the homestead based on siting for a new swine barn	Provide information through email and phone call, site visit for further discussion
Kuhn Farm	September 2015	Ventilation needs in a swine finishing hoop barn	Phone call, email and a site visit during construction for assistance
Stan Duda	November 2015	Nuisance issues from neighboring horse boarding facility	Give regulatory information that farms must follow, contact information for experts and complaint phone number

## **Industry Relations**

<b>Event</b>	<b>Date</b>	<b>Type of Interaction</b>
Illinois Pork Expo	February 2014	Display and Discussion with producers, exhibitors, and IL Pork Producers Association members
Illinois Extension County Directors Annual Meeting	February 2014	Presentation and discussion with regional extension directors
Egg Industry Issues Forum	April 2014	Learn about current concerns for egg producers
Choretime Manufacturing Tour	April 2014	Learn about mechanical systems for livestock buildings
Pork Quality Assurance Advisor Training	May 2014	Learn about pork industry management expectations
Illinois Extension Animal Systems Team Inservice	May 2014	Presentation and discussion with livestock educators
NCCC9 Multistate Committee	May 2014	Meet and plan joint efforts with extension ag engineers from the Midwest
Cumberland Farm Bureau Meeting	June 2014	Meet with local producers
Illinois Extension Beef Field Day	September 2014	Meet beef producers, extension specialists, and members of the IL Beef Association
Valley View Farm	October 2014	Visit large swine finishing facility to see unique manure handling including anaerobic digestion, solid separation, prilling
Illinois Extension Cover Crop Field Day	November 2014	Meet producers and extension agents
Illinois Pork Producers Association	December 2014	Presentation: Current Research and Extension from ABE
Illinois Soybean Association Livestock Roundtable	December 2014	Meet members of the IL Soybean Livestock Development Team
Illinois Pork Expo	February 2015	Display and Discussion with producers, exhibitors, and IL Pork Producers Association members
Meeting with IL EPA	May 2015	Discuss new CAFO regulations joint efforts with IL EPA to provide more information
NCCC9 Multistate Committee	May2015	Meet and plan joint efforts with extension ag engineers from the Midwest
World Pork Expo	June 2015	Learn about current/newest technologies for the swine industry
IL Nutrient Loss Reduction Strategy Meeting	June 2015	Learn about the nutrient loss reduction strategy and meet those providing outreach
IL NRCS Technical Committee	July 2015	Meet additional groups who have interest in NRCS programs

## **Professional Membership**

### Multistate Committees

NCCC9: *MWPS: Research and Extension Educational Materials*

W2173: *Impacts of Stress Factors on Performance, Health, and Well-Being of Farm Animals*

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

ASABE PAFS (Plant, Animal, and Facility Systems) 01 Executive Committee Secretary

ASABE PAFS 40 Environmental Quality & Control Group (Chair 2014&2015)

ASABE PAFS 40/1 Environmental Physiology Member (Chair 2012)

ASABE PAFS 40/2 Environment of Animal Structures (Chair 2013)

ASABE PAFS 50 Environmental Air Quality Member

ASABE PAFS 40/5 Poultry Housing Member

ASABE PAFS 413 Animal Welfare & Care Chair

ASABE MS 23/19/3 Electronics for Identification (Animal)

ASABE P 513 Membership Publications Editorial Board

### American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

TC 2.2 Plant and Animal Environment Technical Committee Member

Iowa State Graduate Student Dean's Advisory Board-College of Engineering 2010-2011

Alpha Epsilon Honor Society

Council for Agricultural Science and Technology (CAST) Member