

<b>Title:</b>	<b>A human behavioral approach to reducing the impact of livestock pest or disease incursions of socio-economic importance</b>		
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**Program Code:** A5152

**Program Name:**

Global Food Security: Minimizing Losses

**Project Director**

Julia Smith  
802-656-4496  
julie.m.smith@uvm.edu

**Recipient Organization**

UNIVERSITY OF VERMONT & STATE AGRICULTURAL COLLEGE  
85 S PROSPECT ST  
Burlington, VT 054051704

**Performing Department**

Animal and Veterinary Sciences

DUNS No. 066811191

**Co-Project Directors**

Koliba, Christopher  
Littlefield, Robert  
Bass, Thomas  
Kerr, Susan  
Parker, Jason  
Schulz, Lee  
Zia, Asim  
Tonsor, Glynn  
Merrill, Scott  
McDonald, Jeannette  
Sellnow, Timothy

**Departments**

Department of Public Administration  
Communications  
{NO DATA ENTERED}  
CAHNRS-Extension  
SENR  
Economics  
CDAE  
Agricultural Economics  
Plant and Soil Science  
  
Nicholson School of Communication

**Non-Technical Summary**

Emerging diseases of socio-economic importance have food security, perceived food safety, and domestic and international trade implications for the marketing of animals or animal products. Understanding the human behavioral dimensions of the introduction, spread, identification, reporting, and containment of new, emerging, and foreign pests and diseases of livestock is critically important for developing effective strategies to sustain a productive, profitable, and secure food animal sector. Experts in animal science and veterinary medicine, agricultural economics, public policy, anthropology, adult education, and risk communication come together to lead this inter-disciplinary applied research and outreach project focused on enhancing biosecurity practices and strategies to reduce the impact of incursions of new, emerging, or foreign pests or diseases of dairy, beef, and swine. Through engagement with project activities, stakeholders in U.S. dairy, beef, and pork production will be encouraged to implement practices and policies that collectively reduce the impact and threat of new, emerging, and foreign pests and diseases to the nation's meat and milk supply. This proposal directly addresses **Priority Area A5152 within the Food Security Challenge Area--Animal Health and Production and Animal Products**. Educational resources, "games", and messages developed and tested during the project will be made available beyond the end of the funding period through learning object repositories and an innovative web portal.

## Accomplishments

### Major goals of the project

Overall Goal: The activities and outputs of this project will facilitate the development and adoption of practices and policies that collectively reduce the impact of new, emerging and foreign pests and diseases to domestic production of cattle, swine and small ruminant foods and byproducts.

The following objectives will guide the activities of this CAP:

Objective 1: Characterize determinants of behavior of stakeholders at critical control points where application of practices or protocols can prevent (or reduce the impact of) incursions of pests and diseases of cattle, pigs and small ruminants.

Objective 2. Determine economic attractiveness of solutions that enhance biosecurity.

Objective 3. Determine most effective communication strategies (message tactic and wording, channels, and sources).

Objective 4. Integrate disease characteristics, human risk perception and socio-economic influences on behavior in a simulated "game" environment.

Objective 5. Develop educational and outreach materials and methods that lead to measurable changes in attitude and behaviors at critical control points in cattle, swine and small ruminant production systems.

### What was accomplished under these goals?

Overall Goal: Food animal production, not counting poultry, represents roughly \$140 billion per year of economic activity in the United States. Mitigating the consequences of diseases and pests with potentially severe social and economic ramifications is a vital aspect of sustaining a profitable and productive food animal sector. Protecting food animal health from new, emerging and foreign diseases and pests requires knowledge of, and routine performance of, behaviors that reduce the likelihood of entry of diseases and pests into an animal facility. Better understanding of the motivational drivers of behavior and better tools will allow us to nudge behavior in the right direction. Innovative research platforms, stakeholder surveys and interactive delivery of educational materials are helping facilitate the development and adoption of practices and policies that collectively reduce the impact of new, emerging and foreign pests and diseases, particularly to domestic production of cattle, swine and small ruminant foods and byproducts. The team's effort is organized around the objectives listed above. These objectives define the major thrust of effort planned out over the course of the project. Their execution is simultaneous not consecutive. Stakeholder input, cross-disciplinary linkages and synergies inform project direction and refinement of objectives over the five-year project.

Objective 1. Characterize determinants of behavior of stakeholders at critical control points where application of practices or protocols can prevent (or reduce the impact of) incursions of pests and diseases of cattle and pigs.

One of the project's most unique aspects is the use of experimental games to learn about human decision-making, which in turn informs our simulation models. A major advantage of this approach compared to surveys is that the user is actively engaged within the environment where opportunities for decision-making arise. With "cloud" and online technology, experimental games can reach a wide audience, simplifying data collection. Based on input from industry stakeholders, our experimental games address facility biosecurity on two levels: strategic/tactical and operational. To become secure against disease, a facility must first adopt best management protocols, such as truck washes and showering units for workers who enter barns. Adopting such measures is a strategic decision made by facility owners/managers. Workers, on the other hand, make operational decisions when they decide to comply or not comply with protocols. We aim to learn under what conditions people make strategic and operational decisions that enhance levels of biosecurity.

Objective 2. Determine economic attractiveness of solutions that enhance biosecurity.

A national swine producer survey documented swine industry characteristics, biosecurity adoption, and how risks to swine health factor into producer decision-making. A feedlot operator survey documented feedlot industry characteristics and how feedlot operators and their team of experts make decisions regarding price and animal health risk. These surveys have set the stage for analyses discussed in next year's work plan, which will lead to additional abstracts and manuscripts. Ultimately these analyses will help us better understand the managerial decision-making process and hence our comprehension of why certain decisions are made. With additional funds from the Iowa State University College of Veterinary Medicine, a relatively simple and transparent method to estimate the economic impact of veterinary diagnostic laboratories (VDLs) was developed and published. Existing equilibrium displacement models have been extended to include the dairy cattle industry and their indirect connections to the beef cattle, swine, and chicken industries. This model is available for use in providing market-level assessments of changes in prices and quantities under different biosecurity scenarios identified by the broader project effort.

Objective 3. Determine, develop and apply most effective communication strategies (message tactic and wording, channels, and sources).

Risk communication can be defined as communication in the face of uncertainty. Risk communication is appropriate in the context of animal diseases, which may or may not impact a particular food animal production business. In this project, risk communication efforts have been focused in three areas. First, an extensive review of the communication process involving the Porcine Epidemic Diarrhea virus (PEDv) outbreak was completed. Second, a collaborative project to develop and test risk messages is underway in collaboration with the SEGS team. Third, communication experts are working together with the educational outreach team to identify and share best practices for risk communication.

Objective 4. Integrate disease characteristics, human risk perception and socio-economic influences on behavior in a simulated "game" environment.

We currently have three versions of our agent-based model (ABM), developed in AnyLogic. They enable the user to learn about disease contagion after an outbreak in the hog production system. The models link risk attitude, contagion factors and the level of biosecurity adopted by the model agents (hog producers, feed mills, auction houses and slaughter plants) and simulate the spread of disease across a geographic region via the interaction networks in the hog supply chain. The calibration data were derived from sources such as the US Department of Agriculture and through active participation by stakeholders in the hog industry. The three ABM versions differ in their geographical extent, system processes and user interface. The first version simulates the network of agents at the state level for North Carolina, Iowa and Illinois. The other two ABMs are designed for Duplin County, North Carolina and have an interactive user interface. One model is designed to identify and learn about vulnerable nodes in the system by allowing the user to strategically start an infection at chosen agent locations. The other ABM is designed for decision-making. The user strategically invests an initial budget into biosecurity with the goal to minimize disease damage assessed by the number of infected farms and the equivalent market dollars of lost pigs. These tools offer a dynamic graphical interface and easy-to-interpret outputs (e.g., infected farms and market losses). The data collected help livestock producers, veterinarians or policy makers to explore the disease dynamics and examine management strategies.

Objective 5. Develop educational and outreach materials and methods that lead to measurable changes in attitude and behaviors at critical control points in cattle, swine and small ruminant production systems.

A suite of learning objects is nearing completion. The topics of these learning objects are: (1) What is Biosecurity? (2) Routes of Infection and Means of Transmission, (3) Finding Points of Disease Transmission Risk, and (4) Biosecurity Strategies. Each learning object is a self-contained set of interactive learning activities, which will be made accessible online. The learning objects include cattle, swine and small ruminant examples. Each learning object can be used independently, but subsequent ones review key points from previous modules and provide additional knowledge required for understanding and completing the fourth and final module of the series. In the final module, students learn about biosecurity strategies, create a biosecurity plan for a sample farm, and identify their top four most cost-effective recommendations. Based on peer-review feedback, the target audience for the biosecurity learning objects is 6th through 12th graders. These educational tools have been introduced to numerous 4-H student groups and demonstrated to agricultural educators at professional conferences and received overwhelmingly positive feedback.

### **What opportunities for training and professional development has the project provided?**

Through this project, training opportunities for three undergraduates, eight graduate students, one post-doctoral research associate, and two program staff have been provided this past year. In addition, faculty collaborators have gained better understanding of different disciplinary perspectives and explored cross-disciplinary initiatives.

#### **Undergraduates**

Luke Trinity, William Nupp and Evan Reilly at the University of Vermont have worked under Scott Merrill's supervision to learn and apply programming skills to developing experimental games for the project. They have also learned biosecurity concepts. Graduate students

Adria McCarty, MA in Communication at the University of Central Florida, was involved in collecting data and writing a manuscript based on the exemplification experiment associated with the disease risk tolerance game. She graduated in May 2017.

Emily Helsel, MA candidate in Communication at the University of Central Florida since January 2017, started working with the project as an undergraduate and assisted with data analysis from the PEDv case study interviews and subsequent manuscript preparation.

Maxwell Kuchenreuther, MA candidate at the University of Central Florida, assisted in development of the grant's Website and logo. He also helps manage the software and hardware needed for data collection.

Serge Wiltshire, PhD candidate in Food Systems and working on a Certificate in Complex Systems at the University of Vermont, was funded by the project fall 2015 through summer 2016 and has been working part-time for the project since then. He has been instrumental in bringing new members of the Social Ecological Gaming and Simulation laboratory up to speed with the use of AnyLogic for programming agent-based models. He presented a poster at the Computational Social Science conference in 2017.

Eric Clark, PhD candidate in Math and Statistics at the University of Vermont, came on board in August 2016. He has assisted with converting the protocol adoption experimental game into an online format and making it accessible. This work supports objectives 3 and 4.

James Mitchell, PhD candidate in Agricultural Economics at Kansas State University, has been supported by the project since August 2016. He has assisted with building an equilibrium displacement model for estimating market-level effects of various biosecurity investments and scenarios, which will be instrumental for objective 2.

Qianrong Wu, PhD candidate in Economics at Iowa State University, came on board in 2016 and defended her dissertation in May 2017. She is lead author of two published manuscripts based on work funded by this grant.

Christopher Pudenz, PhD student in Economics at Iowa State University, came on board in August 2017 and is already lead author on an extension publication published in December 2017.

## Post-doctoral researchers

Gabriela Bucini, (80% FTE) post-doctoral assistant at the University of Vermont, has been employed by the project since September 2016. She is using AnyLogic to program agent-based models and is excited to have deployed the model in an interactive manner online.

## Staff

Eileen Kristiansen, (100% FTE) project budget manager at the University of Vermont, as a benefit of employment is completing her doctoral program in educational leadership.

Susan Moegenburg, (75%) project manager with the Social Ecological Gaming and Simulation laboratory at the University of Vermont, has been employed by the project since December 2015. She keeps up with the literature and the progress of collaborating faculty and students in the laboratory.

Eileen and Susan have both attended project team meetings to strengthen relationships with others on the project and gain relevant knowledge.

## How have the results been disseminated to communities of interest?

Four manuscripts were published and four submitted in year 3 of the project. Seventeen conference papers or posters were presented in a variety of disciplines. As in previous years, we published two project newsletters and conducted two project team meetings, in which stakeholders or advisors participated. We also pilot tested the first learning objects, created new versions of the data collection games and agent-based models, published two extension publications and a staff paper, and conducted a variety of workshops and trainings detailed in a later section of this report.

## What do you plan to do during the next reporting period to accomplish the goals?

### Overall

The project team plans to continue meeting twice a year to share progress, gather input, and determine next steps. The project director will attend the USDA project director's meeting. Team members will present at a variety of national and international meetings. A key international meeting is the first conference of the newly formed International Society for Economics and Social Sciences of Animal Health. The aims of this organization are nearly identical to the goals of this grant project.

Objective 1. Characterize determinants of behavior of stakeholders at critical control points where application of practices or protocols can prevent (or reduce the impact of) incursions of pests and diseases of cattle and pigs.

Efforts described under objective 3 below, factor into accomplishing the third part of objective 1: developing a typology by which stakeholders can be classified for tailoring of risk messages and other incentives to motivate animal health protective behaviors.

Objective 2. Determine economic attractiveness of solutions that enhance biosecurity.

Several analyses will be performed with data from the completed swine producer and feedlot operator surveys. We will determine the factors leading to adoption and the degree of complementarity among biosecurity practices in the swine industry. Additional work will estimate the economic "carrot" needed, in the form of higher market hog prices, to encourage producers to adopt costly biosecurity practices they otherwise may avoid. Furthermore, we will document how producers anticipating payments of indemnity to be conditional on biosecurity effort exert more desirable, proactive investment that may reduce industry-wide disease risk and impact. To better understand tradeoffs and relationships between risk management decisions of feedlot operators, we will examine the relationship between output price and animal health risk management.

In addition, upcoming producer surveys are planned and will be executed as specific willingness of industry partners is confirmed and final project budgets are determined. The main goals are to (1) explore willingness to participate in information sharing around animal health and (2) examine relationships among biosecurity perceptions and efforts. Surveys will likely include contingent valuation and choice experiment questions similar to the completed swine industry survey allowing comparisons of how willingness to invest or adopt additional biosecurity varies across species. Data from these surveys will underlie producer-oriented partial budgets developed to help guide decision-making on key biosecurity practices. Other surveys of agricultural lenders and meat export stakeholders may be developed and conducted subsequently. These surveys would focus on impacts biosecurity practices have on upfront loans granted on new facilities or on recurring, operating loans as well as the impact biosecurity practices have on maintaining or expanding US meat exports.

Objective 3. Determine, develop and apply most effective communication strategies (message tactic and wording, channels, and sources).

In year 4 we intend to continue refining our research to optimize its utility for the swine industry, specifically, and for the animal industry, in general. One way we will expand this research is by completing a study of the poultry industry's efforts to manage Highly Pathogenic Avian Influenza (HPAI), equally extensive to our previous study of the swine industry's response to PEDv. Because HPAI is the cause of a recent outbreak of a disease that triggered eradication under USDA authority, it will provide helpful insights into this type of disease response and allow comparison with the response to an emerging disease that did not trigger eradication. We will assess the utility of our work through our ongoing interaction with industry representatives and peer reviewers for relevant journals and conferences.

Although we have experienced initial success in our message design and test project, we need to conduct further research. This coming year, we will create new messages based on continued research and test them using both the current game and a new game developed by the SEGS team. We hope that, after additional message design and testing efforts, we will have compelling evidence to share with industry spokespersons.

The combination of theoretical development and multiple case studies generated through grant-funded efforts provides sufficient data for a book-length manuscript focusing on risk communication challenges and opportunities in the context of agricultural biosecurity. Lexington Books has responded favorably to our pre-proposal and has invited us to direct our full proposal to the editor of a book series on strategic communication. We have talked with the series editor, and she is enthusiastic about our proposal. We are in the final stages of generating our full proposal for the series editor's final review. If the proposal is accepted as we expect, we will begin writing the book in mid-2018.

We will also attend to strengthening agricultural communication networks. We are particularly interested in engaging with Hutterite producers and those of other Anabaptist sects (e.g., Amish and Mennonite). Dr. Jason Parker, who has relocated to the Ohio State University, is recruiting a graduate student to take on this project. The aim of this work is to identify strategies and channels appropriate for communicating biosecurity messages to Anabaptist producers.

Objective 4. Integrate disease characteristics, human risk perception and socio-economic influences on behavior in a simulated "game" environment.

Led by the project team members affiliated with the Social Ecological Gaming and Simulation (SEGS) Laboratory at the University of Vermont, we will continue to integrate disease characteristics, human risk perception, and socio-economic influences on behavior in a simulated environment. Both an Agent-Based Model (ABM, a type of simulation model) and experimental games will be used to fulfill this objective.

Objective 5. Develop educational and outreach materials and methods that lead to measurable changes in attitude and behaviors at critical control points in cattle, swine and small ruminant production systems.

In the fourth year of the grant, we will complete peer-reviews and pilot testing of the third and fourth learning objects and incorporate changes as needed. The learning objects will continue to be demonstrated at various conferences to promote their use by 4-H leaders and other agricultural educators. In addition, the project team's communication experts are assisting in the development of a risk communication education module for future producers and risk communicators. The risk communication module will focus on the following areas: 1) best practices for risk communication planning, 2) best practices for risk message design, 3) media literacy--the ability to distinguish credible, data-supported information from less credible information, and 4) effective

**Participants**

**Actual FTE's for this Reporting Period**

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	2	0	0.6	0.8	3.4
Professional	0.6	0	1	0	1.6
Technical	1.3	0.4	1	0	2.7
Administrative	0.9	0	0	0	0.9
Other	0	0	0	0	0
<b>Computed Total</b>	<b>4.8</b>	<b>0.4</b>	<b>2.6</b>	<b>0.8</b>	<b>8.6</b>

**Student Count by Classification of Instructional Programs (CIP) Code**

Undergraduate	Graduate	Post-Doctorate	CIP Code
		1	11.08 Computer Software and Media Applications.
3			11.02 Computer Programming.
	2		45.06 Economics.
	2		09.09 Public Relations, Advertising, and Applied Communication.
	1		11.01 Computer and Information Sciences, General.
	1		11.08 Computer Software and Media Applications.
		1	11.08 Computer Software and Media Applications.

**Target Audience**

Team members have presented project-related work to risk communication practitioners (International Risk Communication Symposium), complex systems modelers (Conference of Complex Systems, Agent-Based Modeling symposium), scholars and practitioners in public administration (Northeast Public Administration Conference), as well as epidemiologists and other team members (June 2017 and January 2018 project team meetings). Students and "turkers" (via Amazon Mechanical Turk platform) have played experimental games. Advisors have received copies of all newsletters.

Additionally, stakeholders have engaged in project activities in the following ways:

- Swine producers and feedlot operators have responded to surveys focusing on how animal health risk and economics factor into decision-making.
- Extension faculty and staff from several states have reviewed learning objects three and four.
- Youth have participated in sessions piloting the first and second learning objects.

**Products**

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Koliba, C., S. Merrill, A. Zia, S. Wiltshire, and G. Bucini. "Utilization of computer simulation and serious games to inform livestock biosecurity policy and governance." Public Management Research Conference, Washington, DC. June 8-10, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2017	YES

**Citation**

Wu, Q., L.L. Schulz, G.T. Tonsor, and J.M. Smith. "Expert views on effectiveness, feasibility, and implementation of biosecurity measures for mitigating Tier 1 disease risks in the U.S. swine, beef cattle, and dairy industries." Journal of Veterinary Science and Technology 8(2):435.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Zia A., S. Merrill, C. Koliba, S. Moegenburg, S. Wiltshire, E. Clark, G. Bucini, and J. Smith. "Are human agents myopic or far-sighted under differential conditions of risk and ambiguity? A Bayesian network model of biosecurity state transitions in a sequential decision experiment." Conference on Complex Systems, Cancun, Quintana Roo, Mexico. September 17-22, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

McKendree, M.G.S., G.T. Tonsor, L.L. Schulz. "Feedlot operators' decision making regarding price and animal health risk." 2017 Agricultural and Applied Economics Association Annual Meeting. Chicago, IL. July 30 - August 1, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2017	YES

**Citation**

Kerr, S. 2017. "Practical biosecurity recommendations for farm tour hosts." Washington State University Extension Publication FS257E, <http://extension.wsu.edu/publications/pubs/fs257e/>

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Sellnow, T. L., and D. D. Sellnow. "Crisis communication in response to rapidly emerging diseases." Central States Communication Association. Minneapolis, MN. March 17, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Accepted	2017	YES

**Citation**

Sellnow, T., D. Sellnow, J. Parker, and J. Martin. "Risk and crisis communication narratives in response to rapidly emerging diseases." Risk Research.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Sellnow, T., D. Sellnow, E. Helsel, and J. Parker. "Risk and crisis messages from an industry on the front line: Lessons learned from the PEDv." National Communication Association. Dallas, TX. November 17, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Sellnow, T. "Composing and communicating effective risk messages: Advice from the most current research." International Risk Communication Symposium. Seoul, South Korea. October 26, 2017

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Submitted	2017	YES

**Citation**

Merrill, S., C. Koliba, A. Zia, J. Parker, S. Moegenburg, T. Sellnow, S. Wiltshire, G. Bucini, K. Danehy, and J. Smith. "Adoption of livestock biosecurity practices amidst environmental and social uncertainty: Evidence from a randomized experimental game." Games and Economic Behavior.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Submitted	2017	YES

**Citation**

Wiltshire, S., K. Logan, S. Merrill, and J. Fooks. "Size matters: How social learning can facilitate the diffusion of pro- environmental agricultural innovations." Agricultural Systems.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Submitted	2017	YES

**Citation**

Wiltshire, S., G. Bucini, E. Clark, C. Koliba, A. Zia, S. Merrill, J. Smith, and S. Moegenburg. "Using an agent-based model and network analytics to identify risk factors for epidemiological spread in regional livestock production chains." Journal of Artificial Societies and Social Simulation.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Koliba, C., A. Zia, and S. Merrill. "Utilization of computer simulation and serious games to inform livestock biosecurity policy and governance." Conference on Complex Systems, Cancun, Quintana Roo, Mexico. September 18, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Bucini, G., S. Wiltshire, E. Clark, S. Merrill, A. Zia, C. Koliba, S. Moegenburg, L. Trinity, and J. Smith. "Protecting herd health: Interactive agent-based modeling used to reduce the impact of disease." Larner College of Medicine 2017 Celebration of Excellence in Research. Burlington, Vermont. November 7, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2018	YES

**Citation**

Wu, Q., L.L. Schulz, and G.T. Tonsor. 2018. "Using expert knowledge to understand biosecurity adoption aimed at reducing Tier 1 disease risks in the U.S. livestock industry." *Journal of Agricultural Science* 10:12-26.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2018	YES

**Citation**

Schulz, L.L., D.J. Hayes, D.J. Holtkamp, and D.A. Swenson. 2018. "Economic impact of university veterinary diagnostic laboratories: A case study." *Preventive Veterinary Medicine* 151:5-12.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2017	YES

**Citation**

McKendree, M.G.S., G.T. Tonsor, and L.L. Schulz. "Feedlot Risk Management and Benchmarking Survey Summary." Michigan State University Department of Agricultural, Food, and Resource Economics. Staff Paper 2017-07. October 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2017	YES

**Citation**

Pudenz, C.C., L.L. Schulz, and G.T. Tonsor. 2017. "Biosecurity and health management by U.S. pork producers: 2017 survey summary." Iowa State University Extension and Outreach, Iowa State University of Science and Technology. <https://store.extension.iastate.edu/product/15321>

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Bucini, G., S. Wiltshire, S. Merrill, A. Zia, C. Koliba, E. Clark, L. Trinity, S. Moegenburg, and J. Smith. "Regional U.S. hog production chain biosecurity model." Agent-based Modeling - ABM17- A Symposium that advances the science of ABMs. San Diego, California. April 19-22, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Bucini, G., S. Wiltshire, S. Merrill, A. Zia, C. Koliba, E. Clark, L. Trinity, S. Moegenburg, and J. Smith. "Where will the infection spread? Effects of movement networks and human risk attitude on spread of swine disease." Agent-based Modeling - ABM17- A Symposium that advances the science of ABMs. San Diego, California. April 19-22, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Koliba, C., A. Zia, S. Merrill, G. Bucini, E. Clark, S. Moegenburg, and J. Smith. "Addressing wicked problems: What tools are in the toolbox? Serious gaming and system simulation." Northeast Conference on Public Administration. Burlington, Vermont. November 3, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Zia, A., C. Koliba, S. Merrill, E. Clark, G. Bucini, J. Smith, and S. Moegenburg. "Using agent-based models to address wicked problems." Northeast Conference on Public Administration. Burlington, Vermont. November 3, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Bucini, G., S. Merrill, C. Koliba, A. Zia, S. Wiltshire, E. Clark, L. Trinity, S. Moegenburg, and J. Smith. "Hog production chain biosecurity model." Northeast Conference on Public Administration. Burlington, Vermont. November 3, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Merrill, S., C. Koliba, A. Zia, G. Bucini, S. Wiltshire, E. Clark, S. Moegenburg, L. Trinity, and J. Smith. "Serious games: Data gathering, complex systems analysis, and nudging." Northeast Conference on Public Administration. Burlington, Vermont. November 3, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Published	2017	YES

**Citation**

Smith, J.M., T. Bass, G. Bucini, S. Dritz, S. Kerr, C. Koliba, R. Littlefield, J. McDonald, S. Merrill, J. Parker, J. Rankin, L. Schulz, D. Sellnow, T. Sellnow, R. Sero, G. Tonsor, and A. Zia. (poster) "A human behavioral approach to reducing the impact of livestock pest or disease incursions of socio-economic importance." USDA AFRI Animal Health and Well-Being Program Areas Annual Project Director Meeting, Chicago, IL, December 1, 2017.

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Published	2017	YES

**Citation**

Sellnow, T. L., J. S. Parker, D. D. Sellnow, R. S. Littlefield, E. M. Helsel, M. C. Getchell, J. M. Smith, and S. C. Merrill. 2017. "Improving biosecurity through instructional crisis communication: lessons learned from the PEDv outbreak." Journal of Applied Communications 101(4). doi.org/10.4148/1051-0834.1298

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers	Accepted	2017Y	YES

**Citation**

Wiltshire, S., G. Bucini, E. Clark, C. Koliba, A. Zia, S. Merrill, J. Smith, and S. Moegenburg. (poster) "Coupling agent- based modeling with network analytics and evolutionary computation: Can network features predict epidemiological risk in livestock production systems?" Conference of the Computational Social Science Society of the Americas, Santa Fe, NM, October 21, 2017.

**Other Products**

**Product Type**

Other

**Description**

Workshop: S. Kerr presented "Healthy Pigs = Healthy Pork Products" workshop to 15 attendees in Puyallup, WA, April 21, 2017.

**Product Type**

**Other**

**Description**

Workshop: University of Vermont Social Ecological Gaming and Simulation Laboratory team members funded by USDA NIFA conducted mediated modeling workshop focus group with swine industry stakeholders June 14, 2017. Presented and received feedback on serious games and agent-based models tailored to swine industry. For more information, contact S. Moegenburg.

**Product Type**

**Other**

**Description**

Exercise: S. Kerr represented Washington State University Extension at Washington State Department of Agriculture and King County Foreign Animal Disease Tabletop exercise, April 12, 2017. Day-long activity achieved objectives: validated response plan capabilities; developed stronger coordination between agencies and jurisdictions; coordinated public and stakeholder communications; and identified opportunities for planning and program improvements related to animal and agriculture planning in urban areas. Promoted ADBCAP grant-related activities.

**Product Type**

**Other**

**Description**

Workshop presentation: S. Kerr of Washington State University Extension and A. Itle, Washington State Department of Agriculture Field Veterinarian, co-presented invited biosecurity presentation to after school STEM program at Bellingham Middle School. Students gained appreciation for threats to animal health and actions to protect them; Extension strengthened partnership with WSDA and developed partnership with public school STEM program.

**Product Type**

**Other**

**Description**

Pilot test: S. Kerr piloted learning objects 1 and 2 with students at Lynden Christian School FFA meeting on September 18, 2017. Received feedback from target audience (N = 12) about usability of educational modules.

**Product Type**

**Other**

**Description**

Workshop presentation: S. Kerr gave invited presentation, "Biosecurity for swine farms", as part of day-long workshop for swine producers on November 29, 2017, in Kingston, WA. Small-scale and novice swine producers were educated about swine production biosecurity concerns and protocols and other aspects of swine production. Promoted online learning modules.

**Product Type**

**Other**

**Description**

Training: S. Moegenburg trained University of Central Florida team members in serious game deployment methods. For more information, contact S. Moegenburg.

**Product Type**

**Other**

## Description

Guest lecture: S. Merrill presented "Experimental gaming research: the next step in data gathering and complex systems analysis" lecture to Ecological Economics Class, University of Vermont, Oct. 10, 2017. (Based on work of Merrill, S., G. Bucini, E. Clark, L. Trinity, and S. Moegenburg)

## Product Type

Other

## Description

Workshop: S. Moegenburg presented "Experiencing a serious game: Reducing the impact of new or emergent disease on our livestock industries" and deployed the game for workshop participants at Northeast Conference of Public Administration, Burlington, Vermont, November 3, 2017. (Based on work of Moegenburg, S., S. Merrill, C. Koliba, A. Zia, L. Trinity, G. Bucini, S. Wiltshire, and J. Smith.)

## Product Type

Audio or Video

## Description

Experimental game: Protocol Adoption (Exemplification version). For more information, contact S. Moegenburg. (Other contributors: S. Merrill, A. Zia, and C. Koliba.)

## Product Type

Audio or Video

## Description

Experimental game: Compliance (V2, V3, and Mechanical Turk versions). For more information, contact S. Moegenburg. (Other contributors: S. Merrill, L. Trinity, C. Koliba, A. Zia, E. Clark, S. Wiltshire, G. Bucini, and J. Smith.)

## Product Type

Models

## Description

Agent-Based Models: Several versions of swine system models developed with AnyLogic. For more information, contact S. Moegenburg. (Other contributors: G. Bucini, S. Wiltshire, A. Zia, S. Merrill, C. Koliba, E. Clark, and J. Smith.)

## Product Type

Other

## Description

Grant proposal: Research White Paper submitted to Minerva Research Initiative. (Contributors: S. Merrill, A. Zia, C. Koliba, and J. Smith.)

## Product Type

Other

## Description

Newsletters: Animal Disease Biosecurity Coordinated Agricultural Project newsletters, February and December 2017, available at: <http://blog.uvm.edu/jmsmith/smith-leads-usda-nifa-cap-protection-animal-health/project-newsletters/>

## Product Type

Other

## Description

Team meeting: Animal Disease Biosecurity Coordinated Agricultural Project team meeting, June 2017, Mankato, MN, included team presentations and planning discussions, tour of swine feed mill, and meeting with swine production systems.

## Product Type

Other

## Description

Team meeting: Animal Disease Biosecurity Coordinated Agricultural Project team meeting, January 2018, Orlando, FL. Conducted team planning discussions and interactive session with 10 project advisors.

## Product Type Audio or Video

### Description

Radio spot: Max Armstrong, "Max Armstrong talks biosecurity in the swine industry." Farm Progress America. January 11, 2018.

<http://www.nationalhogfarmer.com/farm-life/farm-progress-america-january-11-2018>

Mentions results of Iowa State University swine producer survey on biosecurity practices. See publication by C.C. Pudenz, L.L. Schulz, and G.T. Tonsor.

### Changes/Problems

We have run into some delays with finalizing the project website and accessing the team file sharing site. After the UCF subaward was executed in late October, we moved forward with our first project newsletter of the year and successfully published it before the January team meeting.

The project director visited with the Board of Directors of the National Institute for Animal Agriculture in person last April and by phone in September. Although the final theme for the 2018 annual meeting did not align with the project as closely as originally expected, there will be opportunities for several collaborators to present at this meeting. Because we do not have a lead role designing a symposium add-on day in conjunction with this conference, other opportunities will be pursued for reviewing and ranking potential influential leverage points for animal health protection across the food animal production chain.

The utility of a disease list other than the National List of Reportable Animal Diseases (NLRAD; [https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/sa\\_disease\\_reporting/ct\\_disease\\_list](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/sa_disease_reporting/ct_disease_list)) seems limited. In 2016 the Center for Food Security and Public Health updated their lists of animal and human diseases from potential bioterrorist agents and USDA high consequence foreign animal diseases and pests (<http://www.cfsph.iastate.edu/Products/resources/WallChart.pdf>). These will be used to inform future efforts of our project and completes the second part of objective 1.

Lack of timely subaward processing for Montana State interfered with progress in exploring communication needs with underserved producers in the west. Further exploration of the Hutterite data is on hold as a key collaborator relocated to another institution.