

# Annual Report 2019

September 15, 2018 – September 14, 2019  
CDC/NIOSH Cooperative Agreement No. 5 U54 OH008085-15-00



## LETTER FROM THE DIRECTOR

The High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) has enjoyed continuous funding for more than 25 years. This year, we celebrated this rich history and took our look in a new direction unveiling a brand new logo. Our previous logo celebrated our successes and partnership with the dairy industry. While dairy is still a key focus area, we are eager to use our strengths in relationship building to establish new partnerships and diversify our involvement across the agricultural sector. Our new look speaks to the dynamic nature of our work and our region – reaching from the mountains to the plains.

Many HICAHS collaborators and students traveled to Seattle, Washington to participate in the Western Agriculture Safety and Health Conference in early August. The conference gave HICAHS the opportunity to showcase our core research and outreach projects as well as highlight the work of grantees from our Emerging Issues, Pilot, and Community-Initiated Grant Programs. Over the course of the conference, HICAHS contributed eight posters, four lightning talks, and five session speakers/panelists.

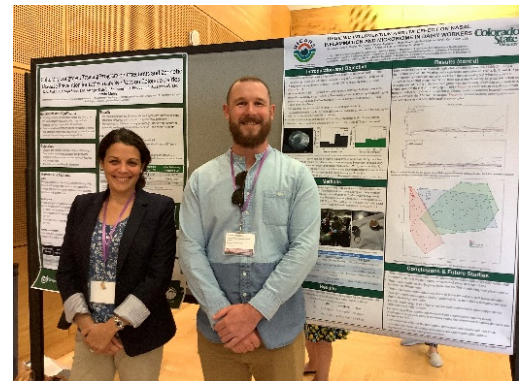
We also hosted a gathering of the International Dairy Research Consortium as part of the conference. Thirty-one researchers and industry members from five different countries gathered to discuss applying a Total Worker Health™ approach to the dairy industry. The meeting is already inspiring new collaborations and prompting discussions on better standardization across worker health studies worldwide.

The closing of our grant year also brings the conclusion of one of our core research projects: “Development of Engineering Controls to Reduce Foldable ROPS Overturn Fatalities”. A preliminary project summary is included later in this report, and we thank Paul Ayers for his contributions to HICAHS. We also want to say thank you to Ellie Brooks, who has left her post as center administrator and moved on to new endeavors.

Here's to another great year!



High Plains Intermountain Center  
for Agricultural Health and Safety  
*New HICAHS logo*



*Dr. Noa Roman-Muniz and graduate student Grant Erlandson presented their posters in August at the Western Agriculture Safety and Health Conference in Seattle, WA.*

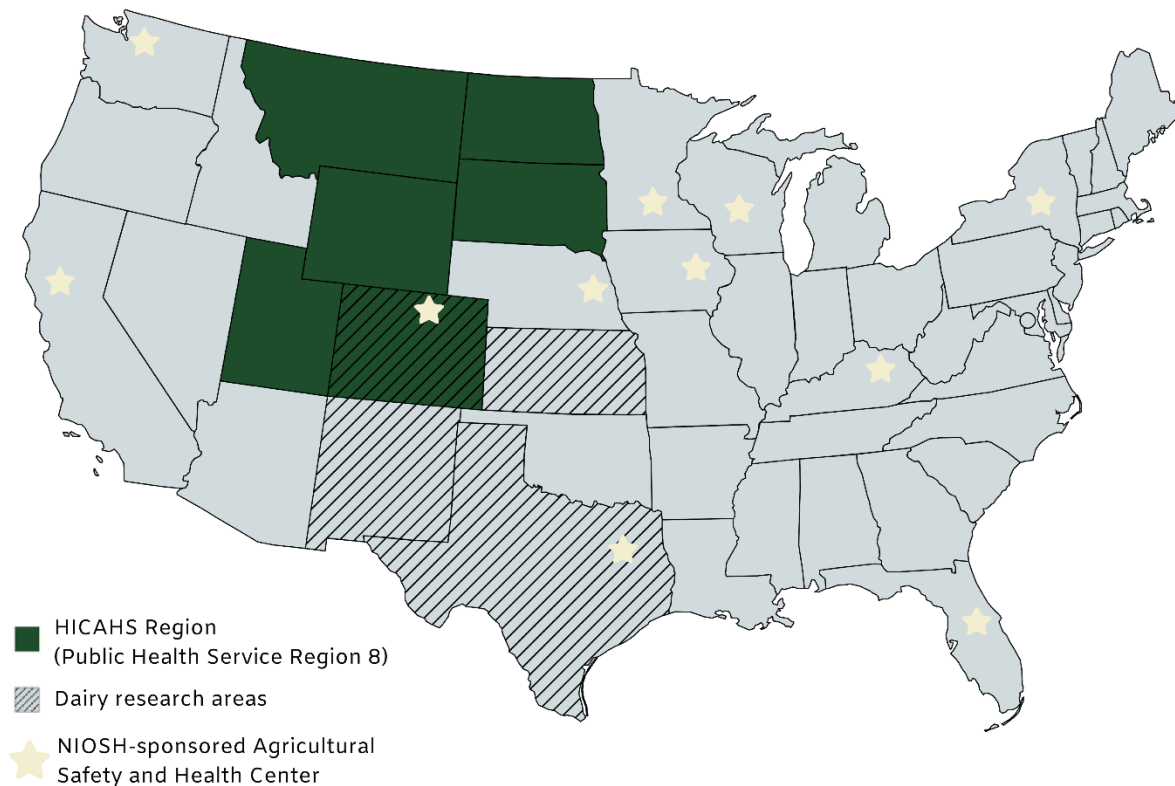


*International Dairy Research Consortium participants in Seattle, WA on August 6, 2019.*

## THE HICAHS REGION

“To be the preeminent scientific authority, resource, and site for innovative strategies that improve the health and safety of agricultural and forestry workers and their families in the high plains intermountain region and beyond.”

-- HICAHS Vision Statement, 2016-2021



### In the HICAHS region there are...

- 152,620 farms and ranches.
- over 300,000 workers (hired, migrant, and unpaid laborers).
- 212 million acres of farmland, with the average agricultural production operation having 1,391 acres. This is 24% of the nation's farmland!
- one-third of U.S. wheat cash receipts.
- 13% of annual U.S. dairy receipts, a total of \$4.9 billion (*dairy research areas*).
- \$9.9 billion in cash receipts annually from the sale of cattle and calves. This is nearly 15% of all annual cattle and calf sales in the U.S. and is the largest single-commodity revenue source in the HICAHS region.

Data compiled from the United States Department of Agriculture, Economic Research Service

# CORE RESEARCH PROJECT UPDATES

## Development of Engineering Controls to Reduce Foldable ROPS Overturn Fatalities

Paul Ayers - University of Tennessee

Foldable rollover protective structures (ROPS) are a popular addition to mowers and to tractors used on orchards. The foldable design allows the structure to be lowered for ease of maneuvering under trees and other low clearance structures. However, these devices usually require many steps to raise and lower, and thus they often remained lowered. Once lowered, the ROPS cannot protect the operator in the event of a tractor rollover.

For this project, Paul Ayers developed a universal lift assist lever that allows the operator to raise and lower a foldable ROPS from the operator seat. This reduces the effort required by the operator, and thus aims to decrease the amount of time the operator leaves the device in the lowered (unprotected) position.

The design was tested to determine if the universal lift assist lever met appropriate ergonomic standards for operator required force and comfort. This was achieved by measuring the required force to lift the ROPS in to place while using the lift assist lever and establishing the zone of comfort and the zone of reach for its use on three different ROPS devices. With the addition of a torsion spring for heavy foldable ROPS models, the lever met all the ergonomic standards.

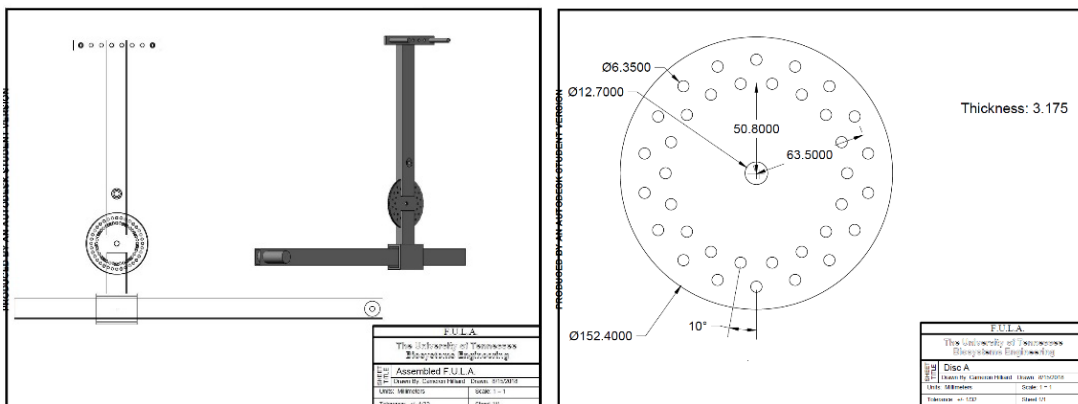
This year, the final year of project funding, computer-aided design (CAD) illustrations were produced for the lever. These precise, technical drawings provide the instructions needed to manufacture and install the universal lift assist lever on a foldable ROPS. Because the design was produced with federal funds, there are no plans to sell or profit from the design. Ayers is working with manufactures and dealers to distribute the design.

### PROJECT SUCCESS

Because of this project, the International Organization for Standardization (ISO) is modifying testing standards for ROPS on agricultural equipment (ISO 12003-2) to include dynamic testing of actuation forces on foldable ROPS (the force required to lift the ROPS in to place).



Universal lift assist lever mounted on a foldable ROPS.



CAD (computer-aided design) drawing of the universal lift assist lever. Credit: C. Hilliard

PRODUCED BY AN AUTOREK STUDENT VERSION



## Occupational Safety Management and Leadership on Large-Herd Dairy Farms

David Douphrate – UTHealth School of Public Health

On the job injury and illness rates for the dairy industry are nearly twice as high as all other occupations (Bureau of Labor Statistics, 2015). Working around livestock and chemicals are just two examples of the many workplace hazards. Building on previous research on the occupational health and safety training needs of this primarily immigrant workforce, David Douphrate and collaborators aim to design and implement a supervisor training program to increase the safety leadership skills of supervisors and improve safety culture on the dairy overall.

To date, 56 dairy supervisors have completed the 12-module training intervention program designed during the first year of the project. Over the course of three months, the training engages participants in weekly interactive digital lessons and assignments. Extension agents reinforce the management practices introduced in digital lessons during hands-on coaching sessions.

In addition to training modules, participants complete a daily report. The app-based questionnaire assesses the participant's adherence to practices described in the modules and during hands-on sessions.

Preliminary results indicate that training participants show the most improvement in topics related to safety discipline, safety meetings, and safety culture. Participants have scored an average of 85.0% on the program's comprehensive final exam.

Currently a third cohort of participants (13 supervisors) is enrolled in the training as a control group. This group will report daily safety leadership and management practices without having received the training intervention. They will receive the training intervention later in the project.

Feedback from participants reveals high levels of satisfaction with the training. Specifically, many report utilizing skills and knowledge from the training to improve communication with their supervisees.

### TRAINING TOPICS

Dairy Safety Introduction  
Supervisor Role & Worker Role  
Causes of Injuries & Fatalities  
Safety Hazards  
Hazards Recognition & Prevention  
Modeling Safety  
Effective Safety Communication  
Safety Discipline  
Workplace Conflict  
Safety Culture



*New Mexico State Extension Dairy Specialist Robert Hagevoort leading a hands-on training.*

### **PARTICIPANT QUOTES**

"I really liked that I started looking at details that are overlooked when you've been working in the industry for a while. I look at them in a different way now. It gave me a safety toolkit."

"I learned to take things in a calm manner and be patient with my guys."

"Now [safety] is part of my routine. Before we start the day, we have a quick meeting. We review cases that have happened before so that we don't repeat it."

## Agricultural Safety Education Initiative

Michael Pate - Utah State University

High school agricultural education programs offer a significant opportunity to develop young workers' safety skills and attitudes as they prepare for an agricultural career. This project targets this audience for early interventions to reduce on the job injury using work-based experiential learning. Through the "Agricultural Safety Education Initiative," Michael Pate and collaborators conduct annual ten-hour teacher trainings addressing machine safety. Teachers then convey the information to their students via a classroom curriculum and guide the appropriate selection of supervised agricultural experiences (SAE).

In the summer of 2019, over 100 teachers attended trainings in Montana, South Dakota, and Utah. The curriculum focused on the use of tractors with implements, including run over risks and hitching.

This year, project leaders began evaluating the impacts of the teacher training on student performance using student data from Montana. This evaluation revealed that there was a statistically significant difference between the pre-test and post-test scores in the 90 students, suggesting that student knowledge did increase overall. Additionally, there was a significant positive correlation between post-test score and age, revealing that, in general, older students did the best on the post-test. The average age of students was 15 years old (standard deviation of 1.3 years). Similar data from students in South Dakota is still pending evaluation.

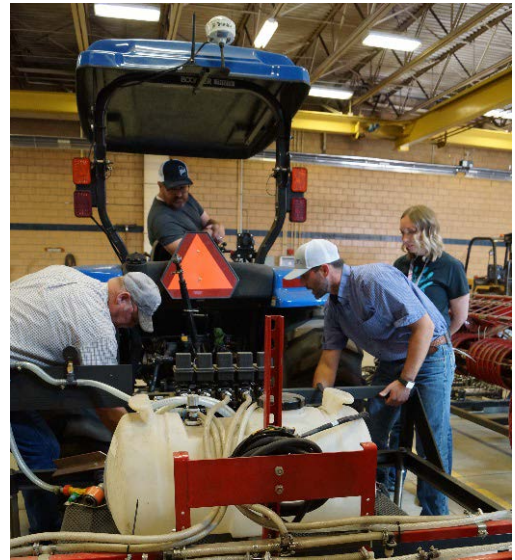
The classroom lesson plans associated with each teacher training are now available online via the Agricultural Experience Tracker (AET).

### TEACHER TRAINING TOPICS

2017 – *Tractor stability, prevention of rollovers, and rollover protective structures*

2018 – *Safe ATV operations*

2019 – *Use of tractors with implements, including run over risks and hitching*



*Teachers examine a hitch and power take off during a teacher training in Utah.*



*Investigator Michael Pate leads lecture portion of a teacher training in Utah.*



*Two teachers participating in a hands-on activity at a training in Utah.*

## Nasal Intervention Study\*

Stephen Reynolds and Joshua Schaeffer - Colorado State University

\*The full title of this study is "Evaluation of effectiveness of a nasal rinse intervention to reduce the pro-inflammatory response in dairy workers exposed to bio-aerosols." For simplicity, it is referred to as the "Nasal Intervention Study".

Building on previous work, Stephen Reynolds, Joshua Schaeffer, and colleagues are investigating the use of a nasal rinse for preventing respiratory inflammation in dairy workers. This year, the necessary administrative tasks to recruit and enroll participants were completed, and 11 subjects have participated.

Once enrolled, participants undergo several procedures before and after their work shift: a health questionnaire, pulmonary function testing (PFT), and a nasal lavage. The questionnaire is used to determine their general health as well as their daily work tasks and work-related symptoms. PFT measures lung function and requires blowing into a tube attached to a computerized machine several times while seated. The nasal lavage involves rinsing the participant's nose with sterile saline and collecting the liquid in a cup.

During the work shift, participants wear an air-sampling device. The device collects dusts and particles that could enter the human respiratory system. In the laboratory, the dust collected is weighed and analyzed to quantify the concentration of endotoxin – an inflammatory agent that is part of the cell wall in some bacteria.

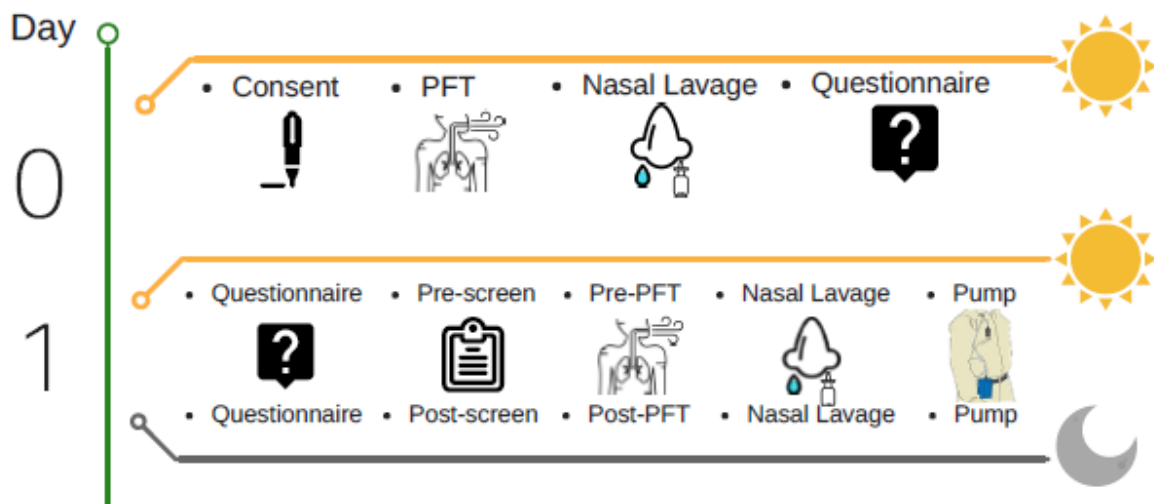
The liquid collected from nasal lavages will be analyzed for markers of inflammation (cytokines) and to define the microbiome (community of bacteria) in the nose. The project hypothesis is that rinsing with hypertonic saline will reduce the inflammatory response without significantly affecting the diversity of the microbiome.

### PROJECT AWARD

Colorado State Doctoral Student, Grant Erlandson, won multiple student awards at the 2019 American Industrial Hygiene Association Conference and Expo for his poster describing the pilot work of the Nasal Intervention Study.



Research associate Mary Bradford demonstrates the nasal lavage treatment.



Flow chart of procedures for study participants. Participants complete procedures for five consecutive days.



# GRANT PROGRAM UPDATES

## Emerging Issues

The Emerging Issues Grant Program provides a structure for HICAHS to identify and respond to issues of high priority for regional producers. The HICAHS Leadership Team reviews and funds project proposals under the direction of the Emerging Issues Program Lead, Joshua Schaeffer.

Six projects were funded this year. Additionally, past recipient, Trevor Durbin, published results from his 2017 project “Assessing Worker Perceptions of Health and Safety Risks in Beetle-Killed Forests” in the January 2019 issue of the *Journal of Agromedicine*.

### Emerging Issues Projects Funded between 9/15/2018 and 9/14/2019



#### WHAT IS AN “EMERGING” ISSUE?

Emerging issues are defined as risks to the health and safety of agricultural workers that are new or are expected to have rapidly expanding impact in the immediate or near future. HICAHS identifies specific emerging issues based on feedback from advisory board members and regional partners. This year, we identified the following:

- Distracted machinery operation
- Labor shortages and high worker turnover
- Mental health
- Robotics
- Extreme weather and climate change
- Land-based fishing production (aquaculture)
- Musculoskeletal disorders
- Substance abuse/misuse

Additional topics were considered given that applicants justified why the topic was “emerging”.



## Community-Initiated Grants

Under the direction of John Rosecrance, the Community-Initiated Grants Program continues to provide funding to agricultural and forestry organizations to help them improve their health and safety programs. The program funded five projects this year.

### Community-Initiated Projects Funded between 9/15/2018 and 9/14/2019

#### **ATV Safety Training for Ag Youth in Southwest Colorado**

Colorado State University  
Extension - Montezuma County

#### **Montana UTV Safety Training Certification**

Dawson County, Montana Weed  
and Mosquito Control Division

#### **Simulator-Based Logging Safety Training Program**

Montana Logging Association

#### **Dairy Employees' Behavioral Health Tool Box: Stress Factors and Implications Pilot Project**

South Dakota State University  
Dairy Extension

#### **Wyoming Good Riding Practices for ATV Use in Agriculture (WyGRiP)**

University of Wyoming Extension

## Pilot/Feasibility Grants

Under the Direction of Maggie Clark, the Pilot/Feasibility Program enjoyed another successful year providing funding opportunities to young investigators and people new to the agricultural health and safety field. The program granted funding to three projects this year.

Additionally, two previous grantees made significant accomplishments this year. Kim Anderson submitted an R21 exploratory/developmental research grant application to NIOSH based on the results from her 2016 project "The application of a novel sensor for spatially and temporally resolved monitoring." Jairo Palomares Velosa successfully defended his doctoral thesis, a portion of which was funded by his 2016 project "Socio-ecological model for exposure to zoonotic diseases among dairy farm workers."

### Pilot Projects Funded between 9/15/2018 and 9/14/2019

#### **Assessment of Nasal Swabs for Measuring Particulate Matter in the Nasal Airway**

Joemy Ramsay  
Doctoral Candidate  
University of Utah

#### **Establishing a Co-Exposure Model to Study Farmer's Lung Disease Immunopathology**

Missy A. Berry  
Doctoral Candidate  
North Dakota State University

#### **Global DNA Methylation and Hydroxymethylation Events in Murine Lung Associated with Inhaled *Aspergillus fumigatus* Exposure**

Sumali Pandey, PhD  
Assistant Professor  
Minnesota State University, Moorhead

# Outreach and Evaluation

## Outreach

HICAHS continues to share new research, administrative updates, and safety and health information on social media via Facebook, Instagram, and Twitter. Across all platforms, users saw HICAHS content more than 95,000 times. Thanks to more consistent posting and a fine-tuned communications plan, this is nearly twice as many views as last year.

Table: HICAHS impressions across social media platforms.

Social Media Platform	Impressions
Facebook	19,232
Twitter	72,553
Instagram	3,794
<b>Total</b>	<b>95,575</b>

HICAHS also continued its electronic newsletter (reformatted in 2018) and email campaigns, sending seven different emails throughout the year. While total readership remained steady this year, engagement with newsletter content (unique and total clicks on email links) did slightly increase.

Additionally, the U.S. Agricultural Safety and Health Centers' joint YouTube page hosts five safety training video series produced by HICAHS grantees. The videos (29 total) were viewed more than 21,000 times this year, for a total watch time of nearly 2,000 hours. Relative to 2018, these videos were watched more frequently and for longer in 2019.

Finally, HICAHS attended regional farm shows and expos this year in Colorado, South Dakota, and Utah. Educational information shared at these events focused on respiratory protection (including during wildfires), hearing protection, and worker training resources.

Table: Performance of HICAHS-funded videos on YouTube.

Video Series	Views	Minutes Watched
ATV Safety (6 videos)	3,021	5,026
Chainsaw Safety (2 videos)	9,429	77,540
Dairy Safety-English (7 videos)	4,461	13,880
Dairy Safety-Spanish (7 videos)	3,604	21,686
Dairy Safety-K'iche (7 videos)	580	936
<b>Total (29 videos)</b>	<b>21,095</b>	<b>119,068</b>



HICAHS table at the Colorado Fruit and Vegetable Growers Association Annual Meeting in Denver, CO in February 2019.



Outreach Coordinator, Whitney Pennington, demonstrating how to don a respirator at the Central Plains Dairy Expo in Sioux Falls, SD in March 2019.

## Evaluation

The HICAHS Evaluation Team continues to track the center’s outputs (table below) and help determine the worker health and safety needs in the region. Results of a needs assessment conducted this year are in the column on the right. This assessment will help the center identify emerging issues to fund during the upcoming year as well as develop research ideas to pursue in the next application for research core funding.

This year, the team also conducted a “social network analysis” to determine HICAHS’ connectivity and relation to other organizations and stakeholders in the region. The success of agricultural health and safety centers depends on partnership among academia, industry, government, agricultural operators/owners, employees, and stakeholders engaged in agricultural safety and health. Promoting worker health and safety requires comprehensive engagement throughout this network, and there may be overlap in activities of different organizations, which can lead to inefficient delivery of services and information.

Based on the social network analysis conducted by the evaluation team, the most prominently connected organizations in the HICAHS region are Extension and education; other agricultural health and safety centers; and cattle, dairy, and pork producers and organizations that support agriculture. This information will be used to help conduct outreach that expands the network and reduces inefficiencies.

### **REGIONAL NEEDS FOR THE UPCOMING YEAR**

Based on the input of 32 regional stakeholders, the most pressing concerns in the region, related to worker health and safety, are as follows:

#### Environment-Related\*:

- Extreme weather events
- Water quantity and quality
- Wildfires

#### Worker Health-Related:

- Mental health
- Substance use (legal and illegal)
- Access to mental health services

#### Worker Safety-Related:

- Musculoskeletal disorders
- Distracted machinery use
- Lack of workforce

\*The “Environment-Related” category was used to help identify specific concerns related to climate change.

Table: HICAHS Outputs for 9/15/2018 to 9/14/2019.

Output Type	Number of Outputs
<b>Publications (Peer-Reviewed Journal Articles)</b>	14
<b>Trade Publications</b>	1
<b>Conference Papers, Presentations, and Abstracts</b>	24
<b>Conference Proceedings</b>	5
<b>Theses/Dissertations</b>	2 Masters, 2 Ph.D.
<b>Editorial and Editorial Board Service Appointments</b>	8
<b>Webinar</b>	1

## HICAHS Researchers and Staff

### Core Leadership and Administrative Personnel

**Director:** Stephen Reynolds, Colorado State University

**Deputy Director, Evaluation Program & Outreach Program Lead:** Lorann Stallones, Colorado State University

**Associate Director:** David Douphrate, UTHealth School of Public Health, San Antonio

**Research Core & Emerging Issues Program Lead:** Joshua Schaeffer, Colorado State University

**Community Initiated Grants Program Lead:** John Rosecrance, Colorado State University

**Pilot/Feasibility Grants Program Lead:** Maggie Clark, Colorado State University

**Research & Administrative Manager (through February 2019):** Elizabeth Brooks, Colorado State University

**Outreach Program Coordinator:** Whitney Pennington, Colorado State University

**Evaluation Coordinator & Administrative Manager (starting February 2019):** Cheryl Beseler, Colorado State University

**Evaluation Program Assistant:** Annie Keeney, Colorado State University

**Research Associate (through May 2019):** Jake Bauer, Colorado State University

**Research Associate:** Mary Bradford, Colorado State University

**Research Associate:** Luna Martinez, Colorado State University

**Financial Manager:** Kathy Petersen, Colorado State University

### Students and Post-Docs

**Michael Desch**, Undergraduate, Colorado State University

**Sari Ennis**, Masters Candidate, Colorado School of Public Health at Colorado State University

**Grant Erlandson**, Doctoral Candidate, Colorado State University

**Blake Frederick**, Masters Candidate, Colorado School of Public Health at Colorado State University

**Robyn Garratt**, Masters Candidate, Colorado School of Public Health at Colorado State University

**Farzaneh Khorsandi**, Doctoral Candidate, University of Tennessee

**Jessica Nunez**, Masters Candidate, Colorado State University

**Anabel Rodriguez**, Doctoral Candidate, UTHealth School of Public Health

**James Seidel**, Doctoral Candidate, Colorado State University

**Sofia Thompson**, Masters Candidate, Colorado State University

**Alix Wertheimer**, Masters Candidate, Colorado School of Public Health at Colorado State University



## Research Core Key Personnel & Contributors:

*\*denotes contributor*

### *“Development of Engineering Controls to Reduce Foldable ROPS Overturn Fatalities”*

**Paul Ayers**, Principal Investigator, University of Tennessee

### *“Occupational Safety Management and Leadership on Large-Herd Dairy Farms”*

**David Douphrate**, Principal Investigator, UTHealth School of Public Health, San Antonio

**Noa Roman-Muniz**, Colorado Dairy Extension, Colorado State University

**Robert Hagevoort**, New Mexico/Texas Dairy Extension, New Mexico State University

**Luis Mendonca**, Kansas Dairy Extension, Kansas State University

**Stephen Reynolds**, Colorado State University

**David Gimeno**, UTHealth School of Public Health, San Antonio

\***Lisa Pompeii**, Baylor University

\***Peter Kines**, National Research Centre for the Working Environment (Denmark)

### *“Agricultural Safety Education Initiative”*

**Michael Pate**, Principal Investigator, Utah State University (Moved from Penn State on 8/1/2019)

**Dustin Perry**, Montana State University

**Scott Smalley**, Iowa State University

**Rebecca Lawver**, Utah State University

\***Serap Gorucu**, Penn State University

\***Alyx Shultz**, Montana State University

\***Lorann Stallones**, Colorado State University

### *“Evaluation of Effectiveness of a Nasal Rinse Intervention to Reduce the Pro-Inflammatory Response in Dairy Workers Exposed to Bioaerosols”*

**Stephen Reynolds**, Principal Investigator, Colorado State University

**Joshua Schaeffer**, Principal Investigator, Colorado State University

**Kenneth Jones**, Principal Investigator, University of Colorado Denver

\***Jill Poole**, University of Nebraska Medical Center

\***Julia Sharp**, Colorado State University

\***Zachary Weller**, Colorado State University

For investigator contact information, please visit [www.hicahs.colostate.edu](http://www.hicahs.colostate.edu) or email [HICAHS@colostate.edu](mailto:HICAHS@colostate.edu).

# HICAHS Advisory Board

## Cooperative Extension & Academia

**Ragan Adams**, Veterinary Extension Specialist, Clinical Science, Colorado State University

**Shawn Archibeque**, Associate Professor, Animal Sciences, Colorado State University

**Keith Belk**, Professor, Animal Sciences, Colorado State University

**Jeff Edwards**, Pesticide Applicator Training Coordinator & State Small Acre/Horticulture Specialist, University of Wyoming Extension

**Robert Ellis**, Professor/University Biosafety Officer, Microbiology, Immunology and Pathology, Colorado State University

**Alvaro Garcia**, Professor/Agriculture & Natural Resources Program Director, Dairy and Food Science, South Dakota State University

**Robert Hagevoort**, Associate Professor/Dairy Extension Specialist, Animal Sciences and Natural Resources, New Mexico State University

**Peter Kolb**, Associate Professor/Forestry Extension Specialist, Forest Management, Montana State University

**Matt Nonnenmann**, Air Quality Improvements Project Leader, Great Plains Center for Agricultural Health, University of Iowa

**J.W. Schroeder**, Retired Extension Specialist, North Dakota

**Bruno Sobral**, Microbiology, Immunology, & Pathology, Colorado State University

**Allen Young**, Professor/Dairy Extension Specialist, Animal, Dairy, & Veterinary Sciences, Utah State University

## Agricultural Producers

**Olga Reuvekamp**, Owner, Hilltop Dairy

**Jon Slutsky**, Owner, La Luna Dairy

**Juan Velez**, VP Farm Operations, Aurora Organic Dairy

## Agriculture-Related Businesses, Non-Profit Associations, & Faith-Based Organizations

**Kevin Dole**, Owner, Alpha Technology USA Corp

**Jessica Lemmel**, Director of Communications, Colorado Livestock Association

**Mike Taylor**, Chief Safety, Health & Environment Officer, The Church of Jesus Christ of Latter-day Saints: Risk Management Division

## Government

**Herb Gibson**, Area Director, Denver Area Office, Occupational Safety and Health Administration

## Healthcare

**Ed Hendrikson**, Director of Environmental Health, SALUD Family Health Center

## Insurance & Workers' Compensation

**Dan Hair**, Senior VP/Chief Underwriting and Safety Officer, Workers Compensation Fund

**David Knell**, Safety Consultant, Pinnacol Assurance

**Brian Schiller**, VP/Agribusiness Department, Flood and Peterson

**Clyde Serna**, Safety Consultant, Pinnacol Assurance

*Thank you to Allen Young and Clyde Serna who have concluded their service on the board.*