



# PACIFIC NORTHWEST AGRICULTURAL SAFETY & HEALTH CENTER

*Research for healthy workers, strong communities & productive agriculture*

## YEAR-END REPORT

**Fiscal Year 2018**

**September 30, 2017 to September 29, 2018**

CDC/NIOSH Cooperative Agreement #5 U54 OH007544

OCTOBER 2018

Michael Yost, PhD, MS, Professor & Director



DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES  
UNIVERSITY of WASHINGTON · SCHOOL OF PUBLIC HEALTH



# **PACIFIC NORTHWEST AGRICULTURAL SAFETY AND HEALTH CENTER Year-End Report**

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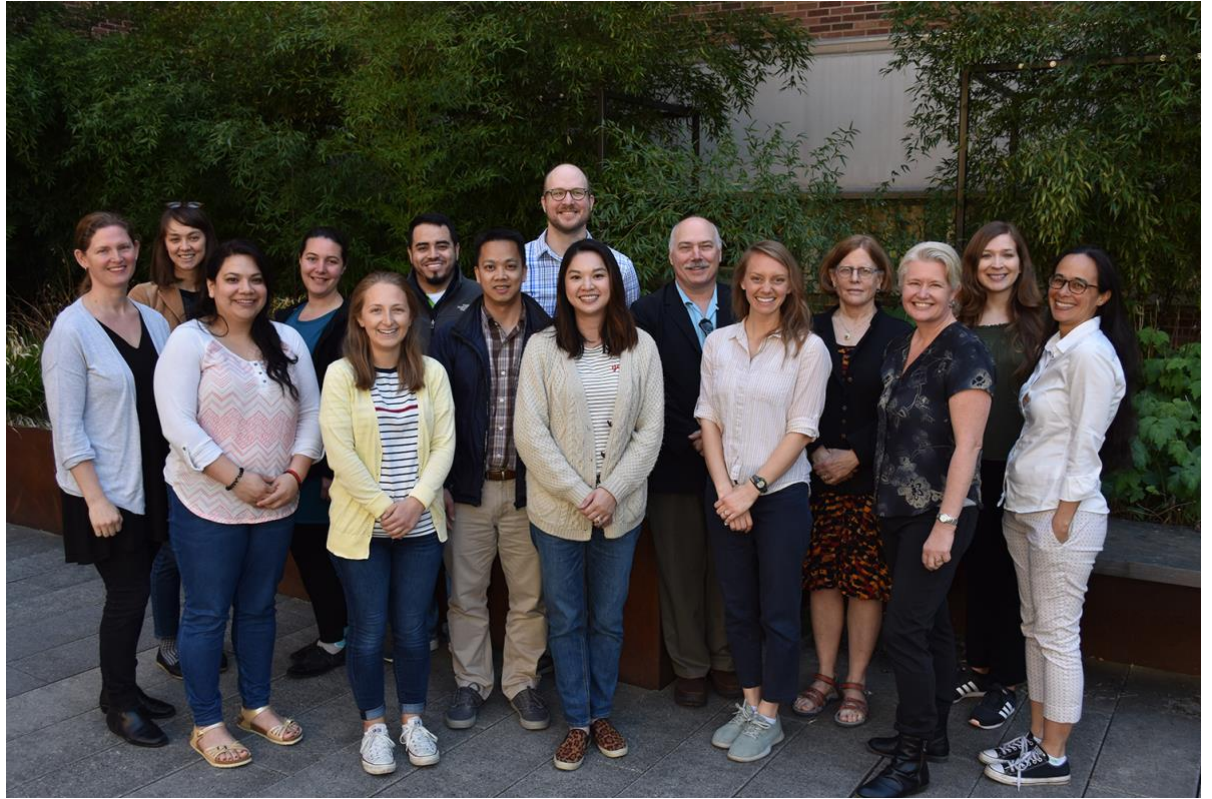
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*PNASH staff and students with Director, Mike Yost, on the University of Washington campus, Summer 2018.*



*Fluorescent tracer (FT) glows under black light. PNASH uses FT to demonstrate pesticide contamination.  
Photo by Sarah Fish*

## CENTER OVERVIEW

The Pacific Northwest Agricultural Safety and Health (PNASH) conducts **Research for Healthy Workers, Strong Communities & Productive Agriculture**. Visit our website: <http://depts.washington.edu/pnash>.

PNASH is dedicated to the prevention of illness and injury among agricultural producers, workers, and their families. One of eleven regional centers, PNASH serves Alaska, Idaho, Oregon, and Washington, integrating expertise from multiple disciplines, institutions, and community partners. The Center is focused on safe and sustainable agricultural workplaces and communities, with an emphasis on injury and illness prevention, especially among hired laborers, migrant/seasonal workers, and children.



*PNASH's region includes Washington, Oregon, Idaho, and Alaska*

Our approach includes:

- Working in partnership with employers, workers, agencies, and other research and service organizations.
- Conducting innovative research and intervention programs that focus on problem solving.
- Taking solutions to the workplace through training, outreach, and participatory research.
- PNASH research priorities and project selections are based on the burden and need of our Northwest communities, the seriousness of the hazard, the number of people affected, and the probability that research will lead to health improvements.

We are housed in the UW Department of Environmental and Occupational Health Sciences, School of Public Health, and have formal affiliations with multiple UW programs, as well as with Washington State University (WSU) and Oregon State University, among others. PNASH's funding base is awarded through the National Institute for Occupational Safety and Health (NIOSH/CDC).

## RELEVANCE

Jobs in the agricultural industries, which include farming, fishing, and forestry, consistently rank among the most dangerous. The fatality rate for workers in the farming sector is six times higher than the all-industry average, while the fatality rate for workers in the commercial fishing and logging sector is 32 times the all-industry average. In addition to injuries and fatalities, agricultural workers also face high risk for illnesses such as lung diseases, hearing loss, heat-related illnesses, skin diseases, and certain cancers associated with chemical use and prolonged sun exposure. Farming is a unique workplace in that families frequently live on-site. Each year, 14,000 children are injured and 100 children are killed on US farms.



Fishing workers are 24 times more likely to die on the job.



Forestry workers are 38 times more likely to die on the job.



Agriculture workers are 6 times more likely to die on the job.

## THIS REPORT & 2018-2019 NIOSH AWARD CYCLE

We invite you, in the following report, to learn about our work and Year 2 progress. New directions in this 5-year cycle include injury surveillance, dairy safety and health, and an enhanced Outreach Core to increase engagement of stakeholders and to move our research results into practice. Each project is at an early stage of development, so please feel free to contact us with your ideas or interests in collaborating. Most important to our mission are our partnerships with agricultural communities, which help ensure our work is relevant to the needs of the industries and the workers we serve.

And **Thank You** to our partners, advisors and our PNASH team of faculty, staff and students. This work is a testament to your dedication and range of expertise.

## PLANNING AND EVALUATION CORE

The Planning and Evaluation Core provides the infrastructure and support for the entire Center and assists in the implementation of individual project and program objectives. Our second year's activities have focused on launching project fieldwork, project team capacity building, and community engagement.

### PNASH Leadership

In Year 2, we proudly announced the advancement of two PNASH investigators to Center leadership positions.



Visit link below to learn more about Mike in a UW interview. [http://sph.washington.edu/news/closeup/profile.asp?content\\_ID=8456](http://sph.washington.edu/news/closeup/profile.asp?content_ID=8456)

Dr. Michael Yost, PhD, MS  
Center Director  
In January, Dr. Mike Yost took the baton as the PNASH Center Director. Dr. Yost has served as PNASH's Associate Director and a principal investigator on a variety of exposure prevention projects, including injuries, noise, and pesticides, spanning the industries of logging, dairy, and tree fruit. Dr. Fenske continues to be involved at the Center as Associate Director and through his PNASH research project to prevent agricultural drift events.

*"This is an easy transition and one where the Center will thrive. Mike and the PNASH team have the vision and expertise needed to move our Center forward, engaging Northwest workers and employers in their efforts to improve workplace health and safety."*

- Richard Fenske



Visit the link below to an interview with Eddie Kasner. <https://youtu.be/6AOroKsclw0>

Edward Kasner, PhD, MPH  
Interim Director of Engagement and Education & Research Scientist  
Beginning this fall, Dr. Edward Kasner is serving as Interim Outreach Director. Dr. Kasner has worked with PNASH as a PhD Student and Fellow. He has made his mark at PNASH with not only his research and expertise, but also his spirit toward partner and stakeholder engagement. Dr. Kasner now serves as a member of PNASH's Internal Advisory Committee, supporting PNASH project teams and leading the PNASH Outreach Core.

Dr. Galavíz led the Outreach Core throughout Year 2 and we are grateful for her work at PNASH and throughout the region. She recently stepped down to return to her previous work at the California EPA. Dr. Galavíz will continue student mentoring and project activities through an affiliate faculty appointment at the UW.

### New PNASH Logo

With this report, we reveal our new PNASH Center logo. Following a yearlong assessment and design review with our Center teams and advisories, the new logo represents the importance we place in our three industries, landscapes, and rural communities.



**PACIFIC NORTHWEST AGRICULTURAL  
SAFETY AND HEALTH CENTER**

## Organization & Advisories

Our PNASH internal network is comprised of over 30 faculty, staff, and students from multiple disciplines and institutions across the Northwest.

### PNASH Internal Advisory Committee

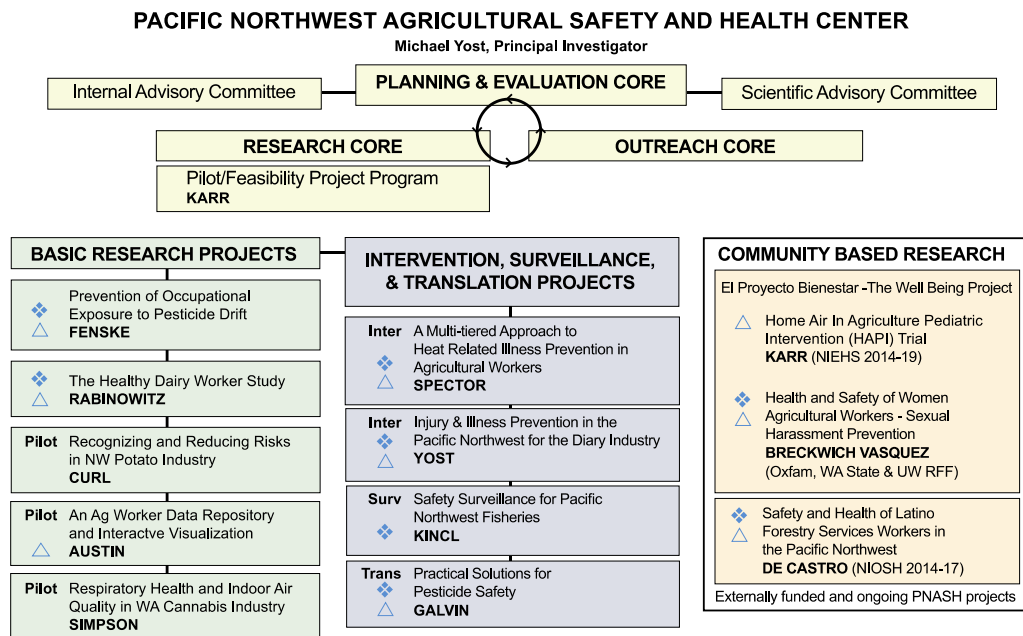
A multidisciplinary team of current PNASH leadership, the Internal Advisory Committee (IAC), meets monthly, providing oversight and advice to the Principal Investigator and project investigators in making scientific and administrative decisions.

Michael Yost, PhD, MS	Director	rfenske@uw.edu
Richard Fenske, PhD, MPH	Associate Director	airion@uw.edu
Vanessa Galavíz, PhD	Director of Engagement & Education (Role in Year 2)	vanesg@uw.edu
Marcy Harrington, MPA	Center Manager	marcyw@uw.edu
Catherine Karr, MD, PhD	Internal Advisory Committee	ckarr@uw.edu
June Spector, MD	Internal Advisory Committee	spectj@uw.edu

### PNASH Scientific Advisory Committee

PNASH's Scientific Advisory Committee (SAC) provides the Center and the projects with guidance on effectiveness, direction of future work, project methods, and result interpretation as well as relevance of activities to regional and national policies and initiatives. The SAC meets bi-annually with one in-person meeting each year, in this Cycle the SAC met in person on October 24, 2017 and focused on new project directions and surveillance research needs.

Kent Anger, PhD	Professor and Director, OHSU and Portland State joint School of Public Health, Oregon Health Workforce Center
Jennifer Lincoln, PhD, CSP	Director, NIOSH Center for Maritime Safety and Health Studies
Howard Kipen, MD, MPH	Chair and Professor, Environmental & Occupational Medicine, Rutgers University
Linda McCauley, RN, PhD, FAAN, FAAOHN	Dean and Professor, Nell Hodgson Woodruff School of Nursing, Emory University



- ❖ Project specific stakeholder advisories facilitated through projects and supported centrally. See Outreach Core plan.
- △ Projects served by El Proyecto Bienestar - The Well Being Project Community Advisory Board

## PNASH Research Review

PNASH's Research Review and Scientific Advisory Committee Meeting was held October 23-24, 2017. The Research Review was an open event attended by 51 PNASH investigators, students, and partners. The event highlighted recent findings, accomplishments, and future directions. To promote further conversation and collaboration, we encouraged project teams to facilitate add-on meetings with regional partners.



*Participants at the 2017 PNASH Research Review in October*

Presented projects included:

Richard Fenske, **Recent Accomplishments and our New Cycle**

Elena Austin, **Northwest Ag Populations and Health Indicators**

Vanessa Galavíz, **Engagement and Education Activities of the Outreach Core**

Eddie Kasner, **Pesticide Technologies and Drift Reduction**

Kent Anger, **A Total Worker Health Intervention for Farmworkers**

Catherine Karr, **The HAPI Study and NextGenSS Project - Community engaged research activities in Yakima Valley**

Elizabeth Torres, **Sexual Harassment Prevention in Agriculture**

June Spector, **Interventions to Enhance Heat Resilience and Prevent Adverse Heat Effects in Agricultural Workers**

Michael Yost, **Evaluation of Safety Training in Washington State Dairies**

Peter Rabinowitz, **The Healthy Dairy Worker Study: Microbiome and the Farm Effect**

John Garland, **New Logging Safety Needs and Directions in the Northwest**

Butch de Castro, **Forest Service Hispanic Workers – Work Hazards and Forest Service Needs**

Laurel Kincl, **Development of a Safety Surveillance System for Commercial Fisheries**

## Student Education

The UW and PNASH Center is a rich environment for student learning. New this year, we have started a **PNASH Student AgFF Research Interest Group**. Sixteen students across the UW meet quarterly, bringing together PNASH faculty, students, and staff in a student-led and student-focused forum. The purpose of this group is to enhance collaboration and learning between PNASH faculty, staff, students, and others interested in AgFF research.

Through a NIEHS training grant, Supporting Undergraduate Research Experiences in Environmental Health (SURE-EH), and other UW support, we are able to provide meaningful student internships with PNASH. Our SURE-EH trainees, Arthur Aguilar and Jannah Amaly, worked alongside Dr. Galavíz in Year 2. Mr. Aguilar drafted a high school level environmental health curriculum and Ms. Amaly is working closely with Dr. Spector's heat illness team in the development of the Heat Education Tool Kit (see Spector's project report).

Below are our key student achievements in Year 2. Please see each component report for additional descriptions of our students and their project work.





**Gabino Junior Abarca, MPH Student** completed his BS degree from the UW School of Public Health and worked as a PNASH SURE-EH Intern. Mr. Abarca's work under Dr. June Spector's heat illness prevention project received the Washington State Public Health Association's Exceptional Student Award. This award honors a student in public health or a related field who has shown leadership and commitment to public health. Inspired by the work experiences of his parents and himself harvesting fruit, Mr. Abarca's research investigated the association between heat exposure, volume/hydration status, and kidney injury, using data collected from orchard workers in Eastern Washington. Mr. Abarca is also a UW McNair Scholar and was profiled in a DEOHS News release. He is now a Masters student in the UW Health Services Program. View news release: <http://deohs.washington.edu/news/uw-funds-underrepresented-students-environmental-health-research>



**Dennise Drury, MPH Student and PNASH Program Coordinator**, is completing her MPH degree in the UW Department of Environmental and Occupational Health Sciences. At PNASH, she chairs the AgFF Student Research Interest Group. She also serves as a Co-Chair of the Student Justice Committee, a subcommittee within the Farmworker Sexual Harassment Prevention Coalition. Coming from a background in environmental science, her interest in the PNASH Center stems from the intersection of environmental and community health. Ms. Drury also continues as part-time PNASH Program Coordinator, supporting Center planning, evaluation and outreach activities, and assists with research translation to share research results with our communities.



**Maria Blancas, PhD Student** recently completed her MPH degree in the Community-Orientated Public Health Practice Program at the University of Washington. She is now continuing her work with PNASH as a PhD student, under the mentorship of faculty Dr. June Spector and Dr. Galavíz. Ms. Blancas will focus her PhD work on the new farmworker-needs assessment described in our following progress report. Ms. Blancas' prior experience includes working alongside Promotores de Salud and farmworkers to help work towards health equity. As the daughter of hard-working farmworker parents, Ms. Blancas is committed to ensuring farmworkers and their families are safe and healthy.

**Orly Stampfer, MPH, PhD Student.** Ms. Stampfer graduated from the MPH Program in the UW Department of Environmental and Occupational Health Sciences this spring. With Dr. Karr as her advisor, she will be working to complete her thesis, Processes to Build Trust and Cultural Relevance in a Community-Engaged Research Partnership. This project is partnering with local universities and high schools in Eastern Washington to trial low-cost air pollution monitors. She is continuing to work with Dr. Karr as a PhD student this fall.

**John Yang, Undergraduate, Public Health.** Mr. Yang graduated with a Bachelor of Science in Public Health. He has been a Research Assistant on the HAPI Project with Dr. Karr for three years, providing him the opportunity to develop skills in sample preparation and analysis, inventory tracking, and data management. He also led a summer project within UW Environmental Health developing an English/Spanish educational game about climate change, modeled on bingo, called 'Loteria'. John is now pursuing his dream of becoming a doctor in pediatrics or family medicine.

## New Awards

Each year, thanks to the nucleus of research expertise and support formed by the Center, our faculty and staff researchers successfully procure additional project grants to help advance the goals and priorities of the Center.

Project awards funded in FY2018 are:



Christopher Simpson, PhD, MSC, Professor, UW Dept. of Environ. and Occupational Health Sciences  
Development of a novel continuous-reading sensor for measuring exposures to ammonia in agricultural workplaces and their environments  
R21 - National Institute of Occupational Safety and Health  
Click the link to read Dr. Simpson's bio: [http://deohs.washington.edu/faculty/simpson\\_christopher](http://deohs.washington.edu/faculty/simpson_christopher)



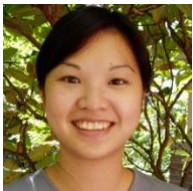
Richard Fenske, PhD, MPH, Professor, UW Dept. of Environ. and Occupational Health Sciences  
Western Regional Agricultural Safety & Health Conference  
U13 Conference Grant Award - National Institute of Occupational Safety and Health  
Click the link to read Dr. Fenske's bio: [http://deohs.washington.edu/faculty/Fenske\\_Richard](http://deohs.washington.edu/faculty/Fenske_Richard)



Vanessa Galaviz, PhD, MPH, Affiliate Lecturer, UW Dept. of Environ. and Occup. Health Sciences  
Addressing Health Disparities Faced by Rural Underserved Agricultural Communities  
Pilot Project – University of Washington Population Health Initiative  
Click the link for her bio: <https://deohs.washington.edu/pnash/vanessa-galav%C3%ADz-phd-mph>



Cynthia Curl, PhD, MS, Assistant Professor, Boise State University  
Measurement of Agricultural and Dietary Glyphosate Exposure among Pregnant Women  
K01 Career Development Award - National Institute of Environmental Health Sciences  
Dr. Richard Fenske at PNASH serves as the Mentor for this award.  
Click the link to read Dr. Curls's bio: <https://hs.boisestate.edu/ceh/ccurl/>



Maria Tchong-French, MS, Research Scientist, UW Dept. of Environ. and Occupational Health Sciences  
Understanding Children Farm Safety Needs of Latino Farmworker/Farmers in the Pacific Northwest.  
Small grant – National Children's Center for Rural and Agricultural Health and Safety.  
Click the link to read her bio: <https://deohs.washington.edu/pnash/maria-tchong-french-mph>

Additional PNASH awarded projects and progress reports are detailed in this report under sections: Pilot Project and Emerging Issues Programs (See page 9), and Other PNASH Related Projects (See page 38).

## Evaluation

PNASH's evaluation program moves beyond traditional program monitoring, using a developmental approach to assist project teams in improving efficacy and outcomes. Our goal is to ensure that our efforts are relevant, feasible, and sustainable; that they reflect the best science and practice; and that they demonstrate efforts consistent with the ultimate goal of reducing injuries and illness.

**AIM 1: Regional Needs Assessment.** To assess PNASH's responsiveness to regional needs and inform Center and project planning, three approaches will be taken: routine interviewing and surveying of Stakeholder Advisories and annual monitoring of Northwest Ag Health Indicators.

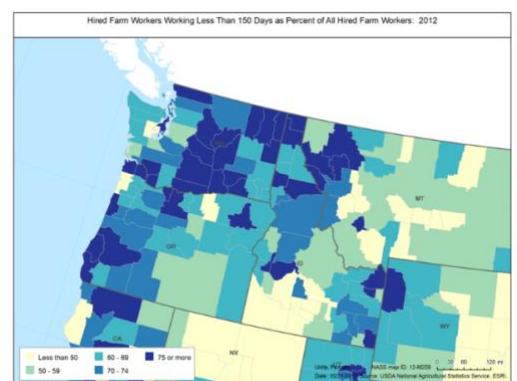
### New needs assessments launched in Year 2 include:

- **Migrant farmworker health and safety needs assessment – Skagit and Whatcom Counties, WA.** This University of Washington pilot project, led by Dr. Vanessa Galaviz and Dr. June Spector, is partnering with a local community organization called Community to Community Development (C2C) to conduct a community-wide survey and housing assessments for farmworkers in Skagit and Whatcom Counties. In the summer of 2018, 348 farmworkers surveys were conducted which were modeled on the National Ag Workers Survey. Analysis of these results will take place over Year 3 as a component of Maria Blanca's doctoral thesis.
- **Logging safety stakeholder interviews.** The priorities raised in these interviews are being followed up in Year 3 with surveys of contract loggers, in conjunction with the Washington state and Oregon State's annual contract logger safety meetings in December 2018 and January 2019 and a formal prioritization of needs through an in-person meeting, Logging Safety Summit, planned for February 20, 2019 in Eugene, Oregon. The summit will provide a forum to share information and prioritize needs regarding NW logging safety. Participants are confirmed from Oregon, Washington, Idaho and Montana.
- Over Year 1-2, we conducted multiple stakeholder needs assessments focused on outreach and education through the Outreach Core and project activities. Results from our Year 2 activities are reported under the Outreach Core for the programs **Ag PromotorX Certification Needs Assessment and Ag Safety Day Surveys** (See page 15-16).



**Ag Health Indicators.** Our Ag Health Indicators program continues regular surveillance activities, while also establishing new data sharing agreements. Current agreements are in progress with hospital discharge data from the Comprehensive Hospital Abstract Reporting System (CHARS) in Washington and SAIF Insurance Corporation in Oregon. Ag Health Indicators has successfully expanded from its PNASH Center Evaluation home into new project data surveillance and mapping projects led by Dr. Elena Austin:

- Kincl. Safety Surveillance for Pacific Northwest Fisheries (pg 28).
- Austin. Pilot: An Agricultural Worker Data Repository and Interactive Visualization (See pg 35).
- Austin. Pilot: Nitrate Well Water Testing in Agricultural Communities: Improving Environmental Health Communication with Health Behavior Theory (See pg 10).



*An interactive map showing employment trends of seasonal hired farm workforce in 2012.*

**AIM 2: Performance, Developmental, and Outcome Evaluation.** Each PNASH program and project participated in both a common monitoring system (PNASH's Harvest Database) and specific evaluation plans reflective of their team goals. PNASH's evaluation plan focuses on relevant and measurable outcomes. The system enables program leadership to

conduct performance reviews for quality, efficiency, and productivity within each project and program. Our Program Monitoring Database, “Harvest” was revised for the new cycle, assisting us in tracking outcomes from recently closed projects and setting project objectives for our new cycle’s projects. The database builds on previous NIOSH and Ag Center evaluation tools, assisting with tracking and analysis of PNASH project outcomes and impacts. Unique to this database is the integration of impact stories, stakeholder anecdotes/quotes, PHS Progress Report fields, and a customizable evaluation matrix to track project-specific indicators of success, such as those reported in this final report. The system employs a relational database with a web-hosted platform for any-time, any-where data entry and reference. Currently, two Agricultural Centers, the National Children’s Center, and the UC Davis Center, have adopted and developed the database for their use.

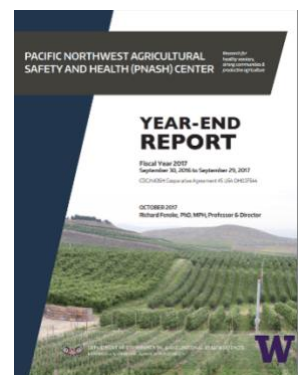
**AIM 3: NIOSH AgFF Initiative and Multi-site Evaluation.** The PNASH Evaluation team collaborates regularly with NIOSH and the ten other NIOSH-funded Agricultural Centers through the Agricultural Center Evaluation, Communication, and Outreach (ECO) group. Year 2 collaborations and workgroups have included development of national educational materials and media campaigns. In addition, PNASH served on a steering committee, along with other NIOSH Ag Centers, for the Marshfield Clinic Research Institute’s Ag Injury News Clippings database, <http://www.marshfieldresearch.org/nfmc/aginjurynews>. This database compiles news articles, injury reports, and case fatalities in farming, fishing, and forestry from throughout the United States. PNASH also participated in NIOSH organized efforts, including preparation of an updated Program Performance One-Pagers (PPOPs). View on the NIOSH website, <https://www.cdc.gov/niosh/docs/2018-112/2018-112.pdf>

## Additional Planning & Evaluation Activities

- Monthly. AgFF Center Directors’ Meetings
- Monthly. Internal Advisory Meetings
- Quarterly. Investigator Meetings
- Bi-annual. Scientific Advisory Meetings
- Bi-monthly. Agricultural Center Evaluation, Communication, and Outreach (ECO) Group
- 2018. Washington Pesticide Application Workgroup: Invited public comments: R. Fenske, M. Yost, and E. Kasner.
- 2018. Oregon Worker Protection Standard Rule Making: Invited public comments: R. Fenske and E. Kasner.
- 2018. AgInjuryNews.org Steering Committee. M. Harrington
- November 2017: Invited Seminar Speaker: Douglas Call, “Antibiotic Resistance and the Collision between Biology and Culture.”
- February 2018: Invited Seminar Speaker: Laurel Kincl, “From Injury Surveillance to Interventions in the Pacific Northwest Commercial Fisheries.”
- February 2018. Annual Ag Center Directors Meeting, Washington DC. Attended by M. Yost.
- May 2018. HRSA’s National Advisory Council on Migrant Health (NACMH). The NACMH is authorized and governed under the Public Health Service (PHS) Act. Yakima, Washington, May 9th. Invited speaker: R. Fenske.
- September 2018. Invited Seminar Speaker and Discussion: Michael Kosnett, “Cannabis Use, Driving, and the Workplace: New Approaches to Assessment of Performance and Impairment.”

## RESOURCES

- Final Report: Pacific Northwest Agricultural Safety and Health Center, 2011-2017, October 2017. Follow the link to see the PNASH Final Report: <https://bit.ly/2Ss38Fc>.
- Year-End Report: Pacific Northwest Agricultural Safety and Health Center, FY 2017, October 2017. Follow the link to see the 2017 Year-end Report: <https://bit.ly/2Dab35F>.
- 2018 PNASH Center Program Performance One Pager (PPOP), February 2018. Follow the link to see the PNASH PPOP: <https://bit.ly/2qjDG8g>.
- Evaluation Tool: Harvest Program Monitoring Database, v. 3.0 (available on request)



## PILOT PROJECT PROGRAM AND EMERGING ISSUES FUND

PNASH administers an annual Pilot Project Program and Emerging Issues Fund, allowing us to award Northwest investigators small projects in research, intervention, and education projects.

### Pilot Project Program – FY2018

The PNASH Pilot Program offers small grant opportunities to both new and experienced investigators who are seeking to explore new directions, test novel methods, or develop preliminary data for occupational safety and health research in farming, fishing, and forestry. A call for pre-proposals is released annually to investigators throughout the Northwest using our contacts and through collaborations with public health programs in regional universities. The practice of submitting pre-proposals and direct consultation with applicants ensures that the final proposals submitted align with the mission and goals of the Center and the Pilot Project program. Final proposals undergo an internal and external review process where they are scored based on the criteria outlined by the Pilot Program Application Guidelines, including:

- **Significance:** the project's responsiveness to regional and national priorities, focus on hazards that are serious and/or have high rates of exposure, and the probability that research will make a difference
- **Investigator qualifications:** qualifications of PI and/or mentor; early career investigators are encouraged to apply
- **Innovation:** new and novel methods; interdisciplinary and community engaged research
- **Approach:** study design; population size and access; evaluation; research-to-practice
- **Future Funding Potential:** likelihood this project will lead to future studies and programs

In 2018, PNASH's Internal Advisory Committee reviewed program objectives, process, and guidelines for applicants and reviewers. Changes resulting from this review included the addition of the Education/Research Translation Track. The Pilot Program now has two application tracks:

- 1) Feasibility Research Track:** for pilot research studies seeking to gather preliminary data or explore new directions to help inform future research, and
- 2) Education/Research Translation Track:** for translation studies seeking to move research into practice through the development and evaluation of training, education, and outreach materials and activities.

The purpose of creating this new track is to provide an opportunity for academic and community partners to apply for funding to disseminate research findings, translate research into practical formats that are accessible to working populations and their families, and explore innovative education strategies based on research. Each application track has separate evaluation criteria to promote fair and comparable assessments by recognizing the distinct goals, strengths, and methods of each.

During the 2018 call for pre-proposals, there were of eight pre-proposal applications submitted from investigators in Washington, Oregon, and Idaho. Of the eight applications received, six were invited to submit a full proposal. Following an external and internal review, the Center selected three projects to award, two from the Feasibility Research Track and one from the Education/Research Translation Track. The projects awarded this year include Evaluation of Wearable-Based Activity Recognition Modeling Applications for Logging Safety for \$27,250 (University of Idaho), Nitrate Well Water Testing in Ag: Improving Environmental Health Communication with Behavior Theory for \$25,000 (University of Washington), and Northwest Safety Summit for Safety Professionals in the Logging Sector for \$5,000 (University of Washington).

## Pilot Projects Awarded for Year 3:



**Rob Keefe, PhD, Associate Professor, University of Idaho**

**Evaluation of Wearable-Based Activity Recognition Modeling Applications for Logging Safety**

Follow the link to read Dr. Keefe's bio: <https://www.uidaho.edu/cnr/faculty/keefe>

This pilot project will integrate geospatial technology and activity recognition modeling into a Garmin smartwatch and smartphone application for rigging crew workers in the logging industry. This application aims to prevent injuries by improving their situational awareness. Participating workers will receive near real-time updates of their coworkers' work activity status and location. This information allows workers to make informed decisions in navigating locations relative to hazards and for team emergency alerts.



**Elena Austin, PhD, Research Scientist, University of Washington**

**Nitrate Well Water Testing in Agricultural Communities: Improving Environmental Health Communication with Health Behavior Theory**

Follow the link to read her bio: <http://deohs.washington.edu/pnash/elena-austin-dsc-ms>

This project will develop educational materials to promote nitrate well water testing among families in Lower Yakima Valley communities using theory-based message mapping. Focus groups will identify the well water testing needs, including knowledge and health beliefs.

Message mapping will be used to integrate focus group findings with publicly available agency resources to improve messaging for this community and culture. The project will be guided by a committee composed of local environmental health stakeholders, including El Proyecto Bienestar and the Latino Community Fund.



**John Garland, PE, OSU Professor Emeritus OSU and UW Affiliate Professor**

**Northwest Safety Summit for Safety Professionals in the Logging Sector**

PNASH is sponsoring a NW Logging Safety Summit with the goal to convene logging safety professionals in a meeting to share information, train on new industry safety developments, and establish priorities for future needs. Participants are joining from across WA, OR, ID, MT, on February 20, 2018 in Springfield, Oregon.

## Emerging Issues Fund – Year 2

Through PNASH's Emerging Issues Fund we can take rapid action to address an emergent issue or cultivate a developing partnership. The Fund allocates up to \$50,000 direct costs per year with awards as small as \$2,000. Awards are available to active investigators within PNASH's Northwest network.

In Year 2 PNASH modified the criteria of the Emerging Issues Fund to prioritize partnership building activities. The fund is used to address issues and priorities raised through project advisory committees, solicitation from Center stakeholder meetings, and ad hoc advisors. Activities should fall outside of the scope of currently funded PNASH work. Distinguishing criteria for this fund are:

- New effort to cultivate a developing partnership
- Address issues and priorities raised by stakeholders
- High impact opportunity in preventing injury and illness
- Immediacy/timeliness of the need
- Not a fit for other funding streams
- Opportunity to extend our research into practice

**Emerging Issues Projects Awarded for Year's 2 & 3:**

**Kit Galvin. Bilingual Pesticide Safety App. - \$5000 Year 2.** The app provides Spanish translations of pesticides label information. (See pg 41). These funds supported the launch of the pilot app with Tree fruit industry partners in time for Spring 2018 pesticide application season.

**Christopher Simpson. Respiratory Health and Indoor Air Quality in Washington's Cannabis Industry - \$24,142 over Year 2-3 funded in part by Pilot Project Program in Year 2** (See pg 37). This pilot measures airborne contaminants associated with cannabis production and evaluate if they are associated with airway inflammation and/or respiratory symptoms. This project was supported in part through funding with the PNASH Emerging Issues fund and our Pilot Project program.

**Kit Galvin. Fluorescent Tracer: Train-the-Trainer. \$16,733 Year 3.** This project aims to provide agricultural managers and educators the tools, knowledge, and skills to develop and deliver their own trainings using the Fluorescent Tracer (FT) technique. Project activities include the development of a tabletop FT exhibit, delivering a train-the-trainer workshop, and providing follow-up support to trainers in their workplace trainings.

**Peter Rabinowitz. Pilot Next-Generation Sequencing of the Dairy Worker Microbiome. \$10,000 Year 3.** This small project will create a pilot dataset of metagenomics sequences from existing DNA samples from subjects. This will be used to more fully explore exposure-health relationships on dairy farms and build critical research capacity for cutting edge research into the health of dairy workers, as well as other agricultural workers with microbial exposures.

**Vanessa Galavíz and June Spector: Addressing Health Disparities Faced by Rural Underserved Agricultural Communities. \$10,000 Year 3.** This project will characterize environmental climate-related concerns, such as smoke, in an agricultural farmworker community. The project builds on the Population Health Initiative Farmworker Disparities Project (See 40) and addresses community concerns from the Summer 2018 wildfires.

## OUTREACH AND EDUCATION CORE

PNASH's Outreach and Education Core is the Center's foundation for building relationships and sharing information with our agricultural community. The Core links the Center to its stakeholders by forging partnerships that are essential to the success of all our activities. Our stakeholders include:

- Agricultural workers – farmworkers, farm supervisors, fishermen, forestry workers, and loggers
- Agricultural employers – farm producers and managers, skippers, forest land managers, and contract logging and service firms
- Health Care Providers/Safety Professionals – physicians, physician assistants, nurses, health educators, community health workers, and safety professionals
- Government Agency Staff – departments of Labor & Industries (state OSHA), Health, Agriculture, EPA, US Coast Guard, Forest Service, NIOSH, OSHA, and state extension specialists
- Academics – researchers, educators, and students



Specific aims of the Core are to:

- Aim 1.** Collaborate with our stakeholders to identify the key issues and problems in agriculture that our Center can address by further research, intervention, or educational activities;
- Aim 2.** Develop a research-to-practice plan for each of the Center's projects to ensure that the benefits of our research, interventions, and education are put back into the hands of agricultural workers and producers, health and safety professionals, health care providers, public agencies, and academic institutions;
- Aim 3.** Implement outreach strategies that are specific to the needs and communication preferences of each stakeholder group;
- Aim 4.** Provide regular communications between the Center and the agricultural community and serve as a forum for our stakeholders to discuss issues and resolve emerging problems.

## Advisories, Engagement, & Needs Assessments

Our stakeholder advisories are facilitated through projects and supported centrally through the Outreach and Education Core. Our advisories are structured for their audience with the goal of achieving relevant and actionable agendas, empowerment/equal voice, and respect. This can mean operationally that some of our advisories, such as Expert Working Groups made up of workers and supervisors, are held in Spanish with simultaneous translation for those who require it.

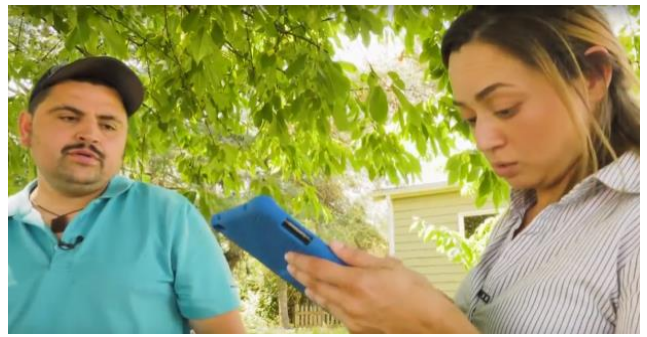
In FY2018 regular PNASH-facilitated stakeholder advisory meetings included: Yakima Farmworker (El Proyecto Bienestar) Partner and Community Advisory Board; Dairy Safety and Health Advisory Group; Heat Illness Expert Working Group; Fishing RISC Advisory Group, and the Forestry Services Technical Advisory and Expert Working Groups. Please see project reports for further information on these activities.



*Expert Working Group (EWG) meeting of forestry services workers. PNASH's EWG advisories are based on a participatory-action research principle that the workers are the expert.*



**Skagit & Whatcom County, WA - Farmworker Community**  
 PNASH joined in a new academic-community project, **Addressing Health Disparities Faced by Underserved Rural Agricultural Communities** (See page 40). This project partners with a local community organization, Community to Community Development (C2C), to conduct a community-wide survey and housing assessments for farmworkers in Skagit and Whatcom Counties. A PNASH team of researchers and C2C promotorX administered 348 farmworkers surveys and completed 24 housing assessments. The study results will shine a light on the health and safety needs of this vulnerable population, such as migratory indigenous farmworkers. Project results will also inform a *Rural Ag PromotorX Certification* program for community health educators.



Watch a video on this work by clicking the link: <https://deohs.washington.edu/hsm-blog/nothing-about-us-without-us>.

**Yakima Valley, WA – Farmworker Community and El Proyecto Bienestar**  
 PNASH maintains close ties to the Yakima Valley, with a field office, projects, and through our ongoing partnership with El Proyecto Bienestar. El Proyecto Bienestar (the Well Being Project) is a long-standing community-based research partnership between the UW PNASH Center, Northwest Communities Education Center/Radio Cadena, Heritage University, and the Yakima Valley Farm Workers Clinic. This partnership is working to resolve issues in the areas of children’s asthma, air pollution, pesticide safety, dairy health and safety, heat illness, and worker safety. Regular outreach activities through the partnership includes dissemination of news and research results through Radio KDNA and local health fairs. In Years 1-2 we re-engaged the community with focus groups (n=15), a needs assessment (34), and personal interviews (13). In 2018, eight new members have joined the Community Advisory Board (CAB).

*“Research is important – especially when the community is involved. We have the strength and experience with the research.”*

- Community Advisor, El Proyecto Bienestar



*PNASH Research Showcase attendees voting on their top health and safety concerns in the poster voting board.*

The Yakima farmworker needs assessment engaged community members at local events with a voting booth. Three voting boards (English and Spanish) addressed: 1) Community Health, 2) Environmental Health, 3) Occupational Health. The top ranked issue for the Community Health board was obesity (6%), Environmental Health board was safe drinking water (6%), and Occupational Health board was pesticide and chemical exposure (5%). This needs assessment was conducted to help guide decisions in setting priorities for the Yakima Valley community with El Proyecto Bienestar.



Follow the link to see the Reality Tale Videos:

<http://deohs.washington.edu/pnash/forestry-services-videos>

materials to be used at forest worksites. These Safety Talks have been disseminated to over 300 contract firms throughout Washington and Oregon.

Visit PNASH's Forestry Services website: <http://deohs.washington.edu/pnash/forestry-services>, for these available resources:

**Forest Worker Safety Talks / Platicas sobre seguridad para los trabajadores forestales (English and Spanish)**

**Reality Tales Videos: Injuries in the Woods /**

**Videos historia Reales: Lesiones en los bosque. (English and Spanish)**

### Logging Safety

In 2018, Dr. John Garland and Marcy Harrington engaged logging safety professionals throughout the Northwest in informational interviews. Safety topics raised included rigging and splicing, anchoring, supervisor training, and new steep-slope tethered logging. Interviewees expressed a need for support and professional development. These issues and others are being addressed in Year 3 through: 1) An advisory committee; 2) Surveys of contract loggers, in conjunction with the Washington State and Oregon State's annual contract logger safety meetings in December 2018 and January 2019, and 3) Prioritization of needs at an in-person meeting, Logging Safety Summit, planned for February 20, 2019 in Eugene, Oregon. The summit will provide a forum to share information and prioritize future training and research needs for NW logging safety. Participants are confirmed from Oregon, Washington, Idaho and Montana.

*"Losing our knowledge basis is the major concern."*

- Logger Educator

### Fishing Safety and Health

PNASH's PI from Oregon State University, Laurel Kincl, is engaging NW fishing communities in conjunction with her 5-year project, Safety Surveillance for Pacific Northwest Fisheries. Guiding this project is a Technical Advisory Board composed of stakeholders from commercial fishing-related organizations including commercial fishermen, the United States Coast Guard, fisheries management professionals, the Oregon Health Authority, academic institutions, and Pacific Northwest commercial fishing extension agents. Advisory meetings are held twice a year and includes UW-based PNASH investigators (See page 28).



*The advisory board for the RISC Fishing Project including PI Laurel Kincl (2<sup>nd</sup> from right in the back) and PNASH research scientist Elena Austin (2<sup>nd</sup> from right in the front).*

## Partnerships

In addition to our PNASH-facilitated advisory groups, PNASH has long-standing roles with organized advisories. Partnerships play an integral role in fulfilling our mission – our work is relevant and impactful only through the strength of our partnerships. Here is a selection of key external advisory groups:

- Latino Center for Health, University of WA. Vanessa Galavíz.
- WA Agricultural Leadership, Skills and Safety Program. Pablo Palmáñez.
- WA State Dept. of Occupational Safety and Health (DOSH) – Agricultural Committee. Pablo Palmáñez.
- WA Governor’s Safety and Health Conf. – Ag Safety Days. P. Palmáñez, J. Grasso, M. Harrington.
- Western Forum for Migrant and Community Health Planning Committee. Jennifer Grasso.
- OR OSHA Forest Activities Code Committee. John Garland.
- USCG Commercial Fishing Industry Vessel Advisory Committee. Laurel Kincl.
- AgInjuryNews.org Steering Committee. Marcy Harrington.
- Children’s Ag Safety Network. Maria Tchong-French.

### Western Regional Conference

In 2018, NIOSH awarded PNASH a conference grant for a **Western Agriculture Safety and Health–Cultivating Collaborations**, planning is underway for hosting in Seattle, WA on August 7-9, 2019. The conference aims to build collaborative partnerships and foster the exchange of ideas. Our program addresses forward thinking research for the safety and health of the western agricultural workforce, including farming, fishing and forestry. Thematic sessions focus on hired/contract workers, climate change, animal/human one-health, injury and exposure prevention, prevention through design, and research-to-practice. Cultivating Collaborations is co-sponsored by the five western NIOSH Agricultural Centers, the NIOSH Western States Division, and participation is invited from all partners in the implementation of science, service and policy.

**2018 Ag Safety Days.** PNASH co-sponsors Washington State’s annual Governor’s Industrial Safety and Health Conference for the agricultural industry. PNASH serves on the planning committee advisory board, along with 10 other organizations. The conference is designed for employers, supervisors, workers, and safety and health professionals, and features programs in English and Spanish. This year, the event was held in two locations including Yakima with 350 attendees and Wenatchee 303 with attendees.

PNASH led two training sessions in both English and Spanish: Injury and Illness Prevention in the Dairy Industry and Heat-Related Illness Prevention. The presentations featured traditional safety messages and also incorporated research results from two PNASH projects. The large presence of the agricultural community at this event provides a good opportunity to engage the workforce in activities and solicit feedback on developing projects. At the PNASH exhibit this year, we featured engaging displays for the Rural PromotorX Certification, the Bilingual Pesticide Safety App and the Fluorescent Tracer Kit. The Rural PromotorX Certification poster voting board featured the preliminary Environmental and Occupational Health curriculum topics and 34 conference attendees selected the topics they perceived to be the most needed. The new Bilingual Pesticide Safety App (BPS), introduced to attendees on sample phone, generated a great deal of interest and allowed us to identify stakeholders for pilot testing.



*The PNASH and voting board at Ag Safety Day in Yakima.*

PNASH’s exhibit and the new Pesticide Safety App was featured in a local TV and online news article: <https://kimatv.com/news/local/agriculture-workers-learn-safety-tips-to-prevent-on-the-job-injuries>.

**2018 Western Forum for Migrant and Community Health.** The Western Forum brings together health professionals and community health workers who provide services for rural and underserved communities. With the 2018 Forum being held in Seattle, PNASH was an active sponsor, serving on the planning committee, hosting a research poster session, and a large participation of PNASH faculty, staff, and students. PNASH students and researchers collectively had six posters on topics including pesticide drift, forestry worker safety, promotora education, and a pediatric asthma study. PNASH led workshops included: 1) Fields > Home > Clinic: Responding to Pesticide Exposures, and 2) Forestry Worker Safety in Health in the PNW: Comparing and Addressing Different Perspectives on Safety Culture and Hazards between Management and Workers.



*PNASH sponsored Research Poster Session at the 2018 Western Migrant Forum.*

**PromotorX Occupational Safety and Health Curriculum**

Our outreach team has met with key organizations (Migrant Clinicians Network, WA Dept. of Health, Communities-to-Communities) and promotora stakeholders who have expressed a need for training in environmental and occupational health/safety. This past year, PNASH conducted a series of needs assessments using a poster voting board to gather stakeholder feedback on potential topics for an Environmental and Occupational Health PromotorX Curriculum. The top-ranked topics included worker’s rights (15%), pesticide safety (14%), sexual harassment (12%), and ladder safety (10%). The PromotorX curriculum has since been integrated in an aim (Aim 3) of the Addressing Health Disparities in Rural Agricultural Communities project. Through interactive modules, this program will enhance PromotorX service to migrant agricultural workers and their families.



*Tethering machines on steep slopes is opening up new land for logging and transforming the Northwest industry.*

**Logging Safety**

Dr. John Garland, PE, has reached over 500 Northwest forestry workers and safety professionals with safety educational seminars and consultation in Washington, Idaho, and Oregon. He regularly serves on the Oregon OSHA Forest Activities Code Committee, providing forest engineering expertise to formation of Div. 7 Forest Activities Code on forestry services and logging. In 2018, Dr. Garland informed code changes for loading and unloading log trucks.

Dr. Garland also serves as the Principal Investigator on the NIOSH funded U01 project on tethered, steep-slope logging technologies and safety and health. Steep-slope mechanized logging has opening up more terrain for harvesting in the NW, yet presents new safety

challenges. Through this research and his role for PNASH serving on the Oregon OSHA Forest Activities Code Committee he advised on tethered-mechanized logging safety – these actives are now informing safety rulemaking activities in OR, WA, and ID.

Learn more about new steep-slop logging technologies by reading the Timber West Article by following the link: [http://forestnet.com/TWissues/2017\\_jan\\_feb/look\\_ahead.php](http://forestnet.com/TWissues/2017_jan_feb/look_ahead.php).

*“We have a basis for providing a selection of training guidelines for logging contractors as they’re moving into steep slope logging.”*

- John Garland, OSU Professor Emeritus & PNASH Affiliate Professor

## Communications & Campaigns

PNASH provide regular communications through our ENews, social media and our website, ensuring our work is transparent and expanding our reach to stakeholders.

PNASH eNews has 1900 subscribers. Our Year 2 communications covered topical issues with resources and prevention tools (i.e., Cold Stress, Child and Teen Safety, Orchard Injury Prevention), PNASH news, and focused campaigns in collaboration with the NIOSH Agricultural Centers (i.e. National Ag Week and National Ag Safety and Health Week). This year, our social media use increased on Facebook and Twitter. Two examples of our reach:

- Reaching 2609 people on Facebook - Our own Dr. Breckwich has an Op Ed in the Seattle Times, *Raising awareness on sexual harassment in agriculture*: <https://www.seattletimes.com/opinion/where-is-the-metoo-for-sexual-harassment-against-immigrant-workers/>
- Reaching 1018 (impressions) on Twitter - PNASH Professor Catherine Karr is featured, *For farmworkers' kids, country air means dust, pesticides and asthma*: <https://www.opb.org/news/article/asthma-air-quality-yakima-valley-washington-farm-workers/>

A USAg Center YouTube analytics report shows the EPA Pesticide Safety video in Spanish has the top viewership, with 1243 impressions and an average watch time of 9:13. The total watch time for the EPA Pesticide Safety video is 2517 minutes. The EPA Pesticide Safety video in English is #5 in views with a total watch time of 644 minutes. View the video, EPA Pesticide Safety for Agricultural Workers (English and Spanish): [https://www.youtube.com/watch?v=8zE9\\_vmPdwQ&t=2s](https://www.youtube.com/watch?v=8zE9_vmPdwQ&t=2s)



*PNASH's EPA Pesticide Video has top views on the US Ag Center YouTube Channel*

## ADDITIONAL ACTIVITIES

**Regular communications include e-media such as our website, monthly e-news, and social media engagement.**

October 12, 2018. PromotorX Occupational Safety and Health Program. Poster presentation at Latino Health Forum 2017 Annual Meeting, Seattle, WA. Jennifer Grasso.

November 6-7, 2017, PNASH Exhibit and Needs Assessment. Washington Dairy Conference Annual Meeting and Trade Show, Yakima, WA.

November 16-17, 2017, Pacific Marine Expo, Seattle, WA. Marcy Harrington.

December 6, 2017, PNASH Exhibit and Presentation at Washington State Tree Fruit Association Annual Meeting. Wenatchee, WA.

February 13, 2018, Keeping Farmworkers Health in Hot Weather, Gabino Abarca and June Spector, poster presentation at UW Undergraduate Research Day, Olympia WA.

February 21-23, 2018, ASHCA National Ag Safety Summit, Phoenix, AZ.

February 22, 2018. John Garland. Steep Slope Logging and Safety. Oregon Logging Conference, Eugene, OR

May 9, 2018, Groundwater Contamination Needs for Lower Yakima Valley. Presentation at WA Governor's Interagency Council on Health Disparities. Kori VanDerGeest.

June 10-13, 2018, International Fishing Safety and Health (IFISH) Conference, Saint Johns, Canada. Planning committee member: Laurel Kincl. Attended by Michael Yost

June 25-27, PNASH Exhibit and Kit Galvin poster presentation on Pesticide Safety App. International Society for Agricultural Health and Safety (ISASH) Conference, Halifax, Canada.

August 14-15. Child Injury Prevention Workshop, National Children's Center for Rural and Ag Health and Safety, Marshfield, WI. Maria Tchong-French.

September 13, 2018. John Garland. Operators in Steep Slope Logging and Safety Measurement. Pacific Logging Conference, Corvallis, OR Forest Section Coordinator: NIOSH NORA Steering Committee. John Garland.

## RESOURCES

Harrington MJ, Lloyd K: A Case History introducing the Oregon Ag Seminar Series – Keys to program and research-to-practice success. J of Agromedicine 22(4) 420-424. 2017. PMID: 28742449.

Article in NIOSH Research Rounds: Novel Blood Test Quickly and Accurately Detects Pesticide Exposure. 2018 July, <https://www.cdc.gov/niosh/research-rounds/resroundsv4n1.html>

Article in NIOSH ENews: Keeping Pesticides on the Farm: Practical solutions for minimizing family exposure. 2018 June, <https://www.cdc.gov/niosh/enews/enewsv16n2.html>

Article in UW School of Public Health News: New study finds Alaska's commercial salmon fishermen suffer from hearing loss at rates five times the national level. 2018 June, [http://sph.washington.edu/news/article.asp?content\\_ID=9210](http://sph.washington.edu/news/article.asp?content_ID=9210)

Article in UW DEOHS News: Pioneering technique developed by PNASH teaches pesticide contamination risks. 2018 July, <http://deohs.washington.edu/hsm-blog/seeing-believing>



*Orly Stampfer, PhD student, demonstrating an interactive exhibit to designed to demonstrate the chemical combustion that occurs when wood burns for the Karr NextGenSS Project.*

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## NIOSH SPONSORED PROJECTS



*Pablo Palmández, PNASH Agricultural Workplace Specialist, and Gabino Abarca, student research intern in the field meeting with wine grape manager.*

# PREVENTION OF OCCUPATIONAL EXPOSURE TO PESTICIDE DRIFT

## YEAR 2 of 5 (2016-2021)

PI: Richard Fenske, PhD, MPH  
Professor  
University of Washington



Our objectives for this project are to understand the mechanisms of pesticide drift exposure among agricultural workers and prevent these exposures in the future. Pesticide drift has been a long-standing issue in the Pacific Northwest, especially for the tree fruit industry and workforce. Data from the Washington State Department of Health (WA DOH) show that the incidence rate of agricultural drift illnesses ranged from 0.33 to 1.85 cases per 100,000 individuals between 2010 and 2015. A study of drift-related illnesses by the National Institute for Occupational Safety and Health (NIOSH), that included WA DOH data (2001-2006), highlighted unfavorable weather conditions as a contributing factor for drift exposure.

Over a five-year period, we will address pesticide drift with the aims to:

- Aim 1.** Determine the probability of drift events due to changing environmental conditions during spraying: we will estimate weather conditions during documented drift events in Washington State from 2000 to 2015 and build a 'drift determinants' model by conducting a case-crossover study of changing wind conditions on drift event days vs. non-drift event days.
- Aim 2.** Proposed revision: Explore wind ramping as a determinant of drift: we will investigate the impact of distance and terrain on AgWeatherNet (AWN)-based meteorological measurements at representative sites in the Yakima Valley and model wind ramping during field sampling of pesticide drift.
- Aim 3.** Translate study findings into exposure prevention tools for agricultural producers and workers: we will produce new training modules for regional 'Drift Management Best Practices' courses, provide a user-friendly method for WA DOH investigators to integrate weather conditions into drift event documentation, and develop a system to alert pesticide applicators about drift-prone weather conditions.

*"All of us have benefited from your steady dedication to engagement with diverse institutions and communities confronting a diverse and dynamic array of agricultural safety challenges."*

- James McFerson  
WSU Research & Extension

Dr. Edward Kasner, under his post-doctoral fellowship, completed Aim 1 of the study to determine the probability of drift events due to changing environmental conditions during spraying. To characterize drift-related weather conditions, we linked WA DOH agricultural pesticide illness data with the Washington State University (WSU) AWN weather data. The illness data included 252 reported drift events involving 738 individuals between 2000 and 2015. Major findings showed that wind speed and direction variability were not statistically different between 'drift days' and 'control days'. While this null finding demonstrated limited ability to predict drift events, it brought several issues to light. Most interestingly, it showed how wind speed and direction reported by AWN can differ from a pesticide applicator's self-reported wind speed and direction. In an event involving 20 orchard workers, Calvert et al. (2015) noted that applicator and meteorological records showed wind speeds were low (0-4 mph, 0-1.8 m/s) early on a spray day, but increased to 18 mph (8.0 m/s) during the time of exposure later in the day. This finding is consistent with some events from our study. We will continue to explore these discrepancies in order to improve weather monitoring practices, with the potential benefits of increased application precision and reduced human exposures.



Year 2 saw significant progress in reporting Aim 1 study results through peer-reviewed journals, among state partners, and to stakeholder groups. Four manuscripts have been submitted to peer-reviewed journals for our drift work and a fifth, related to the 'drift determinants' model described in Aim 1, is being reviewed internally. Three manuscripts from our previous NIOSH-supported study (New Sprayer Technologies) are currently in peer review and one has been published (Kasner, et al., 2018).

The project's next steps (Aim 2) are to sample for drift during dormant canopy conditions (Fall 2018) and again during full canopy conditions (Spring 2019). These field studies are conducted in coordination with our partners at the WSU Prosser Field Station. In Winter 2018, we will assess the internal validation of the AgWeatherNet stations.

In addition, this past year the project team responded to requests for technical advice on the issue of pesticide drift from Oregon and Washington state governments. In January and March 2018, we provided comments to Oregon's Occupational Safety and Health Administration (OSHA) about interpretation and revision of the Application Exclusion Zone described in the federal Worker Protection Standard. In 2018, the Washington State Legislature passed Senate Bill 6529, establishing a Pesticide Application Safety Workgroup charged with developing recommendations for improving the safety of pesticide applications by: 1) reviewing existing state and federal regulations, 2) learning about new pesticide application technology, 3) reviewing the structure of the former Pesticide Incident Reporting and Tracking (PIRT) panel to see if a similar group should be created, and 4) reviewing current data and reports from agencies in Washington and other states. Workgroup members included: Washington State Department of Health, Washington State Department of Agriculture, Washington State Department of Labor and Industries, Washington State Department of Natural Resources, and the Washington Commission on Hispanic Affairs. PNASH investigators from the project were invited to comment at two public sessions.

## RESOURCES

*Additional papers have been accepted and are pending publication.*

Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Blanco MN, Seto EYW, Yost MG. Spray Drift from a Conventional Axial Fan Airblast Sprayer in a Modern Orchard Work Environment. *Ann Work Expo Health*. 2018 Oct 19. [Epub ahead of print]. PMID: 30346469. PMCID: PMC30346469.

Prado JB, Mulay PR, Kasner EJ, Bojes HK, Calvert GM. Acute pesticide-related illness among farmworkers: barriers to reporting to public health authorities. *J of Agromedicine*, 2017;22(4) 395-405. PMID: 28762882; PMCID: PMC5846675.

Kasner EJ. On preventing farmworker exposure to pesticide drift in Washington orchards. Doctoral Dissertation, University of Washington. ResearchWorks, 2017. <http://hdl.handle.net/1773/40560>.

Blanco MN. Real-time particle monitoring of pesticide drift from two different orchard sprayers. Master Thesis, University of Washington. ResearchWorks, 2017. <http://hdl.handle.net/1773/40103>.

Kasner EJ. Use of meteorological data to strengthen public health surveillance of risk and disease, response and prevention. Pacific Northwest Climate Conference, 9 October 2017, WA Dept. of Health, Tacoma, WA.

Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Yost MG. Comparative evaluation of orchard sprayer technology based on pesticide drift exposure potential. International Society of Exposure Science, 15 October 2017, Research Triangle Park, Durham, NC. Poster Presentation.

Blanco MN, Fenske RA, Kasner EJ, Seto EY, Austin E, Yost MG. Real-time particle monitoring of pesticide drift from two different orchard sprayers. International Society of Exposure Science, 15 October 2017, Research Triangle Park, Durham, NC. Poster Presentation.



*Airblast applications are common in tree fruit, hops, and wine grapes – top NW commodities.*

# THE HEALTHY DAIRY WORKER STUDY

## YEAR 2 of 5 (2016-2021)

PI: Peter Rabinowitz, MD, MPH  
Associate Professor  
University of Washington

This study collaborates with the Allen School for Global Animal Health at Washington State University, the Washington State Dairy Federation, and the Migrant Clinician's Network.

A research collaboration with PNASH and the Center for One Health Research is working to characterize dairy worker exposure to microbes and allergens common in dairies. The study evaluates the impact of environmental exposures on respiratory and gastrointestinal health by assessing health symptoms, measuring respiratory function, and monitoring changes in nasal and gut bacterial microbiomes of workers over time. This analysis will provide a better understanding of whether these exposures provide immune benefits or an increased risk of disease. The "hygiene hypothesis" suggests that exposure to microbes on farms may have immune benefits and could be a critical determinant of whether farmworkers remain healthy or develop occupational disease (e.g., infection and airway inflammation). Better understanding of adaptation to dairy environments could lead to improved methods of detecting and preventing adverse infectious and allergic health effects among workers. Visit online, <http://deohs.washington.edu/cohr/>.

This study has three specific aims:

- Aim 1.** Compare reported health status, gut and nasal microbiome, and respiratory function in a cohort of newly hired dairy workers, as well as comparison groups of community controls and experienced workers.
- Aim 2.** Over a two-year follow-up period, compare gut and nasal microbiome change between new workers and controls.
- Aim 3.** Determine whether microbiome components are associated with health status or early work cessation. During the first year of this study, we visited four dairy farms to discuss our research with dairy owners and operators and recruit workers to participate in our study. We have established three new dairy industry partnerships from which we have recruited 12 workers and two community members (controls) to participate in the study. To date, we have administered 14 surveys on these farms, assessing demographics, use of Personal Protective Equipment, hygiene and exposure risks.

This past year, we have substantially increased our interactions with the dairy industry through site visits, participant recruitment, and outreach activities. Through our conversations with dairy farmers, we have identified a new and important need for an infectious disease prevention training program for dairy supervisors. The research team is currently developing the training program in conjunction with a curriculum planning committee under the UW Occupational Medicine Clinic.

For Aim 1, we recruited a total of 37 existing dairy workers, 4 new dairy workers, and 9 community members who are at varying stages of the project (baseline, 3 month, 6 month, and 1-year visits completed). We have lost two existing dairy workers and four community members, but have retained all other participants. Recruitment continues as we try to get more dairy farms to allow us to approach their workers. It has been particularly difficult to recruit new dairy workers for the following reasons: 1) new employees often come from other dairy



*José Carmona, MPH student, obtaining a stool sample from a dairy.*

*“As the owner of a dairy farm, I am interested in the health of workers and feel that your research could shed light on novel methods of maintaining worker health in this work environment where microbial exposure is unavoidable.”*

- WA Dairy Owner

farms in the region and so do not have a "naive microbiome," and 2) some are hired on a trial basis and decide themselves that they do not want to work at a dairy farm, or the farm decides not to hire them permanently following the trial period.

Through the PNASH Emerging Issues funding, we were able to expand Aim 2 to include blood sample collection and analysis for a subset of participants. The additional sampling will allow us to further correlate dairy work activities and immune function in relation to microbial environmental exposures. The first batch of extracted DNA for human fecal and nasal samples, as well as DNA from environmental wall and floor samples, and cow/calf fecal samples were sent to the for sequencing in August 2018. In October 2018, we sent a second batch of blood samples to UW labs for allergy biomarker (IgE) analysis. These samples, as well as another batch in mid-to late 2019, will be analyzed by an MPH student with an immunology background who started in the program in Fall 2018. Results of this sequencing and analysis will provide the first comparative look at new/existing dairy workers and the community controls.

For Aim 3, a new PhD student with extensive experience in microbiome analysis will be leading the analysis of the data and training MPH students how to work in the various programs that lead current microbiome analysis. In Fall 2018, another new PhD student joined our team who has experience working both in microbiome analysis and with this demographic of workers. These two students will help drive the analysis in this constantly evolving microbiome work. In June 2019, we anticipate the completion of a student thesis exploring the impact of lung function (exhaled nitric oxide and spirometry results) in these three groups.

During fall of 2018, we have a scheduled meeting with the National Farm Medicine Research Center to share ideas about microbiome research taking place around the country related to the dairy farming environment, since there are a number of other research projects taking place in other locations.

## RESOURCES

Brochure: Dairy Farming – Hygiene & Health

# A MULTI-LEVEL APPROACH TO HEAT-RELATED ILLNESS PREVENTION FOR AGRICULTURAL WORKERS

## YEAR 2 of 5 (2016-2021)

PI: June Spector, MD, MPH  
Associate Professor  
University of Washington



This study works in collaboration with Washington state growers and workers, farmworker housing partners, and Washington State University's AgWeatherNet. This participatory intervention project will develop and evaluate an approach to prevention of adverse heat health effects for agricultural workers that addresses risk factors at individual, workplace, and community levels. The results and products from this project are expected to lead to more effective prevention of adverse occupational heat health effects for at-risk workers in a changing climate.

We will conduct this intervention study with three specific aims:

- Aim 1.** Develop an adverse heat health effect prevention intervention approach that addresses individual, workplace, and community factors, using an established Expert Working Group model.
- Aim 2.** Assess the effectiveness of the intervention on occupational heat strain and heat-related symptoms in a parallel, comparison, group intervention study in WA summer tree fruit workers.
- Aim 3.** Assess whether the association between workplace heat stress and heat-related symptoms is modified by hot housing conditions using longitudinal observational study design in WA summer tree fruit workers.

Our project is guided by two advisories: a technical advisory group of industry and state/local government representatives and an Expert Working Group (EWG) comprised of seasonal agricultural workers who reside in Yakima Valley. Meetings take place two to four times per year to develop educational materials and the heat awareness system using an iterative process where the study team presents and receives feedback on prototype intervention materials and tools.

In our second year we completed the development of prototype interventions that include:

- Participatory educational approach: 'Heat Education Toolkit'
- Heat awareness (alert) system

### **Aim 1. Intervention: 'Heat Education Toolkit'**

Over 2018, we focused on the development of the participatory educational approach. The Heat Education Toolkit under development provides the trainer with guidance on participatory exercises and a flip-chart style visual display. The content covers symptoms and treatments of heat-related illness and personal, workplace, and weather-related risk factors. Practices for prevention are discussed, such as clothing and hydration, the use of PPE (personal protective equipment) in hot weather, and cooling off in off-work hours. To evaluate the participatory educational materials, we engaged our advisories and also conducted focus groups with two key audiences:

**1) Promotores (community health workers), April:** Eight promotores provided early feedback on the content and usability of the materials when they conducted safety trainings with agricultural workers.



*Pablo Palmández conducting beta training with ag workers using the new HRI prevention flip-chart.*

**2) Agricultural workers, June:** Beta training with twenty workers assessed knowledge gained and solicited feedback.

The promotores group provided specific feedback on the participatory exercises and flip-chart display, including the teacher's instructions. This led us to revise our instructions, change our formatting, and replace certain images. Examples of recommendations that emerged from the meeting with the promotores are:

- Address complexity of worker/employer relations before starting training.  
*Example:* Often times, migrant workers are afraid to address workplace hazards due to the threat of losing their job. However, employees should still take precautions and be mindful of their health.
- Offer culturally appropriate recommendations with which indigenous populations will be more familiar.  
*Example:* We should find a "cultural equivalent" to calamine lotion which is used to soothe heat rash.
- Represent women, including pregnant women, and emphasize the prevalence of sexual harassment.
- Explain why water is better than other energy drinks.  
*Example:* Most field workers exclusively drink Monster/Red Bull which is sugary and dehydrating.



*This [Ag Weather Net](#) weather station is one of 175 in WA state managed by WSU in Prosser, WA.*

The PNASh-led worker training in June provided a reaction assessment by the target audience. Based on this evaluation, we have confidence in our current approach, but are revising the materials to be more visible (enlarging flip-chart) for larger group settings. We have also integrated feedback from our other advisories, including: 1. Emphasize role-playing in real world scenarios, 2. Address that workers avoid notifying supervisors if they are not feeling well because of concerns about missing work and job security, and 3. Consider workers' level of awareness of heat illness symptoms, because awareness is first needed if workers are to take actions to protect and treat themselves and co-workers.

For the **Aim 1 AgWeatherNet (AWN) heat awareness system intervention**, heat prevention messages and tips for supervisors will be sent out during weather forecasts with a high risk for adverse heat health effects. We are currently working with our advisory and expert working groups to develop the messages to ensure they are practical for use in the field. Our goal is to develop a heat awareness application that is tailored to the agricultural community and that assists with making decisions to support occupational health.

Activities in Year 2 further developed the technical heat awareness features within the current WSU AWN system. The application is being programmed to send out messages to managers with suggestions for preventing adverse heat health effects at the workplace in advance of heat waves and excessively hot days. Managers voluntarily sign up for the service. When the AWN station they select has a forecasted temperature that is above a threshold based on health risk from previous research studies, the manager will receive a message both a week before and the day before the forecasted hot day or heat wave. Messages and recommendations are based on the corresponding wet-bulb globe temperatures (WBGTs) and tailored from existing health and safety guidelines. Our focus is now on further refinement of the heat awareness system application. The project advisory groups have completed their review and the application will be beta tested in 2019 as part of the intervention field study.

**Aims 2 & 3** began with field testing of methods for the evaluation of the interventions (**Aim 2**) and assessment of housing heat conditions (**Aim 3**). During the summer of 2018, we developed and assessed the feasibility of several methods for assessing farmworker housing temperatures and relative humidity, personal heat exposure, and periodic heat-related symptoms. Based on our experience during the summer of 2018, we are in the process of refining and adapting these methods. During the 2019 growing season, educational materials and the awareness system will be packaged together in a toolkit for the agricultural community and outcomes assessed. Outcomes measured will include self-reports of heat-related illness symptoms and injury and field measurements of heat strain. These studies will be conducted with participating growers and workers in real field settings.

# INJURY AND ILLNESS PREVENTION FOR THE PACIFIC NW DAIRY INDUSTRY

## YEAR 2 of 5 (2016-2021)

PI: Michael Yost, PhD, MPH  
Professor  
University of Washington



*A dairy calf from a dairy farm participating in the training intervention study.*

This study combines expertise from Washington State University's Department of Animal Sciences, Washington State Department of Labor and Injuries (LNI) Safety and Health Assessment and Research for Prevention (SHARP) Program, Washington state Fatality Assessment (FACE) Program, and the Washington State Dairy Federation.

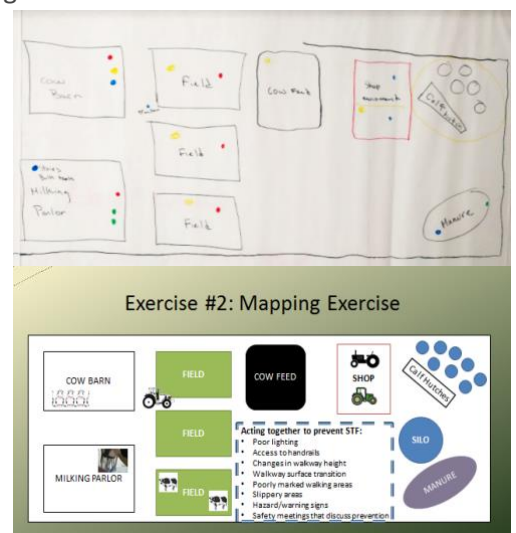
This intervention project seeks to minimize acute worker injuries in Washington State dairies and develop a surveillance program to track acute and chronic injuries. Washington claims data shows that dairy workers in the state have a higher than average rate of injury than the overall worker population. Industry specific risks include acute injuries from animal assaults, slips and falls on wet surfaces, and chronic injuries from repetitive stress. We hypothesize that a targeted intervention in participating dairies addressing both worker training and their physical environment will result in workers adopting safer and more efficient working practices.

During the course of this five-year intervention study, we aim to:

- Aim 1.** Identify common tasks and circumstances associated with acute injury risk in Washington Dairies.
- Aim 2.** Survey current safety training and animal handling practices in Washington Dairies.
- Aim 3.** Establish an Expert Working Group (EWG) comprised of managers and workers involved in day-to-day activities in the dairy industry.
- Aim 4.** Implement and evaluate selected training interventions with a study population.
- Aim 5.** Develop methodology for and conduct a dairy injury surveillance program.
- Aim 6.** Translate results in a Best Practice Guide for minimizing injuries in Washington dairies.

This year, we continued to work closely with the dairy industry to pilot and evaluate on-farm training formats with workers and to finalize the Safety Practices Survey for employers. This work has been guided by the Technical Advisory Group (TAG) and an Expert Working Group (EWG) comprised of the on-the ground dairy managers and workers.

For **Aim 1**, we have continued to collect and analyze workers' compensation data for WA dairy workers to identify the most common injuries and their risk factors. This year, we compiled WA State claims injury data from 2009-2013 for workers whose employers have the NAICS code 112120 (Dairy Cattle and Milk Production). In this dataset, there is almost complete overlap between this group of workers and those identified using the WA Risk Class "Dairy Farms" (7301). This injured workers population was predominantly male (97%), 70% Spanish speaking and 80% under the age of 45. Hospitalization resulted from 4% of the reported injuries and 40% of injuries resulted in more than 31



*A hazard mapping exercise in which workers identified the various injury risks associated with different tasks and locations on a farm.*

days of Time Loss Paid. Injuries were also described based on the event or exposure leading to the injury. Contact with objects and equipment, as well as falls to a lower level were predominant injury events.

For **Aim 2**, we drafted a survey of Washington State dairy owners and operators, to establish their current safety practices and needs. This survey was formatively developed by a precursor survey and discussion session we hosted at the WA Dairy Federation Safety meeting. This survey has also been reviewed by our newly established Technical Advisory Group (TAG) who have provided feedback on the content and provided avenues for dissemination of the survey. The survey has been adapted to allow for electronic delivery using the secure REDCap web application. An initial pilot of the survey was administered to 30 dairy owners. The results revealed that a priority topic of interest is animal handling. To address this issue, we are partnering with Amber Adams-Progar and Susan Kerr at WSU to share training videos and demonstrations of safe animal handling practices.

Through the guidance of our TAG group, we have finalized the Safety Practices survey for dairy owners and operators, developed to assess their current safety practices and needs described in **Aim 2**. We intend to send out a wider distribution of this survey questionnaire through both paper and electronic formats.

In the fall, we will begin doing dairy safety walkthroughs to lead the Expert Working Group (EWG) activities in **Aim 3**. For **Aim 4**, the Slips, Trips and Falls (STF) training, as well as the Cattle Handling 101 training, have been finalized. Each training includes two modules that will be randomly assigned to participating farms. The two trainings include the same key messages, but the training format is different. For STF, the contrast will be between a PowerPoint presentation and an interactive workshop. For Cattle Handling 101, the contrast will be between an interactive workshop and a video. This year 143 workers were trained over the course of seven distinct one-hour training sessions.

This past year, the research team participated in a series of events and conferences to share the preliminary results of their research, pilot-test trainings, and engage with industry stakeholders. Last November, PNASH was a sponsor and exhibitor at the WA State Dairy Federation Safety Meeting and Dr. Austin facilitated a training on Dairy Safety with 20 participants. At the 2018 Ag Safety Days in Yakima and Wenatchee, Dr. Austin facilitated the English Dairy Safety Training and Pablo Palmández led the Spanish training, featuring a total of 34 workers.

## RESOURCES

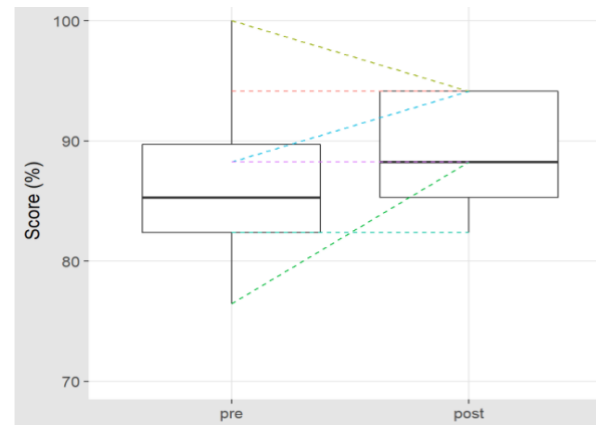
Nov 2017. Exhibit at Washington State Dairy Federation Safety Meeting

February 22 2017. Presentation at Washington Governor’s Safety and Health Conference – Ag Safety Day, Yakima, WA. (English and Spanish)

Evaluation Tool: Survey of Dairy Owners and Producers

Dairy Safety Training Curriculum: Slips, Trips, and Falls

Dairy Safety Training Curriculum: Animal Handling 101



*A boxplot showing the pre- and post- test results from a pilot training for workers in English.*

# SAFETY SURVEILLANCE FOR PACIFIC NORTHWEST COMMERCIAL FISHING: Risk Information System for Commercial (RISC) Fishing

YEAR 2 of 5 (2016-2021)

PI: Laurel Kincl, PhD, CSP  
Associate Professor  
Oregon State University



This five-year project aims to develop a safety surveillance system for commercial fishing that can be used to evaluate and inform safety initiatives in order to prevent injuries in this dangerous industry. This partnership effort brings together the expertise of the National Institute for Occupational Safety and Health (NIOSH) Western States Division, Marine and Environmental Research and Training Station (MERTS), Oregon Health Authority, United States Coast Guard, Alaska Marine Safety Education Association, and Alaska Marine Safety Education Association, as well as the OSU Colleges of Earth, Ocean and Atmospheric Science, and Public Health and Human Sciences.

RISC Fishing (Risk Information System for Commercial Fishing) is a surveillance system that compiles personal and vessel casualties and disasters. It will be used by researchers and industry leaders to conduct hazard assessments for specific fisheries, vessels, and community needs. RISC Fishing will be beneficial to develop fishery-specific approaches to hazard identification, risk mediation, and intervention evaluation.

This study includes three specific aims:

- Aim 1.** Create a practical, scalable commercial fishery surveillance system for the Pacific Northwest.
- Aim 2.** Assess the utility and accuracy of commercial fishing surveillance data.
- Aim 3.** Develop evidence-based hazard assessments with commercial fishery safety stakeholders.

Guiding this project is a Technical Advisory Board composed of stakeholders from commercial fishing-related organizations including commercial fishermen, the United States Coast Guard, fisheries management professionals, the Oregon Health Authority, academic institutions, and Pacific Northwest commercial fishing extension agents. In Year 2, the board convened in two meetings (one virtual and one in person) in December and July, with nineteen participants in the July meeting. The July meeting included a demonstration of the RISC Fishing database and reported system modifications based on past input from the board members. A second demonstration of a web-based visualization, developed in collaboration with Elena Austin and UW PNASH, obtained feedback from the board.



*Technical Advisory Board for the RISC Fishing Project*

**Aim 1.** The national Commercial Fishing Incident Database (CFID) was upgraded to CFID 2.0 and moved to a Center for Disease Control (CDC) development server, allowing our NIOSH colleagues to successfully test the web interface and format. We have just received approval for CFID 2.0 to be moved to a CDC production server, which is secure, so it can be managed by the NIOSH Western States Division. All historical data with Personal Identifying Information (PII) will be added as table imports, then ongoing surveillance can be entered with the



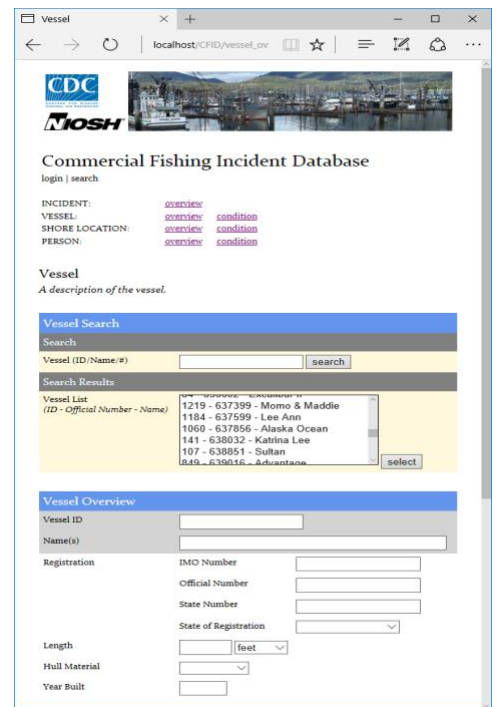
new web-based data entry interface. This will allow for ongoing and sustainable surveillance of commercial fishing fatalities and vessel disasters by NIOSH at a national level.

To continue our work on this aim, we retained a version of the RISC Fishing (Risk Information System for Commercial Fishing) database locally at Oregon State University in order to build the additional modules for non-fatal injuries and vessel casualties. We have successfully developed and entered previous data from US Coast Guard District 13 (Pacific Northwest) for the non-fatal injuries and vessel casualties. We also received the data and developed the tables for the Oregon Trauma System from 2000-2016. There were 750 cases related to “farming, fishing, and forestry,” with eight readily identified as commercial fishermen. This dataset has potential for more cases with searches of text narratives. The draft application for the Washington Trauma System has been completed. The data from marine insurers is on schedule and will be integrated in the coming year.

**Aim 2.** In Year 2, we established a close collaboration and workflow with NIOSH Western States Division, receiving regular updates to the versions of databases in their CFID 2.0: Fatalities/Disasters, Vessel Casualties, and Non-Fatal Injuries (without personally identifiable information). In order to identify overlapping information from the various data sources, we are developing and testing our matching algorithm. To date, we have looked at 370 CFID fatal incidents that overlapped in date/time with vessel casualty data and found a total of 11 matches. By identifying data from different sources of data that match, we can consolidate all the information about the same incident and improve the accuracy of our incident counts. To date, our study team has built the framework for RISC, a centralized database that will pull information from a variety of sources to create a comprehensive injury surveillance system. The study team is continuing to work on gaining access to additional state data sources to populate the injury surveillance system and has a fourth technical advisory board meeting planned for December 2018. As the RISC fishing database becomes populated and linked in Year 3, we expect to engage additional stakeholders and begin using RISC in hazard assessments.

*“Commercial Fishing is a difficult lifestyle for many reasons, but being a dangerous occupation doesn't have to be one of the reasons.”*

- Lori French, Dungeness Crabber's Wife, F/V Langosta II



Commercial Fishing Incident Database.

## RESOURCES

Commercial Fishing Incident Database. Version 2.0.

Syron LN, Lucas DL, Bovbjerg VE, Case S, Kincl L. Occupational Traumatic Injuries among Offshore Seafood Processors in Alaska, 2010-2015. J Safety Res. 2018 Sep;66:169-178. doi: 10.1016/j.jsr.2018.07.008. Epub 2018 Jul 19. PubMed PMID: 30121103; PubMed Central PMCID: PMC6141186.

Kincl LD. “Injury Prevention for Commercial Fishermen: From Surveillance to Interventions.” College of Public Health and Human Sciences, Oregon State University, 2 June 2017, Corvallis, OR. Oral Presentation. Online presentation at this link: <https://www.youtube.com/watch?v=01zgBajHhD0>

Article (hyperlink): [Who Do You Want By Your Side at Sea? Fisherman's News](#)

Article (hyperlink): [Danger Below Deck: Study Investigates At-sea Processing Accidents. National Fisherman](#)

# PRACTICAL SOLUTIONS FOR PESTICIDE SAFETY

## YEAR 2 of 5 (2016-2021)

PI: Kit Galvin, MS, CIH  
PNASH Senior Scientist  
University of Washington



This education project seeks to identify and develop practical solutions to promote safe pesticide use in Northwest agricultural industries. The project builds upon previous research and the Practical Solutions for Pesticide Safety guide for the tree fruit industry and broadcast spraying. This new project will meet safety concerns and challenges of the nurseries, grass seed production, and reforestation industries with solutions that: 1) reduce exposure; 2) are practical, compatible, convenient, adaptable, safe, novel, and meet regulations, and 3) support the training needs of the newly revised U.S. EPA Worker Protection Standard. We are engaging with regional industry managers and handlers in the identification and evaluation of solutions. Lastly, we will create a practical solutions online community presence using web and social media tools for ongoing discussion and dissemination nationally. Visit link: [http://deohs.washington.edu/pnash/practical\\_solutions](http://deohs.washington.edu/pnash/practical_solutions)

The specific aims of this study include:

- Aim 1.** Establish advisory groups to inform the development and dissemination of new practical solutions for handheld pesticide application equipment.
- Aim 2.** Develop practical solutions for pesticide safety for handheld application equipment.
- Aim 3.** Disseminate Practical Solutions for Pesticide Safety guide.

The PSPS2 project team selected the horticultural industry (nurseries and greenhouses) because it is the largest agricultural sector in Oregon state and shares great interest in this project. The team has developed relationships and built partnerships with stakeholders in the Oregon Department of Agriculture, Oregon OSHA, insurance companies, and greenhouse operators to understand the safety challenges and legislative requirements surrounding pesticide use in Oregon. Conversations with the horticultural industry and agency stakeholders showed there was the opportunity to develop a large number of potential practical solutions, due to the diversity of crops and the wide variety of hand-held application equipment that is used in the greenhouses and outdoors. In future years, we will engage our other industry partners (grass seed and reforestation).

**Aim 1.** The first regional meeting with the nursery industry was held in June 2018 and was attended by ten participants from the Oregon Association of Nurseries including owners, managers, safety specialists, and handlers. The agenda for this meeting included an introduction to Practical Solutions for Pesticide Safety, engagement activities to identify safety challenges and potential solutions, and selection of potential study sites. In the meeting this coming fall, we will present the eight solutions identified during field studies, facilitate the discussion on how well these solutions fit the selection criteria, and determine the modifications needed to reach a broader audience. We will also select locations are best suited to facilitate on-site testing.

For **Aim 2**, we conducted two preliminary industrial hygiene walkthroughs and two study site visits, one at a greenhouse operation, and the other at an outdoor nursery with three locations. We identified a total of 24 potential practical solutions including the following pesticide safety topic areas: storage; mixing, loading, rinsing,



*A no entry sign placed over the door knob is simple and effective 'practical solution.'*

PPE storage, onsite pesticide transport, emergency eye washes, and onsite signage techniques that inhibit unauthorized access to treated rooms under the reentry interval (REI). Most of these practical solutions address specific aspects of the Worker Protection Standard (WPS). Key WPS safety messages and short hands-on shop trainings are being identified and will be evaluated along with the associated practical solution.

Based on our internal evaluation, eight solutions were selected from the initial 24 to be developed at this time. These included: 1. reusable treated area posting cones for outdoor production, 2. REI warning sign posting for greenhouse doors, 3. pre-marked buckets and measuring cups, 4. respirator storage, 5. eyewash fountains, 6. solarization, 7. black-bottom herbicide measuring equipment, and 8. shielded sprayer. Interviews were conducted with handlers, supervisors, and managers to obtain information about what problem was addressed by the practical solution, the inspiration for the solutions, ease of use, and possible improvements and adaptations. The 11 subjects completed interviews for one to three solutions for a total of 22 interviews.

For **Aim 3**, our overall goal is to create a practical solutions online community presence using web and social media tools for ongoing discussion and dissemination nationally. This coming year, we will focus on disseminating the solutions developed with the Regional Working Group. We have been collaborating with the Oregon Pesticide Safety Education Program (PSEP) to develop a practical solution hands-on training session on Thermo-Wind Meters, previously developed by the Practical Solutions for Pesticide Safety guide, for the Worker Protection Standard train-the-trainer program for agricultural extension personnel.

Researchers also participated in two conferences in the U.S. and Canada. At the 2018 Oregon Pesticide-Symposium, Kit Galvin and Maria Tchong-French developed connections with individuals that work in the regulatory enforcement and oversight of pesticide use in Oregon, as well as pesticide safety educators. Individuals included a former nursery manager who now works with Oregon Department of Agriculture, representatives from Oregon OSHA, EPA Region 10, National Pesticide Information Center, and the Oregon Department of Forestry. Kit Galvin gave a poster presentation at the International Society for Agricultural Safety and Health Conference to share the success of the participatory research model with the tree fruit industry, and to discuss the research goals and progress of the new project.



*Herbicides and backpack sprayers are used in reforestation activities.*

*“A top priority is the need for practical site-specific ways applicators can reduce exposure in their work to compliment the standard PPE and safety practice recommendations.”*

- Extension Pesticide Safety Educator

## RESOURCES

NASD Online Training: Keeping Pesticide on the Farm: Practical Solutions for Minimizing Family Exposure. Visit online at <http://training.nasdonline.org/>.

Galvin K. “Practical Solutions for Pesticide Safety: Handheld Equipment.” International Society for Agricultural Safety and Health Conference, 25 June 2018, Halifax Marriott Harbourfront Hotel, Halifax, Nova Scotia, Canada, Poster Presentation.

## PNASH PILOT PROJECTS



*Cutting potato seed pieces is a task that can present injury hazards, as it requires extended standing time and repetitive motion. Photographer: Matthew Blua*

# PILOT: RECOGNIZING AND REDUCING RISKS IN THE NORTHWEST POTATO INDUSTRY

YEAR 1 of 2 (2017-2018)

PI: Cynthia Curl, PhD, MS  
Assistant Professor  
Boise State University

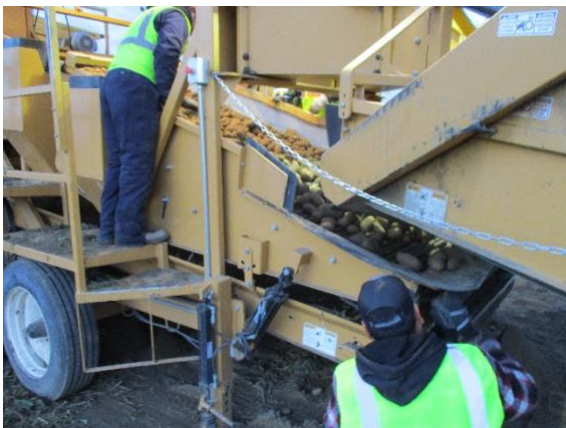


Photographer: Matthew Blua

This pilot project was conducted in collaboration two organizations actively invested in fostering a safe and healthy environment for workers in the potato industry, the Washington state Potato Commission and the Idaho Potato Commission.

The purpose of this pilot study is to work with potato growers in Idaho and Washington to understand growers' perceptions of the most problematic safety hazards associated with potato production. This study then aims to assist growers in mitigating safety hazards using a guided hazard self-assessment tool. This tool encourages growers to stop, watch, and identify safety hazards at their own operations, and provides recommendations on how to address these hazards.

- Aim 1.** Describe potato growers' perceptions of the highest priority safety hazards associated with potato production.
- Aim 2.** Develop a guided hazard self-assessment tool that will allow growers to identify, and potentially control, safety hazards on their own farms.
- Aim 3.** Determine the usage rate of the hazard self-assessment tool among potato growers, and evaluate whether its use influenced hazard perceptions or affected farming practices.



Potato production uses large machinery, which can present a risk for physical hazards.

**Aim 1.** In the first year of the study, Dr. Curl and Dr. Adams developed and piloted the Hazard Perception Survey to assess growers' perceptions of the frequency and severity of injuries associated with the tasks: planting, irrigation, pest management, harvest, storage, and other farm activities. The survey received 63 responses (7%), and showed the ten most common tasks associated with injury as: standing/sitting for extended periods of time, repetitive motion, lifting/carrying materials, falls during potato sorting, falls from machinery and equipment, falling/tripping while transporting materials, working at heights, reaching/stretching, awkward posture, and vehicle/ATV use. Growers felt bending, twisting, and lifting tasks resulted in the most common and severe injuries, as well as potato sorting. The results from the survey were then used to inform the development of the hazard assessment tool.

**Aim 2.** Investigators are currently finalizing the Hazard Self Assessment Tool (HSAT) that will be distributed to potato growers throughout Idaho and Washington. The HSAT includes a Job Hazard Analysis table that encourages users to stop, watch and identify safety hazards associated with job tasks on their own farm. The HSAT links to a series of recommended safety practices that correspond to the hazards identified by growers in the survey. Participants will be sent an email containing a link to the tool. The recommended practices will be available for printing or for electronic viewing.

For **Aim 3**, following the distribution of the HSAT, investigators will survey growers that utilized the tool and assess changes on their perception of hazards in the workplace and the adoption of the recommended safety practices.

Dr. Curl presented this work at the Agricultural Safety and Health Council of America's (ASHCA) annual meeting. ASHCA is a group of national safety leadership, including representatives across agricultural industry, insurance, academic research, education and government agencies.

## RESOURCES

Curl CL. "Recognizing and Reducing Safety Hazards in Northwest Potato Production." Agricultural Safety and Health Association North American Agricultural Safety Summit, 21 February 2018, Hilton Scottsdale Resort, Scottsdale, AZ. Poster Presentation.

Hazard Self-Assessment Tool: A Tool for Growers and Producers

*"Keeping our workers safe is a high priority for the Washington state Potato Commission. We are pleased to be in partnership with Boise State University and PNASH on this project, which I am confident will help growers improve safety on their farms."*

- Matthew Blua, WA state Potato Commission

# PILOT: AN AGRICULTURAL WORKER DATA REPOSITORY AND INTERACTIVE VISUALIZATION

## YEAR 1 (2016-2017)

PI: Elena Austin, PhD, MPH  
Research Scientist  
University of Washington



This pilot project serves as the base for an ongoing system to Collect, Organize and Display data (Data COD) related to agricultural workers and communities in the Pacific Northwest. The repository will store worker and community health information, including employment demographics, injury profiles, environmental justice indicators, and emerging issues.

The goal of the project is to collect, curate, and disseminate the data into a web-based platform with interactive maps that can be accessed by researchers and the public. Our project specific aims are to:

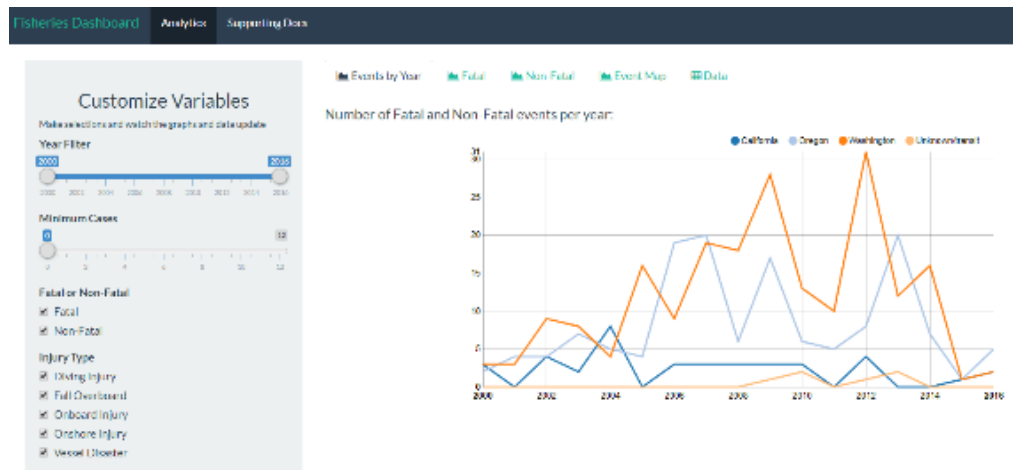
- Aim 1.** Identify data sources, both internal and external to the PNASH Center and identify internal data needs.
- Aim 2.** Develop a database framework to combine sources and conduct analysis.
- Aim 3.** Develop a visualization platform to display and interact with this data.

Our first year's progress completed the core project aims. For **Aim 1**, we selected, cataloged, and formed a data repository of external data sets including: U.S. census data, Ag census data, WA state workers compensation data, CHARS (hospital records) data, and WA well-water testing data.

Within **Aim 2**, we focused on two regions of interest that have been identified through discussion with PNASH investigators. The first is the general Northwest PNASH service region and the second is the Yakima Valley of WA. Data has been organized into codified tables, stored in the Rdata format – a format that saves storage space and provides efficient access the data.

For **Aim 3**, our pilot data visualization platforms focused on:

**Fisheries related injuries and fatalities.** Hazards to commercial fisherman in the Pacific ocean are recognized throughout the industry stakeholder groups. We demonstrated through an organized and interactive data visualization platform that well-informed stakeholders discovered new ways to engage with data. Stakeholders included industry partners and insurers. In addition, we found that having data visualized facilitated the identification of data gaps that are otherwise easy to overlook.

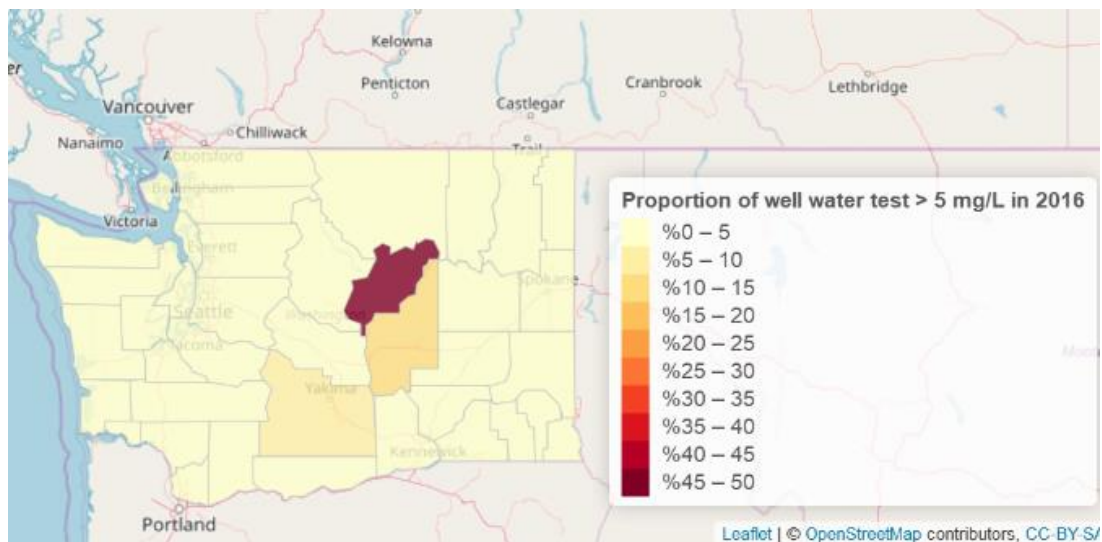


*An interactive figure of the number of fatal and non-fatal events per year from 2000-2015 in the PNW fishing industry from the database developed by the project team.*

**Nitrates in Drinking Water.** We have used publicly available nitrate and well water data from governmental agencies to develop community-level data visualizations. Once environmental health data is made accessible, the public's ability to understand

and act upon that information depends upon the environmental health literacy (EHL) of the individual. Through our Data COD pilot, we have developed tools to foster EHL within the Latino community in the Lower Yakima Valley regarding local groundwater contamination. This project work has successfully led to a new PNASH-funded research pilot in Year 3, Nitrate Well Water Testing in Agricultural Communities: Improving Environmental Health Communication with Health, where we will develop a quantitative tool to measure changes in EHL and measure the impact of our training.

PNASH's long-term goal is to develop an interactive tool for dissemination and to enhance our industries and communities' engagement with occupational injury and health assessments.



*A map of Washington state counties displaying the nitrate concentration of well water using dark color shading to depict the regions with the highest concentrations.*



# PILOT: RESIRATORY HEALTH AND INDOOR AIR QUALITY IN WASHINGTON'S CANNABIS INDUSTRY

## YEAR 1 of 2 (2018-2019)

PI: Christopher Simpson, PhD, MS  
 Professor  
 University of Washington



This pilot study of workers in cannabis production assesses airborne contaminants and evaluates if there is associated airway inflammation and/or respiratory symptoms. Our goal is to provide solutions to the industry to improve workplace safety and reduce occupational exposures. This project was funded in part by PNASH's Emerging Issues Fund to respond to an emerged health concern in this industry.

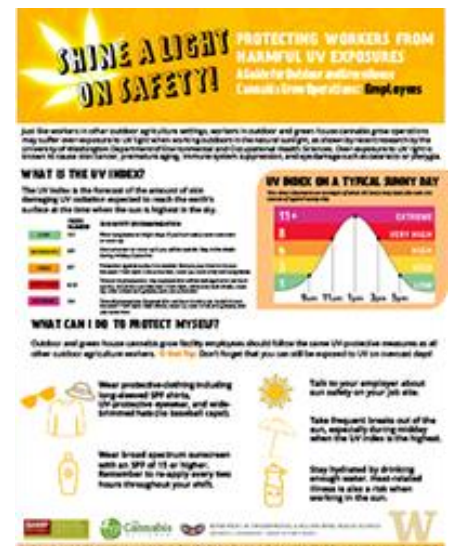
Marijuana is now medically legal in thirty states and recreationally legal in 9 states, including Washington, Oregon and Alaska. Due to the drug's illegal history, there is a lack of scientific study on the occupational hazards for this workforce. A recent report identified twenty-three potentially hazardous exposures, and with the rapid growth of the cannabis industry, there is now a large worker population with potential exposures. This pilot research will lead to improved occupational health for cannabis production workers, by identifying the specific hazards associated with respiratory health concerns, and identifying appropriate industrial hygiene solutions to mitigate those hazards. Broadly, the pilot will build the research base of this emerging industry.

Our project specific aims are to:

- Aim 1.** Measure airborne concentrations of specific contaminants associated with cannabis production, including organic dusts and volatile organic compounds, at a large indoor cannabis grower and processor.
- Aim 2.** In a panel of 10 workers obtain repeat pre-and post-shift measures of airway inflammation (assessed as exhaled nitric oxide, FENO), respiratory symptoms and dermal symptoms (assessed via questionnaire).
- Aim 3.** Evaluate the association between the exposure measures in Aim 1 and the health outcome measures in Aim 2, to identify specific exposures and work activities associated with adverse health outcomes.
- Aim 4.** Based on the findings in Aim 3, recommend industrial hygiene solutions to reduce hazardous exposures and reduce the incidence of respiratory health problems among cannabis production workers.

This study launched recently with progress milestones achieved in the formation of the research team, recruitment of grower sites, and development of the baseline protocols, analysis plan and health questionnaire. These methods have been reviewed by the UW Internal Review Board for human subject ethics. Also, in the project's first year, the development of the assay for measurement of terpenes (the key airborne contaminate of concern) was completed.

In the next study year, we will begin sample collection in October 2018 and plan to complete this pilot study in 2019. The findings from this work will be translated into infographic guidance materials that will be distributed to cannabis growers and workers. Study results will also direct future projects with an expanded scope of collaborators and a wider range of exposure hazards.



Example of hazard prevention factsheet for Cannabis industry from previous UV light exposure project.

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## OTHER PNASH RELATED PROJECTS



*Pesticide safety exhibit at a community event in Yakima, Washington.*

The Pacific Northwest Agricultural Safety and Health (PNASH) Center’s foundational award is through NIOSH/CDC and establishes a base for other projects to fulfill PNASH’s mission: Research for healthy workers, strong communities and productive agriculture. In FY2017, the following projects and awards enhanced PNASH’s innovative research and service in the Northwest.

**I. PNASH-RELATED PROJECTS COMPLETED IN YEAR 2**



*‘Safety Talks’ in English and Spanish were sent to 300 forestry services employers throughout WA and OR.*

**Safety and Health of Latino Immigrant Forestry Services Workers**

NIOSH 2014 – 2017

PI: Arnold de Castro, University of Washington

Forestry services workers are largely young immigrants from Latin America and are at high-risk for work-related injury and illness. While performing work essential for U.S. forest management, these workers encounter injury and illness rates 2 to 3 times higher and fatality rates 9 times higher than the general U.S. workforce. To address this occupational health disparity, an academic community-based organizational partnership between University of Washington’s PNASH Center, Northwest Forest Worker Center (NFWC), and the University of California Berkeley’s Labor Occupational Health Program created a safety and health training and advocacy initiative called **Sí Sé: Salud y Seguridad en el Trabajo (Yes, I Know: Health and Safety on the Job)**. Using a participatory model and mixed-methods study design, this project characterizes working conditions, injury and illness experiences, safety mitigation efforts, employer retaliation, and recovery/return-to-work times among this workforce. Data collection involved worksite observations, employer and worker surveys, and in-depth case study interviews. Findings were then used to develop educational materials, including first-person digital stories to be used by NFWC’s promotoras de salud (lay health educators) in worker training and advocacy programs.

Additionally, employer and supervisor training needs were addressed by producing and evaluating bilingual “Safety Talk” training materials to be used at forest worksites. These safety talks have been disseminated to approximately 300 contract firms throughout Washington and Oregon states. The overarching goal of this project is to facilitate empowerment-building among a community of underserved, highly vulnerable, workers and forestry services contractors, in order to seek workplace and employment improvements.

**Resources**

PNASH’s Forestry Services website has these available resources:

- Forest Worker Safety Talks / Platicas sobre seguridad para los trabajadores forestales (English and Spanish)
- Reality Tales Videos: Injuries in the Woods / Videos historia Reales: Lesiones en los bosque. (English and Spanish)

Learn more and access resource at the website: <http://deohs.washington.edu/pnash/forestry-services>.

Wilmsen C, Breckwich-Vásquez VB, Bush D, Harrington MJ, de Castro AB. System failure: work organization and injury outcomes among Latino forest workers. J Agromed. In Press.

**Heat Exposure, Injury Risk, and Productivity in Agricultural Workers**

NIOSH K01 2014 – 2018

PI: June Spector, University of Washington

Through this new investigator award, Dr. June Spector, examined the association between heat exposure and traumatic injury risk in agricultural workers, with the ultimate goal of developing injury prevention solutions. The study drew on established climate models and WA workers’ compensation data. Harvest workers were then evaluated in the field for associations between heat stress, psychomotor performance, and productivity. The field studies tested the feasibility of using urinary 8-hydroxy-2’-deoxyguanosine (8-OHdG) as a biomarker of heat acclimation. Researchers reviewed 12,200 workers’ compensation injury claims between 2000 and 2012 in relation to maximum daily humidex exposures. The papers released show an increased risk for traumatic injuries in ag workers during hot conditions, particularly while

participating in certain work-intensive harvesting activities in July. The connection between heat and injury was not surprising. Due to heat exposure, dehydration, and fatigue, a person can become less stable on their feet and have more difficulty concentrating. The study team will now take these lessons into the field to determine the specific mechanisms and risk factors for injury (See PNASH project, page 24). The team will engage with employers to estimate future heat illness-related productivity losses and health effects and will develop heat related illness prevention interventions.

## Resources

- Spector JT, Krenz J, Calkins M, Ryan D, Carmona J, Pan M, Zemke A, Sampson PD. Associations between heat exposure, vigilance, and balance performance in summer tree fruit harvesters. *Appl Ergon*. 2018;67 1-8. doi: 10.1016/j.apergo.2017.09.002. PubMed PMID: 29122180; PubMed Central PMCID: PMC5912891.
- Quiller G, Krenz J, Ebi K, Hess JJ, Fenske RA, Sampson PD, Pan M, Spector JT. Heat exposure and productivity in orchards: implications for climate change research. *Arch Environ Occup Health*. 2017 Nov 2;72(6):313-316. doi: 10.1080/19338244.2017.1288077. Epub 2017 Jan 31. PubMed PMID: 28139172; PubMed Central PMCID: PMC5562533.
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- Quiller G. Heat stress, heat strain, and productivity in Washington State tree fruit harvesters. Masters Thesis, University of Washington. ResearchWorks, 2017.  
<https://digital.lib.washington.edu/researchworks/handle/1773/36642>

## II. PNASH-RELATED PROJECTS CONTINUING



See video on new partnership project in link below:  
<https://deohs.washington.edu/hsm-blog/nothing-about-us-without-us>

training preferences, and access to community resources. A subset of farmworkers also participated in a housing assessment. This assessment included a detailed home environment checklist, temperature and humidity measurements inside the home for approximately one to two weeks using Kestrel D2 Drops, and an assessment of sleep duration and efficiency using Actigraph accelerometers. A PNASH team of researchers and C2C promotorX administered 348 farmworkers surveys and completed 24 housing assessments. The study findings will be integrated into a Rural AgX Certification program for community health educators, which will be developed in partnership with the community and designed to build the communities' capacity to respond to the social and environmental challenges faced by farmworkers. Learn more about this project by following the link to see the UW feature video:

<https://deohs.washington.edu/hsm-blog/nothing-about-us-without-us>.

### Addressing Health Disparities Faced by Underserved Rural Agricultural Communities

UW Population Health Initiative 2018-2019

PIs: Vanessa Galavíz, June Spector, and Gino Aisenburg

This project partners with a local community organization, Community to Community Development (C2C), to conduct a community-wide survey and housing assessments for farmworkers in Skagit and Whatcom Counties. The purpose of this study is to assess the factors that impact farmworker health at the individual, community, and societal levels. In summer 2018, a farmworker survey, modeled after the National Ag Workers Survey, was administered throughout the region. The survey covered topics such as current jobs and tasks being performed at work, work history in agriculture, access to water and sanitation facilities, previous work-related injuries, housing conditions, safety

## Preventing Farmworker Sexual Harassment: A Community-Engaged Worksite Training Intervention with and for Agricultural Stakeholders

UW Royalty Research Fund 2018-2019, and individual gifts  
PIs: Victoria Breckwich Vásquez and Jody Early

This project is producing an evidence-based sexual harassment training video and curriculum specifically designed for agricultural workers and growers. The video builds on previously funded PNASH projects including the pilot project, Sexual Harassment Prevention, which developed the script and was informed by farmworkers and the guidance of a 12-member community advisory board. This issue received statewide attention earlier this year through the release of a series of news articles and op-eds in the Seattle Times, Yakima Herald, and El Sol de Yakima. Of these features, the article, “Where is the #MeToo for sexual harassment against immigrant workers?”, brought to light the lack of attention the #MeToo movement has given to the sexual harassment endemic in the immigrant workforce and called for policy action. In November, Dr. Vásquez addressed the WA State House of Labor and Workplace Standards Committee to discuss the severity of this matter and present a case for this issue to be classified as an occupational health and safety issue. The research, advocacy, and stakeholder engagement efforts of this work have now launched a statewide effort called Washington Coalition to Eliminate Farmworker Sexual Harassment.



See video trailer for the Ag Sexual Harassment Prevention Training here: <https://vimeo.com/179345478>.

Learn more about PNASH Sexual Harassment Prevention research by following this link to see the webpage: <http://deohs.washington.edu/pnash/sexual-harassment>, and this link to see the video trailer: <https://vimeo.com/179345478>.



*The App, Etiquetas Bilingües de Pesticidas/Bilingual Pesticide Safety.*

## The Etiquetas Bilingües de Pesticidas/Bilingual Pesticide Safety Project

University of Washington CoMotion  
PI: Kit Galvin 2017-2018

The Etiquetas Bilingües de Pesticidas/Bilingual Pesticide Safety Project is developing an app for agricultural workers and growers which provides access to pesticide labels in English and Spanish. Pesticide labels and information on proper protective equipment and other EPA pesticide safety requirements are currently only available in English. Throughout over 15 years of pesticide safety research, farm managers frequently expressed the need for pesticide label information in Spanish. Farm managers and coworkers have traditionally provided on-the-spot translations, which often prove inaccurate or are unavailable when needed. We seek to address this language disparity by using common technology and true and accessible Spanish translations. Central to our work is removing language barriers and developing safety solutions designed for a predominantly Spanish-speaking agricultural workforce. Then, agricultural workers, managers, and companies can have the confidence that they are taking the appropriate measures to minimize ag worker, family, and community exposure to pesticides, as well as protect their crops and the environment. The app is currently in the beta testing stage with the Tree Fruit industry and is available for development with other agricultural industries.

Learn more about this project through PNASH’s Pesticide Safety webpage: <http://deohs.washington.edu/pnash/bilingual-pesticide-safety-project>.

### Next-Generation Air Pollution Research

EPA Star Grant 2016-2019

PI: Catherine Karr, University of Washington

This partnership project develops low-cost air pollution sensors to help Native American and Latino communities in the Yakima Valley reduce their exposure to wood smoke. Researchers will use next-generation air particle sensors that are portable and battery powered. Researchers will then work with local students over the next three years to both understand and help reduce the community's exposure to wood smoke. Forest fires and residential fires are likely contributors to wood smoke pollution in rural Washington. "We will work with the community, including with Heritage University, the Yakama Nation, and area high schools, putting new low cost air pollution sensors to work to understand areas of concern and opportunities to improve local air quality," said lead investigator Catherine Karr, Professor of Pediatrics and Environmental and Occupational Health Sciences. The project builds on longstanding research-to-action partnerships between the University of Washington PNASH Center and the Yakima Valley community.

### Home Air in Agriculture Pediatric Intervention (HAPI) Trial

NIEHS 2015-2019

PI: Catherine Karr, University of Washington

The HAPI project, made possible through our community partnership with El Proyecto Bienestar, aims to reduce exposure to inflammatory agents and allergens in the homes of asthmatic Latino children residing in an area of intense dairy and crop-based industrial agricultural production. Community-based participatory activities in the Yakima Valley of Washington State have identified pediatric asthma as a priority health concern. This study addresses three highly underdeveloped components of asthma and environment research: the health of children with asthma living in communities with industrial-scale agricultural operations, asthma in a particularly vulnerable subpopulation (Latino farmworker children), and evidence-based intervention strategies in these populations.

Children with poorly controlled asthma aged six through twelve years, recruited through the Yakima Valley Farmworker Clinic, are randomized to the clinic's usual asthma educational program or an enhanced program, which includes two portable high efficiency particulate air (HEPA/NH3) cleaners located in the child's sleeping area and living room. Children in the usual program group will receive HEPA/NH3 units after their study year. This study seeks to characterize key indoor pollutant exposures for 75 children with asthma who reside within 800 meters of crop production or dairy operations. The program opened for recruitment in the summer of 2015 and 59 families have completed the study and 11 families will be finished by mid-February 2019. The team is currently creating a comprehensive dissemination and outreach plan and once data collection and preliminary analysis is complete, the team will work with community representatives to form appropriate messaging on asthma and air quality and begin sharing the results with participants and the wider Yakima Valley community.

Learn more about this project through these Yakima Herald articles by following these links to see the 2017 article: <https://bit.ly/2Dc1YJS> and the 2018 article: <https://bit.ly/2Sx2d6L>.



*Home visit by PNASH partner, Adriana Pérez, Yakima Valley Farmworkers Clinic. Photograph credit: Yakima Herald.*

## OTHER PNASH PEER-REVIEWED PUBLICATIONS

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*Poster presentation by PNASH Intern, Janna Amaly.*

