PACIFIC NORTHWEST AGRICULTURAL SAFETY & HEALTH CENTER

# YEAR END REPORT

FISCAL YEAR 2023
9/30/22 - 9/29/23

Our Vision

The PNASH Center, established in 1996, is housed within the University of Washington's School of Public Health. We conduct research and promote best occupational health and safety practices for Pacific Northwest farming, fishing and forestry. One of twelve regional NIOSH Agricultural Centers, PNASH works throughout Washington, Idaho, Oregon, and Alaska, integrating expertise from multiple integrated disciplines, institutions and community partners. Our vision is: **Research for healthy workers, strong communities and productive agriculture.**

2022–23 Year End Report

This report provides an overview of the PNASH Center's progress during the first year of this program cycle.

Thank You to our partners, advisors, and research participants. Your collaboration makes our work possible and ensures it is relevant and meaningful for ag communities.
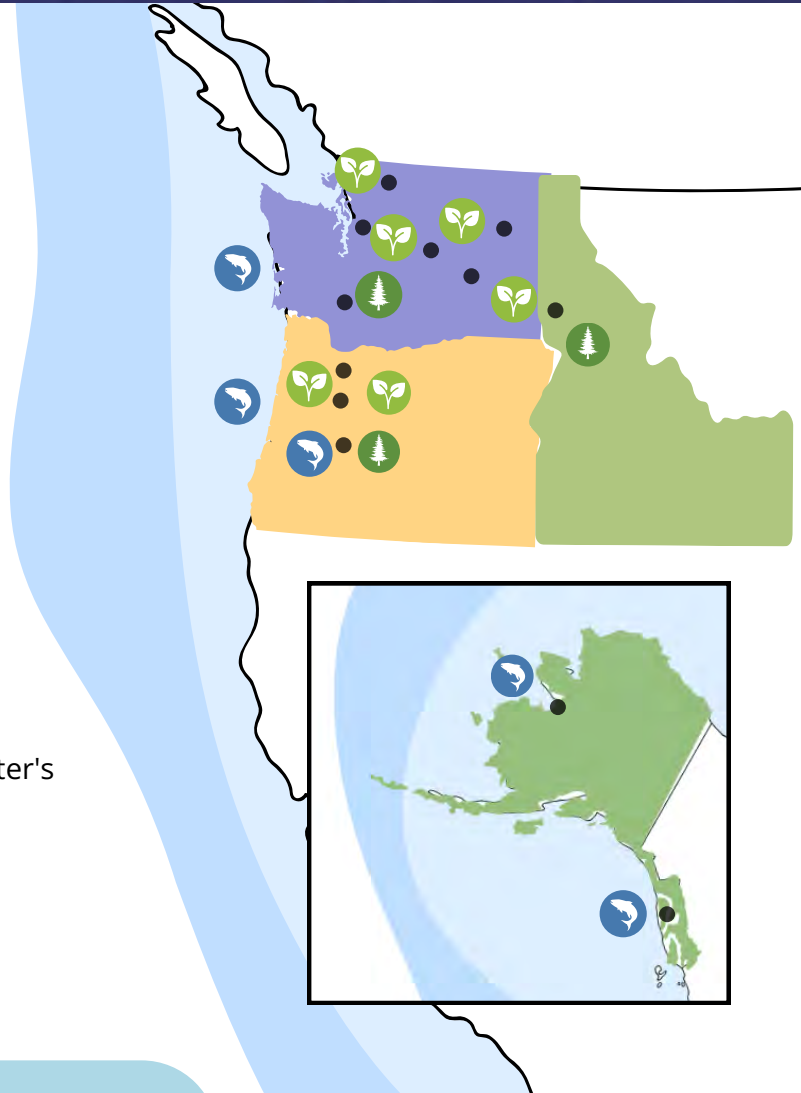
What is the injury burden in AgFF?

Forestry
28x

Forestry workers are 28 times more likely to die on the job. [5]

Fishing
22x

Fishing workers are 22 times more likely to die on the job. [5]

Farming
7x

Farming workers are 7 times more likely to die on the job. [5]

Did you know?

- Alaska produces **60% of seafood** in U.S.[1]
- Idaho produces over **13 billion pounds** of milk annually. [2]
- Oregon produces **28% of plywood** in the U.S. [3]
- Washington is the top producer of apples, **producing 6.5 billion pounds annually.** [4]

Sources
1. National Oceanic and Atmospheric Administration. 2020 Fisheries of the United States Report.
2. Idaho Department of Agriculture. Idaho Facts and Statistics, 2021.
3. Oregon Forest Resources Institute. Oregon Forest Facts 2023-24 Edition.
4. National Agriculture Statistics Service 2019. 2017-Census_Fruit_TreeNut_Berry_Production.pdf. p. 2. Report No.: ACH17-6.
5. U.S Bureau of Labor Statistics. Census of Fatal Occupational Injuries (CFOI) – Current and Revised Data 2018. Washington, DC.

CONTENTS

Research Projects

2023 Scientific Advisory Committee meeting attendees in Seattle, WA.

Use of Location- and Wearable-based Occupational Activity Recognition to Quantify on-the Job Digital Health and Safety Metrics for the Forestry Workforce

YEAR 1 of 5 (2022-2027)
PI: Robert F. Keefe, Ph.D.
Associate Professor and Director, University of Idaho Experimental Forest,
University of Idaho

🌐 https://deohs.washington.edu/pnash/forestry-workforce-location-and-wearable-based-activity-recognition-quantify-job-digital-health-and

Figure 1: Logging workers on a conventional logging operation near Cataldo, Idaho.

Challenge

Logging is among the most dangerous professions in the United States, with fatal work injury rates ranging from 68.9 to 135.9 cases per 100,000 full-time equivalent workers between 2015 and 2020 (U.S. Bureau of Labor Statistics 2021). Fatalities and near-fatal incidents are particularly common among ground workers such as cable rigging crews and timber fallers working with chainsaws, since these workers are not protected in modern equipment with enclosed cabs (Lefort et al. 2003, Shaffer and Milburn 1999, Lagerstrom et al. 2017). For example, manual timber felling and rigging crew workers on conventional cable logging operations accounted for over 47% of injury claims in Idaho and Montana from 2011 to 2014 (Lagerstrom et al. 2017, Lagerstrom et al. 2019). Equipment operation accounted for the next-highest category of injuries after manual felling and rigging crew work (22.35%) (Lagerstrom et al. 2017). Equipment operators have limited visibility due to dense, young vegetation, topography, weather, and other factors, and are often unaware of the exact locations of ground workers. There is a clear need to reduce fatal and near-fatal injuries that frequently result from interactions among ground workers, heavy equipment, and dynamic operational-, terrain- and weather-related hazards on active logging operations. Loggers could have improved situational awareness if they had a system that made it possible for the locations of all resources, including individual workers, to be displayed in real-time on a digital map in the cabs of equipment. The sensors on smartwatches are capable of detecting and characterizing human movements, so an app that quantifies the particular activities workers and coworkers are doing, as well as their potential health and safety exposures during work, could help improve awareness of hazards and reduce the potential for incidents to occur.

Project Overview

The major goals and aims of our project are to develop smartwatch-based recognition of human work activities carried out by logging workers during regular productive operations, and to then program these models into a new smartwatch app prototype that can be used to help improve the health and safety of loggers through increased situational awareness. Additionally, we are improving on an existing system developed through prior NIOSH-funded research, making a user-friendly version of a system for sharing the locations of ground workers and heavy equipment working together on logging operations in remote areas.

Ultimately, the new smartwatch app and real-time mapping system may help to reduce fatalities and near-fatal injuries among logging workers in the Pacific Northwest.

Progress to Date

The first year of this project has primarily been preparing for multiple field studies taking place in fall 2023 and early spring/summer 2024. These field studies include time studies

and collection of smartwatch, smartphone, and real-time worker and equipment GNSS location data needed to conduct the initial analysis for the project. In Year 1, we purchased the primary equipment necessary to complete this proposed work, including smartphones and smartwatches. We have upgraded and maintained a variety of existing electronic devices that are also needed, including digital radios that create the network used to improve communication and safety among loggers at the jobsite. An outstanding Postdoc, Dr. Eloise Zimbelman, was hired for the funded postdoc position on our project. Dr. Zimbelman wrote computer code to update and improve on an existing app that will be used to collect the Garmin smartwatch data needed for the research. As of August 2023, the new code is working well and we are now able to begin our primary field sampling for the project.

Next Steps

In the next year, we will be conducting observational sampling on active logging operations in order to collect the primary field measurements needed to create models of work activities and to begin coding the new smartwatch app to improve the safety of loggers. We will be sampling at 5 different field sites in Idaho, Oregon and Washington. The data collected will be processed, analyzed, and used to begin preliminary app programming. Additionally, we will work with our project Technical Advisory Board to gain input on our methods, on the best potential uses of the new app, and on discussion of ethical considerations. Lastly, we will begin a longitudinal survey intended to characterize the perspectives of logging contractors and workers on the use of smartwatch apps for logging safety.

Partners and Collaborators

- Idaho Department of Lands (https://www.idl.idaho.gov/)
- Washington Dept. of Natural Resources (https://www.dnr.wa.gov/)
- Oregon Dept. of Forestry (https://www.oregon.gov/odf/pages/index.aspx)
- PotlatchDeltic Corp. (https://www.potlatchdeltic.com/)
- Weyerhaeuser Corp. (https://www.weyerhaeuser.com/)
- Green Diamond Resource Company (https://www.greendiamond.com/)
- Manulife (https://www.manulifeim.com/institutional/global/en)
- Associated Logging Contractors of Idaho (https://www.idahologgers.com/)
- Garmin Health (https://www.garmin.com/en-US/)

Respiratory Health and Indoor Air Quality in the Cannabis Industry

YEAR 1 of 5 (2022-2027)
PI: Christopher Simpson, PhD
Professor and Assistant Chair for Research and Faculty Engagement, Department of Environmental & Occupational Health Sciences, University of Washington

Coralynn Sack, MPH, MD
Assistant Professor, Medicine and Department of Environmental & Occupational Health Sciences, University of Washington

🖥 https://deohs.washington.edu/pnash/cannabis-worker-health-and-safety

Figure 2: Nursery worker tending to cannabis plants.

Challenge

Production and processing of cannabis is a rapidly growing industry in the US, however very limited information is available on the occupational hazards faced by workers in this industry. Recent pilot studies have demonstrated that cannabis production workers are exposed to a variety of respiratory hazards, have a high rate of work-related health symptoms, and may be at increased risk of occupational lung diseases, particularly work-related asthma. However, there is still significant uncertainty around the specific causes of work-related health symptoms in these workers.

Project Overview

In this project we will undertake a panel study of cannabis workers to investigate whether exposure to specific airborne contaminants released during cannabis production is associated with adverse health effects. In addition, we will evaluate the effectiveness of engineering control to reduce occupational exposure to respiratory hazards. Based on findings in this study, we aim to develop a guide describing best-practices and incorporate our study findings into worker health and safety training materials. This will help cannabis employers comply with applicable occupational health and safety regulations, and to reduce respiratory exposures within this industry.

Progress to Date

We received Institutional Review Board (IRB) approval to recruit workers in WA. We received legal clarification that we can recruit workers in Oregon and are now awaiting IRB approval to work in Oregon.

We have developed our protocols for collection of exposure measurements, questionnaire data and health measurements at the cannabis cultivation and processing facilities. We are also reaching out to employers directly, and through our collaborator – The Cannabis Alliance - to recruit worksites to participate in this study.

We met with the PNASH external science advisory board (ESAB) in May and toured a large cannabis cultivation and processing facility so that the ESAB could better appreciate the work processes and occupational health hazards associated with this industry. The ESAB provided helpful feedback to refine the research plan for this project.

Most of the supplies necessary for the health measurements have been purchased and we are currently optimizing health data collection methods. Finally, we have begun discussion with an industry partner who would supply an air cleaner to be used in a local exhaust ventilation (LEV) system to capture airborne contaminants from the shaker-box system

> With thousands of new employees entering the workforce each year, there is an urgent need for a better understanding of occupational health and safety within the cannabis industry.

that is commonly used to sort and separate cannabis flower.

Next Steps
We aim to begin fieldwork for this project in late fall of 2023. Field work, including exposure and health measurements, will continue for years 2-4.
We plan to conduct a focus group with cannabis workers later this year to 1) identify specific production process amenable to installation of a local exhaust ventilation (LEV) exposure control, and 2) identify barriers to implementation of an LEV, and solutions to those barriers. Installation and evaluation of the LEV intervention in select worksites will take place in years 2 and 3.

Partners and Collaborators
- The Cannabis Alliance (https://thecannabisalliance.us/)
- Skagit Organics (https://skagitorganics.net/)
- Inbio (https://inbio.com/)
- Think Happy Consulting (https://www.linkedin.com/company/think-happy-consulting-co/)

📄 Peer Reviewed Papers
- Sack C, Simpson C, Pacheco K. The Emerging Spectrum of Respiratory Diseases in the U.S. Cannabis Industry. Semin Respir Crit Care Med. 2023 Jun;44(3):405-414. doi: 10.1055/s-0043-1766116. Epub 2023 Apr 4. PMID: 37015286; PMCID: PMC10449032.
- Simpson, C.D. Occupational health and safety in the cannabis industry. 2020. Annals of Work Exposures and Health. 64(7):677–678. doi: 10.1093/annweh/wxaa068. PMID: 32696046; NIHMSID: NIHMS1856484; PMCID: PMC9769117.
- Silvey, B., Seto, E., Gipe, A., Ghodsian, N., and Simpson, C.D. Occupational Exposure to Particulate Matter and Volatile Organic Compounds in Indoor Cannabis Production Facilities. 2020. Annals of Work Exposures and Health. 64(7):715-727. doi: 10.1093/annweh/wxaa068. PMID: 32696065; PMCID. PMC7407603.
- Sack, C., Ghodsian, N., Jansen, K., Silvey, B., and Simpson, C.D. Allergic and Respiratory Symptoms in Employees of Indoor Cannabis Grow Facilities. 2020. Annals of Work Exposures and Health. 64(7):754–764. DOI: 10.1093/annweh/wxaa068. PMID: 32459852; PMCID: PMC7407609.

Engineering Solutions to Reduce Pesticide Exposure and Waste on Northwest Fruit Farms

YEAR 1 of 5 (2022-2027)
PI: Edward Kasner, PhD, MPH
Assistant Teaching Professor, Department of Environmental and Occupational Health Sciences, University of Washington
Lav Khot, PhD, MS,
Associate Professor, AgWeatherNet Director, College of Agricultural, Human, and Natural Resources Sciences, Washington State University

🌐 https://deohs.washington.edu/pnash/index.php/engineering-solutions-reduce-pesticide-exposure-and-waste-northwest-fruit-farms

Figure 3: Over-the-Row Canopy Sprayer, Vineyard Field Demonstration, May 2023, Photo Credit: Tania Vallejo, DEOHS Applied MS Student

Challenge

Labor-intensive fruit commodities can put farmworkers and their families at disproportionate risk of pesticide-related illness through pesticide handling, drift, or the take-home exposure pathways. Robots, drones, sensors, autonomous tractors, and other digital technology are quickly changing the landscape of agriculture, including claims related to reducing pesticide use. This work builds off prior work on pesticide application safety from two previous PNASH cycles.

Project Overview

This project focuses on capturing current and planned uses for these new technologies in the Pacific Northwest and center worker expertise and skills in the next generation of pesticide application safety personnel and technology.

Progress to Date

UW Graduate Research Assistant (Tania Vellejo) was hired during Spring 2023 to make progress on our aim to characterize the adoption of emerging application technologies among Northwest fruit growers and impacts on occupational safety and health. Tania completed a literature review of current pesticide application methods and developed a draft survey for fruit growers and pesticide applicators in Washington and Oregon. With the help of our WSU co-investigator (Gwen Hoheisel), we are updating the draft bilingual (English-Spanish) survey by incorporating results from two previous surveys of Washington growers about technology use and adoption.

Tania and another UW graduate student (Miguel Rojas-Flores) took a field trip to attend "Optimizing & Use of Canopy Sprayers in the Vineyard" in May 2023. Alongside vineyard owners, managers, and employees, the UW students attended the demonstration to understand which technologies exist to optimize coverage and increase data acquisition during spraying. This field day event taught proper calibration and optimization of sprayers and introduced best management practices (BMPs) for better spray coverage with technologies such as rate controllers, directed and/or over-the-row sprayers, intelligent sprayers, and adaptations to air-blast sprayers. The UW students spoke with several pesticide applicators in Spanish to gain their perspective on these technologies and see how sprayers operate.

> To address needs related to labor shortages and farm operation safety, growers are accelerating the implementation of automation technologies into their field operations.

Next Steps

This fall and spring we will hold check-in meetings with the full project team (University of Washington, Washington State University, and Oregon State University). The focus of these meetings will be on survey analysis and fieldwork planning. We plan to deploy our survey and begin data collection in the winter. We will be piloting the survey on a small group of collaborators in Washington and Oregon (n=10). The survey will be distributed digitally through stakeholder channels maintained by University Extension Programs and Departments of Agriculture in Washington and Oregon. Importantly, we will begin deploying the survey at winter events (annual tree fruit industry meetings and pesticide safety meetings) throughout Washington and Oregon. Lastly, we have onboarded one of two new Research Assistants. One undergraduate student, Nede Ovbiebo, will upload the bilingual survey into our database (REDCap) for deployment and then analyze responses qualitatively (Dedoose) and quantitatively (R) under the direct supervision of a graduate student and Eddie Kasner. The graduate student will be hired for the winter and spring quarters.

Partners and Collaborators

- Washington State University: Center for Precision & Automated Agricultural Systems (https://cpaas.wsu.edu/)
- Oregon State University: Intelligent Spray Application Technology Team (https://horticulture.oregonstate.edu/nursery/precision-spray-applications)
- Washington State Department of Agriculture: Technical Services and Education Program (https://agr.wa.gov/services/education-and-training/pesticide-technical-assistance-and-education)
- Washington State Tree Fruit Association (https://wstfa.org/)
- Agricultural Leadership Program (Washington)
- Innov8.Ag, Inc. (https://www.innov8.ag/)
- SmartGuided Systems (https://www.smartguided.com/)

Tracking Agriculture, Forestry, and Fishing Health Indicators: RISC 2.0

YEAR 1 of 5 (2022-2027)
PI: Viktor Bovbjerg, PhD, MPH
Professor, Oregon State University

Figure 4. Data dashboard in simulation.

🖥️ https://deohs.washington.edu/pnash/tracking-agriculture-forestry-and-fishing-health-indicators-risc-20

Challenge

The agriculture, forestry, and fishing sector has the highest-risk for any occupational sector identified by the United States Bureau of Labor Statistics. Non-fatal injuries and illnesses for this sector were estimated at 5.2 per 100 workers, well above that of the next highest sector, transportation and warehousing, at 4.4 per 100 workers. This project builds off prior work from the 2016-2022 PNASH cycle by expanding the Risk Information System for Commercial (RISC) Fishing data system, which merged multiple sources of injury and fatality data to facilitate the development of fishery-specific approaches to assess hazards, mediate risks, and evaluate interventions.

Project Overview

This tracking and monitoring project is planning to link data from both emergent systems (e.g. trauma, Emergency Medical Services) and longer-term care (e.g. workers' compensation) to create a database documenting injuries in agricultural, forestry, and fishing settings. The project will identify work settings and activities that are associated with injuries, describe the nature and severity of injuries, detail injury treatment, and characterize worker groups at greatest risk of injury. The project explicitly pairs surveillance activities with innovative data visualization approaches to promote rapid and scalable translation into practice.

Effective prevention and control require comprehensive surveillance, paired with active engagement and outreach.

Progress to Date

We have created a data analysis plan that follows the National Institutes of Health Data Management and Sharing Plan guidance, which was co-developed by DEOHS and PNASH personnel. We also created a draft dashboard using publicly-available data from the Bureau of Labor Statistics.
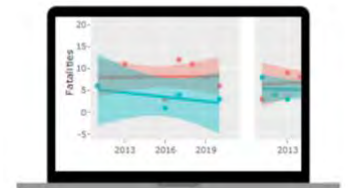
Next Steps

We will continue to manage the administrative setup for our project. We will also focus on establishing partnerships in Washington, Oregon, Idaho, and Alaska.

Partners and Collaborators

- NIOSH Western States Division in Alaska (https://www.cdc.gov/niosh/contact/im-wsd.html)
- Oregon Sea Grant (https://seagrant.oregonstate.edu/)
- Washington Sea Grant (https://wsg.washington.edu/)
- Washington State Department of Labor & Industries (https://www.lni.wa.gov/)

Fishermen Led Injury Prevention Program (FLIPP) for Lifejackets Mobile Program

YEAR 1 of 5 (2022-2027)
PI: Laurel Kincl, PhD, CSP
Professor and Associate Dean of Academic & Faculty Affairs,
College of Health, Oregon State University

🖥️ https://health.oregonstate.edu/labs/osh/resources/flipp#lifejackets

Figure 5: Ready to talk about lifejackets at Pacific Marine Expo in Seattle, WA.

Challenge

In commercial fishing, fatalities have occurred when those lost were not wearing a lifejacket. Commercial fishermen deaths have extended impacts on the coastal communities and families. Nationally, from 2000-2014, the most recent data published, there were 693 US commercial fishermen who died while fishing with vessel disasters with falls overboard accounting for the majority. From the most recent regional data available, 2000-2018, there were 93 fatalities in Washington and Oregon. Only five of the fatalities were wearing a lifejacket and three of those were not wearing it properly.

The success of the Lifejackets for Lobstermen program by the Northeast Center (NEC) for Occupational Health and Safety, which used a social marketing approach and a mobile program to get lifejackets to fishermen in Maine and Massachusetts, led to the development of FLIPP for Lifejackets to fill a need in the Pacific Northwest.

Project Overview

The objective of the FLIPP for Lifejackets project is to better understand the behavior of lifejacket use among commercial fishermen in Oregon and Washington and to promote the use by creating a mobile program for commercial fishermen that increases access to lifejackets that they will wear. We are collecting fishermen's views and experiences related to vessel safety including use of lifejackets and their stage of behavior change related to lifejacket use, adapting an evidence-based intervention to build a region-specific program, implementing, and evaluating the program, and comparing strategies. This project is using a social marketing approach (the 4 P's - Price, Product, Place, and Promotion) to get lifejackets to fishermen.

Recent technological advances in lifejackets address some of the barriers fishermen have to wearing them while working (comfort, accessibility, confidence in, etc.) and improve the flotation and survivability when worn.

Progress to Date

We completed 48 out of our goal of 50 interviews with commercial fishing stakeholders who were asked about their perceptions of lifejackets and for ideas related to the 4 P's of social marketing. Common responses included the following: 1) A variety of brands/designs with good potential for commercial fishermen exist or have existed. 2) What prevents fishermen from wearing one includes entanglement, bulk, feeling encumbered, feeling invincible so not needed, and cost. 3) What would make a fishermen consider wearing one included wearability/fit, knowledge, stormy/rough conditions and nighttime, captain enacting a policy, and witness of someone going overboard.

We collected 79 out of our goal of 100 fishermen state of change surveys from commercial fishermen in Oregon (n=32) and Washington (n=47). Data analysis is ongoing and will help us understand barriers to and perceptions of lifejacket use in the Pacific Northwest among commercial fishermen.

We created a database to track modifications as we develop our FLIPP for Lifejacket program based on input from stakeholders and fishermen.

We collaborated with the PNASH Outreach Core to draft graphics and materials to support the mobile program.

Figure 6: FLIPP for Lifejackets team members from UW and OSU at the Fishermen Safety Fair in Seattle, WA.

Next Steps

This Fall 2024, we will be hosting the first PFD advisory board meeting during the Pacific Marine Expo in Seattle, WA. This will be a joint meeting with NEC's PFD advisory board and will be run partly on Zoom and partly in person. This Fall we will also begin trialing 7 different styles of lifejackets with 40 fishermen in Oregon and Washington. Fishermen will wear a lifejacket assigned to them for a month while fishing and report back with their impressions. We will also be completing our remaining stakeholder and fishermen interviews and analyzing the data. We will continue to work with NEC to track modifications we are making based as finalize our plans for what the FLIPP for Lifejackets program is as well as how it will be implemented. These modifications will be based on stakeholder input and regional needs and will be compared with the approach used in New England with NEC. This will help us design and implement our mobile lifejacket program, tailored to the Pacific Northwest, sometime in 2024.

Partners and Collaborators

- Lifejacket manufacturers such as Mustang (https://mustangsurvival.com), Spinlock (https://www.spinlock.co.uk), Kent (https://www.kentsafetyproducts.com), Stormline (https://www.stormlinegear.com), Datrex (https://www.datrex.com), and Hero (https://www.herowaterwear.com).
- Marine retailers, like Englund Marine (https://www.englundmarine.com) and Fisheries Supply (https://www.fisheriessupply.com).
- Fishermen's support associations like the Deep Sea Fishermen Union (https://www.dsfu.org/), Mid Water Trawlers Cooperative (https://www.midwatertrawlers.org/), and Newport Fishermen's Wives.
- Tribal groups such as the Columbia River Inter Tribal Fisheries Commission (https://critfc.org/).
- Government agencies such as United States Coast Guard District 13, and both the Oregon and Washington Departments of Fish and Wildlife.
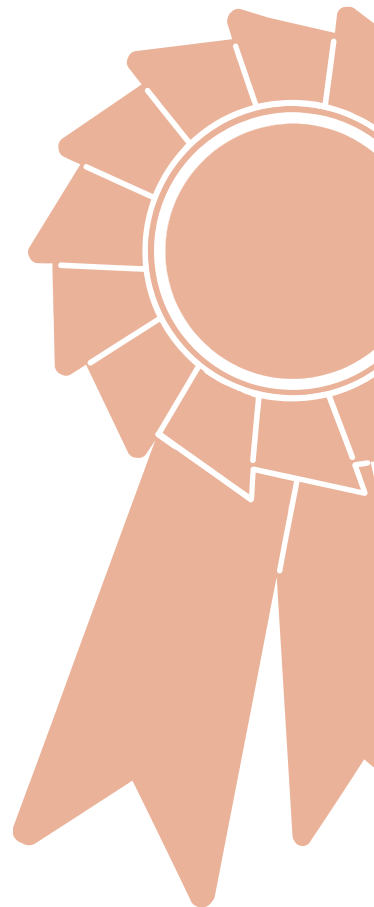- Northeast Center for Occupational Health and Safety (https://necenter.org/).

Awards

2023 Agricultural Safety Day in Kennewick, WA

PNASH Small Grant Programs

PNASH allocates funding annually to allow us to 1) foster new exploratory research, 2) support stakeholder's outreach and education activities, and 3) respond to emerging needs in our region.

Pilot Project Program (PPP)

The PNASH Center administers the PPP to support new initiatives in research, intervention, and translation. The PPP will fund projects in Years 1 through 5 through a competitive process for a maximum annual direct cost allocation up to $30,000 and a project duration of 12 months. The PPP participates in the Center-wide program monitoring, tracking progress, activities, and products. Previous awardees have contributed greatly to the success of the PNASH Center through the development of new partnerships, scientific publication, and career development of young investigators. This year, one of our previous PPP awardees was offered a full-time faculty position at UC Berkeley and a second was awarded a NIH K-99 award. Visit our website for more information: https://deohs.washington.edu/pnash/pilot23.

Karie Boone, Applied Social Scientist, Center for Sustaining Agriculture and Natural Resources, Washington State University. **Planning for the "new normal": assessing service organizations' climate-related impacts and resiliency to support farmworkers.** Climate-related environmental hazards, including successive high-heat days and poor air quality from wildfire smoke, are projected to continue and worsen, increasing occupational risks for farmworkers in Central Washington. Farmworker support agencies are facing related training and resource provision needs while filling associated support gaps. This project will (a) identify opportunities to better prepare support entities for identified impacts, (b) co-develop a roadmap for advancing climate resilience for farmworkers, and (c) convene entities currently working independently on related topics to explore collaboration opportunities.

John Flunker, Postdoctoral Scholar, University of Washington. **Developing a harmonized method to refine estimates of spatiotemporal variation crop worker exposures to heat and wildfire smoke in rural agricultural regions: Case study among H-2A foreign visa worker applications.** This project seeks to refine spatial and temporal estimates of wildfire smoke, heat, and dual exposure among region X crop workers. This project will estimate and compare the burden of exposure (worker days at risk) to wildfire smoke (WFS), heat, and dual exposure among crop worker groups. Spatial variability will be accounted for at a more refined level than the county level via validated modeled WFS and heat exposure data linked to H2A application data and Bureau of Labor Statistics (BLS) worker counts per crop worker group. Through researcher and stakeholder driven products, the project will address the mission of the PNASH Center to engage agricultural stakeholders to conduct research and promote best practices as well as meet NIOSH NORA AFF and respiratory health goals.

Leslie Hammer, Professor, Co-Director, Oregon Healthy Workforce Center, Associate Director of Applied Research, Oregon Institute of Occupational Health Sciences, Oregon Health & Science University. **Evaluation of the Oregon Overtime Pay Legislation (HB-4002) among Latine Agricultural Workers.** This proposal seeks to evaluate the impact of the new Oregon overtime law on farmworkers' work experiences (e.g., wage theft; work overload; stress; job insecurity) and well-being, including mental health. Oregon passed HB 4002 in 2022, which began its 5-year phase-in to provide overtime pay to agricultural workers starting in January, 2023. Although much is known about the impacts of consistently working overtime and/or low pay on physical health, mental health, sleep, and mortality, little is known about the experiences of farmworkers and their families in reference to working overtime, and, to our knowledge, no work has considered the impact or effectiveness of state-level overtime legislation on farmworkers' work experiences, mental health and wellbeing.

Julie Postma, Professor, Associate Dean for Research, College of Nursing, Washington State University. **Smoke hazards in the Agricultural Workplace; a bilingual survey for agricultural employers.** Agricultural workers are exposed to fine particulate matter from wildfire smoke given the nature of their work. The purpose of the proposed study is to explore and compare perceptions of AQ monitoring, health impacts, and hazard communication strategies among Spanish and English-speaking agricultural employers and employees. Findings from our bilingual survey will be disseminated through peer-reviewed journals, conferences, and industry stakeholders.

Outreach Mini-Grants

The Outreach Mini-Grant Program is a new funding opportunity intended to support stakeholder activities dedicated to promoting workplace health and safety among underserved populations. The Outreach Mini-Grant program has $15,000 available for small projects between $2,000 and $7,500 direct costs. The next call for proposals will be announced in Spring 2024. Visit our website for more information: https://deohs.washington.edu/pnash/mini-grants

- **Pineros y Campesinos Unidos del Noroeste** (PCUN) in Oregon received funding to disseminate a new resource to help Spanish-speaking forestry and farmworkers understand their rights and changes in heat and smoke rules.
- **Washington Grower's League** received funding to disseminate ¡Basta! Toolkit, deliver training for trainers, and develop an instructional video and legal perspectives video.
- **Alaska Marine Safety Education Association** (AMSEA) received funding to distribute personal floatation devices and safety education with Unalakleet Setnet fishermen.
- **Washington State University** received funding to administer a survey to understand wildfire smoke safety practices and training needs with Spanish-speaking workers.
- **Northwest Justice Project** in Washington received funding to print and disseminate calendars with health and safety information for Spanish-speaking farmworkers.
- **Reed Company, Inc.** in Oregon received funding to purchase logging first aid kits.

Emerging Issues Fund

This fund is dedicated to addressing new or timely safety issues and priorities raised by agricultural stakeholders in our region and developing new partnerships. 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.

Edward Kasner, PhD, Assistant Teaching Professor, University of Washington. **Best Practices for Working in the Heat: Updating AgWeatherNet's (AWN) Web Portal to Reflect Current Science and to Align with Washington State's New Outdoor Heat Exposure Rules** ($9,799). This project seeks to create an updated bilingual AWN web portal with information on local weather conditions to help agricultural employers and workers plan work activities to reduce heat stress in accordance with the new Washington State outdoor heat exposure rules. The team will develop heat illness prevention materials using the Heat Toolkit and disseminate them in an outreach campaign. WSU's AgWeatherNet: https://weather.wsu.edu/

John Flunker, Postdoctoral Scholar, University of Washington. **Characterizing the H-2A and H-2B foreign visa workforce in Northwest AgFF: Spatiotemporal trends in worker distributions within and among industries and occupations** ($8,000). This project will develop a database and evaluate workforce trends for 2008-2022 AgFF foreign labor (H-2A and H-2B guest workers) using US Department of Labor publicly available data. The team will develop a database, analyze job and housing characteristics for H-2A and H-2B workers in forestry and fishing for 2008-2022, assess spatiotemporal variation in environmental exposures, such as extreme heat and wildfire smoke, and develop a dashboard to identify opportunities for future research or education activities.

Julie Postma, PhD, Assistant Professor, Washington State University. **Smoke Hazards in the Agricultural Workplace: Survey Translation** ($4,883). This project seeks to conduct a survey to assess smoke hazards in the agricultural workplace. The purpose of the survey is to determine the perspectives of agricultural employers on the source, understanding, adoption, and communication of AQI readings and hazardous work conditions. The survey is currently limited to responses by English language speakers. This project will make the survey available to Spanish speakers to help us identify best practices to enhance smoke safety for the agricultural workforce.

Marcy Harrington, Research Coordinator and PNASH Evaluation Lead, University of Washington. **Bilingual Pesticide Labels and Hazard Communications for Forestry Services** ($12,500). In response to an industry request, this project seeks to address the need for Spanish language pesticide labels and safety solutions in the forestry services industry. This project

will translate commonly used pesticides in forestry services in the PNASH PestiSeguro app and evaluate the app in collaboration with Ramos Reforestation, Port Blakely, WSU forestry extension, Oregon forestry extension, and Assoc. Oregon Loggers' new forestry services branch. The team will also be hosting and evaluating training with forestry service workers to assess knowledge gain and adoption of practical solutions.

New PNASH-Related Awards

PNASH researchers received outside funding for additional projects.

Edward Kasner, PhD, Assistant Teaching Professor, University of Washington. **Washington State Department of Labor & Industries SHIP Grant: Integrating Air Quality Sensors in AgWeatherNet.** PNASH is partnering with Washington State University (WSU) and the Washington State Tree Fruit Association on this project that aims to improve the air quality monitoring for worker safety through integration of particulate matter (PM)2.5, PM10, O3, and CO2 sensors on WSU AgWeatherNet (AWN) managed weather stations.

June T. Spector, MD, MPH, Associate Professor, Department of Environmental and Occupational Health Sciences Assistant Professor, Seattle School of Public Health, University of Washington. **University of Washington EarthLab Innovation Grant: A Collaborative Approach Preparing and Protecting At-Risk Communities from the Impacts of Climate Change in North-Central Washington.** In partnership with Wenatchee CAFE, this project proposes to bring together community leaders and stakeholders in north-central Washington to form a Community and Climate Impact Hub for collaboration and the intention of developing a cohesive and consistent group that will outlast this funding cycle. This group will collaborate to co-develop a toolkit for strengthening community engagement and improving access to and content of heat and smoke related climate impact messaging in Chelan, Okanogan, Grant and Douglas counties.

Cores

2023 Council on Forest Engineering logging field visit in Lebanon, OR

Evaluation and Planning Core

YEAR 1 of 5 (2022-2027)
PI: Michael Yost, PhD, MS
Professor and Chair, Department of Environmental and Occupational Health Sciences, University of Washington

🖥 https://deohs.washington.edu/pnash/blog/new-federal-grant-improve-northwest-agricultural-safety-and-health

Background

The Planning and Evaluation (E&P) Core provides the infrastructure and support for the entire Center, conducts strategic planning, and assists in implementing and evaluating individual project and program objectives. Our new 5-year cycle began in October 2023, launching new research activities and engagement across all three AgFF industries.
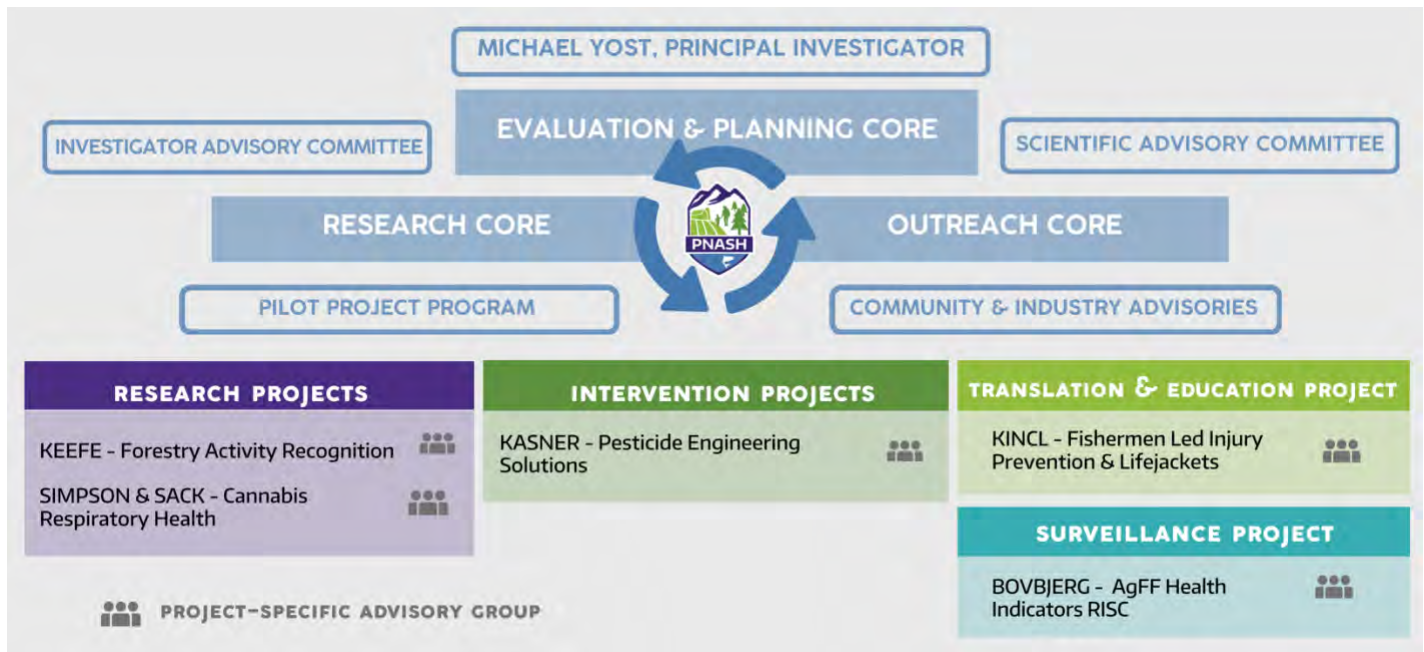
Overview

Aim 1. Leadership & Management
The E&P Core manages and facilitates Center operations, building capacity and sustaining our relationships and service. Including: institutional and partner relationships; mentorship and human resources; grant management and development; protocol assurance; record keeping and reporting; providing appropriate and adequate organization, expertise, and infrastructure for the conduct and integration of research, outreach, and education activities.

Aim 2. Strategic Planning
Engaging in strategic planning with PNASH projects, programs and advisories. Facilitating balanced participation of diverse populations and harmonized assessment questions to frame and forecast future needs. Annual assessments led by Evaluation Program will connect these qualitative stakeholder needs assessments with quantitative evidence from our original research and our AgFF Health Indicators program. Emerging Issues and Pilot Projects play an essential role in this planning, scanning stakeholder needs and testing the feasibility of new proposed approaches and solutions.

Aim 3. Emerging Issues Fund
Through PNASH's Emerging Issues Fund we can take rapid action to address an emergent issue or cultivate a developing partnership. E&P Core administers the Fund on an annual basis, soliciting, reviewing, and awarding small projects and funds to respond to emerging issues that fall outside the scope of currently funded PNASH work. The Fund allocates up to $50,000

direct costs per year, with $10,000 dedicated to Outreach Mini-grants available to regional businesses and service organizations to launch implementation projects based on PNASH-developed programs.

Aim 4. Evaluation Program

Ensures that our efforts are relevant, feasible, and sustainable; that they reflect the best science and practice; and that they are consistent with our ultimate goal of reducing exposures, injuries and illness. Aims and methods reflect our Center goals and logic model framework and those framed for each program and project.

Progress to Date

Leadership & Management

In August 2023, Paulina Osinska joined PNASH as the new program manager for the Center. She has a Master's degree in Public Health from the University of Illinois at Chicago. She has worked in project management and research in areas like patient safety, quality improvement, perinatal health, and violence prevention. She has been at UW for almost eight years, most recently managing a national center on improving communication with patients after medical injury.

Strategic Planning

We recognize that collaboration in academia happens by creating space and platforms for our faculty and students to come together and foster new ideas. This past year, the PNASH Center was involved in conferences that served as space for collaboration, presentation, and discussion.

Our Ag Health Indicators program conducted regular surveillance activities while building new data repositories and visualization systems. Drs. Austin and Kasner mentor our faculty and students in data indicators and visualizations. In year 1 of the cycle, we drafted two data dashboards for AgFF fatalities and Washington workers compensation injury and fatality data. The dashboards use publicly available data and are developed in R and R-Shiny. The dashboard tools are intended for use by our stakeholder advisories.

Emerging Issues Fund

Updates on the Emerging Issues Fund can be found in the PNASH Small Grants Programs section on page 17.

Evaluation Program

PNASH's evaluation program moves beyond traditional program monitoring, using a developmental approach to assist project teams in improving efficacy and outcomes. In meetings with project teams, we assessed impact opportunities, areas where there is an emerging need and a target audience for a health or safety intervention. In addition, in year 1 we conducted an outcome evaluation of our new continuing education course series, which had live and asynchronous sessions. A combination of in-course testing and personal interviews demonstrated an overall appreciation for the courses, learning gains, and intention by participants to integrate the resources into their regular training. It also revealed system improvement needs, such as simultaneous translation during the live sessions.

Next Steps

Collaboration with our advisories and stakeholders will continue throughout the cycle. The E&P Core will lead a strategic plan and needs assessment review at the beginning of year 2, as well as developmental evaluation for each project. We will begin an internal review of our Ag Health Indicators program in the year 2. Finally, in partnership with the Western Center for Agricultural Health and Safety, we will plan a Western Regional AgFF Safety and Health Conference to be held 2024.

Partners and Collaborators

- PNASH Investigator Advisory Committee (IAC): https://deohs.washington.edu/pnash/directory/project-officers
- PNASH Scientific Advisory Committee (SAC): https://deohs.washington.edu/pnash/directory/advisors
- NIOSH Agriculture, Forestry, and Fishing (AgFF) Program: https://www.cdc.gov/niosh/programs/agff/default.html
- NIOSH Ag Centers: https://www.cdc.gov/niosh/oep/agctrhom.html
- NIOSH Ag Center Evaluators, Coordinator and Outreach (ECO) Group

- NIOSH's NORA: https://www.cdc.gov/nora/default.html
- Association of University Programs for Occupational Health and Safety (AUPOHS)

⚒ Resources

- FY 2022 PNASH Year-end Report (washington.edu)
- Repository for PNW Agricultural Health Indicator Program: Data sources and analysis code

Event Highlights

NIOSH Ag Centers Marshfield Meeting,
9/20-9/21/2023

Outreach and Education Core

YEAR 1 of 5 (2022-2027)
PI: Edward Kasner, PhD, MPH
Assistant Teaching Professor, Department of Environmental and Occupational Health Sciences, University of Washington

🖥️ https://deohs.washington.edu/pnash/resources

Background

The Outreach Core is the Center's foundation for building relationships and sharing information with agricultural communities. The Outreach Core builds partnerships with regional stakeholders to co-develop resources that improve the health and safety of workers and their employers in farming, fishing, and forestry. In the new cycle, this Outreach Core focused on supporting advisory activities, attending regional events, and developing and promoting resources to promote research findings from PNASH projects from the previous cycle.

Dennise Drury   Sarah Fish   Pablo Palmández   Idanis Cruz

Maria Blancas   Marcy Harrington   Amelia Vaughan   Maria Tchong-French   Elizabeth Torres

Ilsa Olsen   John Garland   Judy Lysiak   Paulina Osinska

Overview

The Outreach Core is the Center's foundation for building relationships and sharing information with agricultural communities. It is organized into committees to help us achieve our first three aims: needs assessment, research and language translation, and communications. The fourth aim centers on the need for our researchers to be present in and responsive to the communities we serve.

1. Identify key needs in farming, fishing, and forestry, and set research priorities to understand the safety challenges and develop solutions.
2. Translate research findings into practical guidance and safety tools in collaboration with agricultural stakeholders.
3. Create accessible, effective, and culturally-tailored communications to promote research findings and safety resources.
4. Participate in regional and national efforts to improve the health and safety of farming, fishing, and forestry workers and their communities.
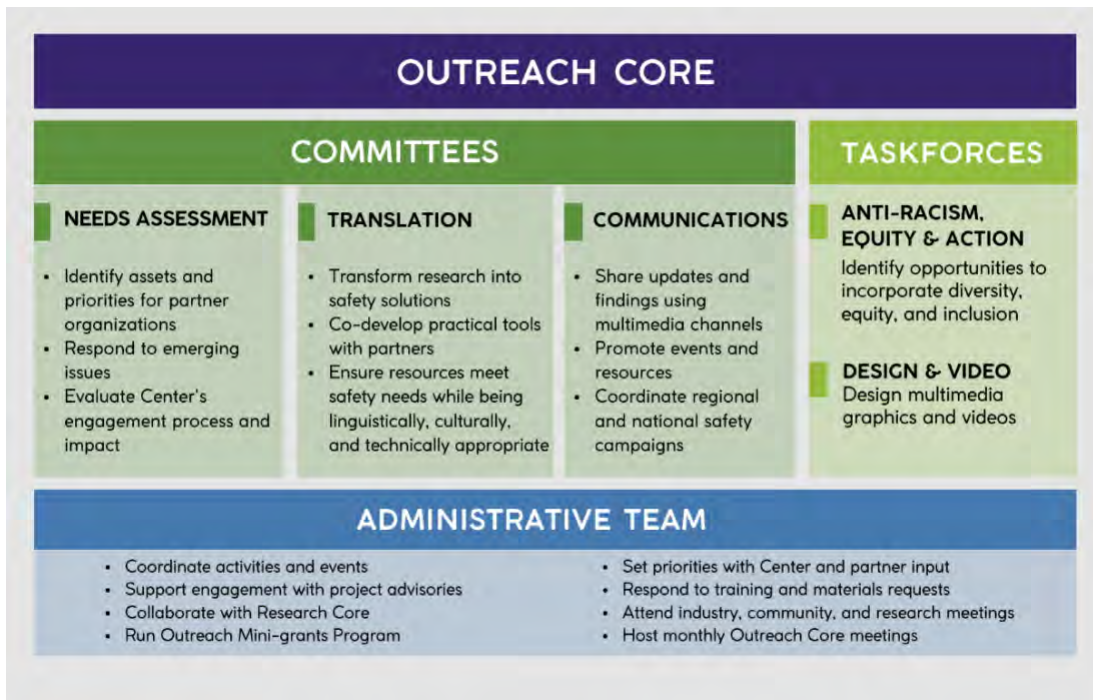
Progress to Date

The Outreach Core partners with regional stakeholders to develop, evaluate, and disseminate best practices, new technology, and health and safety resources built from our research.

Aim 1. Identify Regional Needs
- Conducted 2-needs assessment with agricultural employers and workers at Ag Safety Day: 1) gain insight on farmworkers' acclimatization practices to develop messages for the Heat Toolkit and 2) understand employers' practices and safety needs regarding infection prevention and control with the Center for One Health Research
- The Forestry Worker's Group developed 2-year outreach plan to: 1) enhance worker safety presence at the Council of Forestry Engineering (COFE) in January 2024, 2) develop safety resources based on industry priorities, and 3) translate commonly used pesticide labels on the PestiSeguro app
- Attended listening sessions with the Wenatchee Cafe and the UW Community and Climate Impact HUB team to learn about wildfire communication and resource needs for agricultural communities in Washington State

Aim 2. Co-develop Resources with Agricultural Communities
- Supported the development of 2 new resources for the Heat Toolkit:
  - Heat Acclimatization training module with recommendations for modifying work activities to allow workers to adjust to working in the heat
  - Best Practices for Preventing Heat Illness poster that communicates changes in the Outdoor Heat Rule in Oregon and Washington
- Developed the Be Smoke Ready magnet to share information on the health impacts of wildfire smoke and recommendations for smoke exposure for agricultural families

Aim 3. Communicate with Agricultural Communities
- Developed a new webpage to host 9 training modules in the Dairy Safety Toolkit
- Published a new Cannabis Safety resource page to highlight research and resources
- Created new webpages for the 5 new NIOSH-funded research projects
- The PNASH website had a total of 34,435 views, 12,630 users, and 3,983 downloads from September 29, 2022 to July 5, 2023

Aim 4. Engage with Regional and National Stakeholders

- Awarded 85 scholarships to agricultural employers, managers, trainers, and community health educators for the PNASH On-demand courses: Safety Solutions in Agriculture
- Supported the evaluation of the new Agricultural Leadership Program developed by the Washington State Tree Fruit Association, Washington State Department of Agriculture, and Washington State University
- Coordinated radio presence for Washington Ag Safety Days to: 1) create radio advertisements to enhance participation and 2) invite Radio KDNA to host a live program and interview event participants
- Awarded 4 Outreach Mini-Grants to support stakeholder initiatives to promote worker safety (for more information, see page 17).

Next Steps

The Outreach Core will support engagement and educational activities. In the coming year, emphasis will be placed on supporting advisory activities for fishing and forestry stakeholders. In Spring 2024, we will also host a child safety workshop in collaboration with the National Children's Center for Rural and Agricultural Health and Safety. We will also expand our regional presence to support engagement activities with farming, fishing, and forestry in Oregon and Idaho.

Partners and Collaborators

The Outreach Core works in partnership with agricultural stakeholders and research teams to identify and respond to regional health and safety needs. The Needs Assessment Committee leads the engagement in regional advisories with agricultural workers and employers, community organizations, academics, and agencies.

Partnership for Ag Safety and Health
This partnership was established to identify educational needs of agricultural workers and collaborate to develop resources. Partners include the WA Department of Labor and Industries (WA L&I), WA Department of Health, WA Grower's League, Yakima Health District, UW Health Promotion Research Center, UW Center for One Health Research, El Proyecto Bienestar, Radio KDNA, and other community organizations.

Ag Safety Day Planning Committee
This group organizes the largest health and safety training events in Washington by bringing together industry, agency, and academic partners to develop sessions responsive to current health and safety needs in farming. Committee members include WA Dept. of Labor and Industries, WA Dept. of Agriculture, WA Farm Bureau, WA Potato Commission, Yakima Valley OIC, and local growers.

El Proyecto Bienestar – Farmworker Advisory Group
This long-standing community-based partnership focuses on agricultural workers environmental and occupational health issues. Partners include: the PNASH Center, Northwest Communities Education Center/Radio KDNA, Heritage University, Yakima Valley Farm Workers Clinic, and members of the Yakima Valley agricultural community.

Risk Information System for Commercial Fishing Technical Advisory Board (RISC TAB)
An ad hoc RISC TAB has started to form and provide recommendations to the study team about the development and visualization of a regional surveillance system. The RISC TAB stakeholders include state agencies, commercial fishers, occupational safety and health researchers, and practitioners in the states of Alaska, Idaho, Oregon and Washington.

Forestry Working Group
The Forestry Safety Working Group (FSWG), is a standing advisory with a goal to develop new project directions and resources for the Northwest related to logging and forestry services. The FWG's goals include initiating small education projects and conducting needs assessments. Participants include UW School of Forestry, Associated Contract Loggers of Idaho, Associated Oregon Loggers, OSU School of Forestry, Washington State Dept. of Labor and Industries, Washington State Dept. of Natural Resources, Gahlsdorf Logging, and University of Idaho College of Forest and Rangeland Sciences.

⚒ Resources

- Heat Toolkit https://deohs.washington.edu/pnash/heat-toolkit
- Dairy Safety Toolkit https://deohs.washington.edu/pnash/dairysafetytoolkit
- Wildfire Smoke Safety https://deohs.washington.edu/pnash/wildfiresmoke
- Fishing Safety https://deohs.washington.edu/pnash/fishing-safety
- Northwest Forest Worker Safety https://deohs.washington.edu/pnash/forest_safety
- Cannabis Worker Health and Safety https://deohs.washington.edu/pnash/cannabis-worker-health-and-safety
- PNASH searchable Resource database https://deohs.washington.edu/pnash/resources

Regional Event Participation Highlights

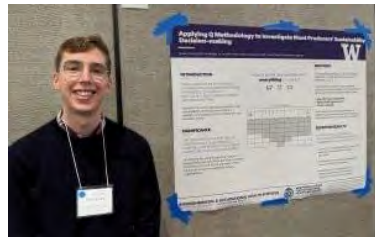OR Forestry Operations Visit, 10/4/2022

Council on Forest Engineering 10/4-10/7/2022

Pacific Marine Expo 11/17/2022

WA Dairy Federation Conference 12/5-12/7/2023

Cascadia Annual Symposium 1/5-1/6/2023

WA Ag Safety Days 2/1 & 2/22/2023

Cannabis Grow Facility Tour 5/1/2023

Seattle Fishermen's Memorial 5/7/2023

WA Promotores Network 5/29-5/31/2023

Agricultural Leadership Program 7/26/2023

Community & Climate Impact Hub 8/23/2023

Governor's Safety Conference 9/27-9/28/2023

Supporting Students

The PNASH Center is fortunate to have talented and passionate students involved in our research every year. We want to express our gratitude to these students and recognize their academic achievements, inspiring stories, and professional accomplishments. PNASH coordinates with multiple training and pathway programs for student support and research funding to work with PNASH projects. Our student support includes meaningful student internships.

2023 Graduates

Diana Marquez, MS, Occupational Hygiene
Diana completed her work in the Occupational Hygiene Track, March of 2023. She is now an industrial hygiene compliance officer with WA State Department of Labor and Industries. Read more about her experience, work and motivation to build safe and healthy workplaces.

Isabel Nerenberg, MS, Environmental Public Health
Isabel's research in Environmental Public Health focused on how planned relocation impacted the well-being of coastal communities. Similarly, she studied the impact of wildfire smoke on farmworker families in Eastern Washington. Isabel plans to continue working in environmental health after graduation. Isabel is a recipient of the Castner Endowed Student Research Fund.

Emelin Delgado, BS, Medical Anthropology & Global Health
Emelin's undergraduate research focused on H-2A agricultural worker housing and crowding among the Region X states. After graduation, she plans to work at Seattle Children's Hospital while she prepares to apply to medical school. She is the recipient of the Undergraduate Research Symposium Population Health Recognition Award and the Washington Apple Education Foundation Scholarship (2020-2023).

New Students

Miguel Rojas-Flores, Master Student, Public Health
Miguel's research project is assessing behavior change for the Agricultural Leadership Program, a program developed and hosted by the WA State Department of Agriculture, the WA Tree Fruit Association, and WSU. Surveys would be conducted in focus groups to measure behavior change and analyzed to create recommendations for the Agricultural Leadership Program. Miguel is the recipient of WICHE's Western Regional Graduate Program.

Continuing Students

Erica Chavez Santos, MPH, PhD Candidate, Health Systems and Population Health
Erica's dissertation is a mixed-method study focused on labor and social determinant-related laws that impact agricultural workers and how those laws are associated with agricultural worker health. Erica is the recipient of multiple awards and honors, including the UW Harry Bridges Center for Labor Studies, LERA-Bassett Scholarship in Labor Relations (2019) and WA State Labor Research Grant (2022-2023).

Allison Clonch, MPH, PhD Student, Environmental and Occupational Health Sciences
Ally is a second-year PhD student. She has contributed to PNASH research in logging and log trucking safety and analyzing guest-worker demographic data. Ally's dissertation will focus on assessing experiences of gender-based violence and harassment and their impact on mental health among U.S. mariners.

Solaiman (Abeer) Doza, MPH, PhD Candidate, Environmental and Occupational Health, Oregon State University
Abeer's current research at Oregon State University draws from the Risk Information System for Commercial (RISC) Fishing, Ag and Forestry injury datasets and several national surveillance data sources in the United States to estimate injury risk and risk factors. Through this effort, he is building skills in data analysis and hazard assessment to help inform prevention efforts.

Tania V. Vellejo Quiroga, Master Student, Environmental and Occupational Health Sciences
Tania is currently collaborating with PNASH project, "Engineering Solutions to Reduce Pesticide Exposure and Waste on Northwest Fruit Farms." This project aims to explore new spraying technologies that benefit the fruit-growing communities of the region in terms of exposure and efficiency. She is the recipient of the Warren A. Cook AIHA Past Presidents Scholarship (2022).

Mei Fang Wu, BS Student, Global Public Health
Mei has a strong interest in exploring the intersectionality of public health and data science. She enjoys working with data and

is particularly interested in data visualization and analysis. Mei believes the insights gained through analyzing various datasets will help identify patterns and inform public health interventions. These informed public health interventions will make a real difference in people's lives. She is the recipient of the Double Eagle Endowed II Scholarship.

Simran Gupta, BS Student, Public Health & Global Health Informatics

Simran hopes to continue research that bridges her love for tech and science. This summer, she will study abroad in London for a month, focusing on racial health disparities. In the future, she hopes to work with health informatics toward accommodating various patients' needs to close the gap in healthcare disparities.

Community-Engaged Learning & Research with UW Bothell

During the Spring Quarter 2023, PNASH hosted two graduating senior interns from UW Bothell. They contributed to our social media messaging for the logging and forestry industry.

Lauren Allen, BS, Health Studies

Lauren wrote a blog post about Lyme disease and tick safety (Tip: watch out for the black-legged tick!). In the future, Lauren would like to work in public health and earn her master's degree.

Diyana Abraha, BS, Health Studies

Diyana's internship project centered on promoting Spanish language safety tools for forestry workers. After graduation, she is looking forward

PNASH in the News

Peter Rabinowitz, MD MPH, UW DEOHS PROFESSOR AND DIRECTOR OF CENTER OF ONE HEALTH RESEARCH.

Wood, Alden. "UW, Stanford Launch Resource to Help Health Care Professionals Respond to Climate Concerns." *UW News*, School of Public Health, University of Washington, 5 September 2023, http://www.washington.edu/news/2023/09/05/uw-stanford-launch-resource-to-help-heath-care-professionals-respond-to-climate-concerns/.

UW DEOHS ASSISTANT PROFESSOR, Elena Austin, DSc, MS and DEOHS CLINICAL ASSISTANT PROFESSOR, Christopher Zuidema, PhD, CIH

Weinberger, Hannah, and Farah Eltohamy. "What WA's New Wildfire Smoke Rules Might Mean for Outdoor Workers." *Crosscut*, 2 August 2023, http://www.crosscut.com/investigations/2023/08/what-was-new-wildfire-smoke-rules-might-mean-outdoor-workers.

UW DEOHS PROFESSOR AND PNASH CENTER DEPUTY DIRECTOR, Christopher Simpson, PhD, MSc

Johnson, Gene. "Washington Legal Pot Farms Get Back to Work after Pesticide Concerns Halted Operations." *APNews*, 15 July 2023, http://www.apnews.com/article/washington-marijuana-pesticide-ddtdde-f5e5187d5248dca434956a67eb084df6.

OSU COLLEGE OF PUBLIC HEALTH AND HUMAN SCIENCES, Laurel Kincl, PhD, Associate Professor

Sadiq, Sheraz. "Oregon State University program aims to reduce injury and boost safety in commercial fisheries." *Oregon Public Broadcast (OPB)*, 17 May, 2023, https://www.opb.org/article/2023/05/17/oregon-state-university-program-aims-to-reduce-injury-and-boost-safety-in-commercial-fisheries/.

UW DEOHS POSTDOCTORAL FELLOW, Savannah D'Evelyn, PhD

"Ready for Wildfire Season? Here's How Bad This Year's Season Could Be across the West." *KomoNews*, 14 May 2023, http://www.komonews.com/news/local/how-bad-will-2023-western-united-states-wildfire-be-fire-season-risk-drought-climate-environment-rain-snowpack-meteorology-smoky-skies-air-quality-forests-firefighters-smoke-jumpers-washington-oregon-idaho-utah-nevada-montana-california.

ALASKA MARINE SAFETY EDUCATION ASSOCIATION

Fish, Sarah. "Alaska Native Salmon Set Gillnetters in Norton Sound Brave Fierce Conditions." Fishermen's News, May 2023, Vol. 79, No. 05, pgs. 34-35. ISSN 0015-2994. http://www.fishermensnews.com/.

UW DEOHS POSTDOCTORAL FELLOW, Savannah D'Evelyn, PhD

Bejarano, Johanna. "Study: Farmworking Parents Need More Resources to Cope with Wildfire Seasons." *Northwest Public Broadcasting*, 31 March 2023, http://www.nwpb.org/2023/03/31/study-farmworking-parents-need-more-resources-to-cope-with-wildfire-seasons/.

UW DEOHS ASSISTANT PROFESSOR, Jennifer Otten, PhD, MS, RD

Takahama, Elise. "Food Insecurity Persists in WA, Just as Emergency Benefits Expire." *The Seattle Times*, 28 February 2023, http://www.seattletimes.com/seattle-news/health/food-insecurity-persists-in-wa-as-emergency-snap-benefits-run-out-this-week/.

UW DEOHS ASSISTANT PROFESSOR, Elena Austin, DSc, MS

Bejarano, Johanna. "Farmworkers Don't Always Notice Their Own Mental Health Struggles." *Northwest Public Broadcasting*, Edward R. Murrow College of Communication at Washington State University, 22 February 2023, http://www.nwpb.org/2023/02/22/farmworkers-dont-always-notice-their-own-mental-health-struggles/.

OSU OCCUPATIONAL ERGONOMICS AND BIOMECHANICS RESEARCH LABORATORY
"Commercially Fishing for Crab: Bang or Not? And How Best to Bang?" Fishermen's News, February 2023, Vol. 79, No. 02, pgs. 22-23. ISSN 0015-2994. www.fishermensnews.com.

ALASKA MARINE SAFETY EDUCATION ASSOCIATION, Jerry Dzugan, AND OSU COLLEGE OF HEALTH, Amelia Vaughan, MLIS.
Hall, Sarah. "Preparing Your Boat, Crew for the Upcoming Commercial Fishing Season." Fishermen's News, February 2023, Vol. 79, No. 02, pgs. 24-28. ISSN 0015-2994. www.fishermensnews.com.

ALASKA MARINE SAFETY EDUCATION ASSOCIATION
"Fishing as a Contact Sport." Fishermen's News, February 2023, Vol. 79, No. 02, pgs. 34-35. ISSN 0015-2994. www.fishermensnews.com.

OSU COLLEGE OF HEALTH, ENVIORNMENTAL EXPOSURE AND BIOMARKERS, Amelia Vaughan, MLIS
"Slips, Trips & Falls: Don't Fall for It." Fishermensnews.com, 29 December, 2022, www.fishermensnews.com/article/slips-trips-falls-dont-fall-for-it/.

UW DEOHS AND SCHOOL OF MEDICINE PROFESSOR, CATHERINE KARR, MD, PhD
Ajasa, Amudalat. "Young Kids Who Breathe Polluted Air Can Fall behind in School, Study Finds." The Washington Post, WP Company, 30 November 2022, http://www.washingtonpost.com/climate-environment/2022/11/30/air-pollutants-poverty-childhood-development/.

UW DEOHS ASSISTANT PROFESSOR, Diana Ceballos, PhD, MS, CIH
Menger-Ogle, Lauren, et al. "Protecting Temporary Workers: Best Practices for Host Employers." Centers for Disease Control and Prevention, 28 November 2022, https://blogs.cdc.gov/niosh-science-blog/2022/11/28/temporary-workers-best-practices/.

UW DEOHS ASSISTANT PROFESSOR, Elena Austin, DSc, MS
Hassanein, Nada. "Black Saliva, Sore Throat, Shortness of Breath: How Dangerous Is Wildfire Season for US Farmworkers?" USA Today, Gannett Satellite Information Network, 10 October 2022, http://www.usatoday.com/story/news/health/2022/10/10/farmworkers-health-risks-wildfire-season/9705243002/.

PNASH-Related Research Publications (2022-2023)

CANNABIS

Sack C, Simpson C, Pacheco K. The Emerging Spectrum of Respiratory Diseases in the U.S. Cannabis Industry. Semin Respir Crit Care Med. 2023 Jun;44(3):405-414. doi: 10.1055/s-0043-1766116. Epub 2023 Apr 4. PMID: 37015286; PMCID: PMC10449032.

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Carmona J, deMarcken, Trinh P, Frisbie L, Ramirez V, Palmandex P, Vedal S, Sack C, and Rabinowitz P. A Cross Sectional Study of Respiratory and Allergy Status in Dairy Workers. Journal of Agromedicine, 2023 Feb 06. DOI: 10.1080/1059924X.2023.2171522.

FISHING

Doza S, Bovbjerg V, Case S, Vaughan A, Kincl L. Utilizing Haddon matrix to assess nonfatal commercial fishing injury factors in Oregon and Washington. Inj Epidemiol. 2023 Mar 24;10(1):18. doi: 10.1186/s40621-023-00428-7. PMID: 36964638; PMCID: PMC10037792.

Kincl L, Doza S, Nahorniak J, Case S, Vaughan A, Bovbjerg V. Commercial Fishing Fatalities and Injuries Described by Linked Vessel Incidents. J Agromedicine. 2023 Oct;28(4):881-889. doi: 10.1080/1059924X.2023.2229827. Epub 2023 Jun 30. PMID: 37387508; PMCID: PMC10543625.

FORESTRY

Clonch A, Harrington M, Spector J, Monsey LM, Baker MG. Exploring determinants of log truck accidents resulting in injury or fatality in the Northwest United States between 2015-2019 using Motor Carrier Management Information System data. International Journal of Forest Engineering, Published online: 15 Mar 2023. DOI: 10.1080/14942119.2023.2186026.

Jeong Ho Kim & Woodam Chung (2023) Forestry professionals' perspectives on exoskeletons (wearable assistive technology) to improve worker safety and health. International Journal of Forest Engineering, DOI: 10.1080/14942119.2023.2256104.

Zimbelman E, Keefe R. Lost in the woods: Forest vegetation, and not topography, most affects the connectivity of mesh radio networks for public safety. PLOS ONE. 2022 Dec 7. https://doi.org/10.1371/journal.pone.0278645

HEAT-RELATED ILLINESS

Spector JT, Sampson L, Flunker JC, Adams D, Bonauto DK. Occupational heat-related illness in Washington State: A descriptive study of day of illness and prior day ambient temperatures among cases and clusters, 2006-2021. Am J Ind Med. 2023 Aug;66(8):623-636. doi: 10.1002/ajim.23506. Epub 2023 Jun 8. PMID: 37291066; PMCID: PMC10330917.

OTHER FARMING

Thamsuwan O, Galvin K, Palmandez P, Johnson PW. Commonly Used Subjective Effort Scales May Not Predict Directly Measured Physical Workloads and Fatigue in Hispanic Farmworkers. Int J Environ Res Public Health. 2023 Feb 5;20(4):2809. doi: 10.3390/ijerph20042809. PMID: 36833506; PMCID: PMC9957310.

PESTICIDE EXPOSURE

Hyland C, Ruiz I, Meierotto L, Som Castellano R, Curl C. Forging Community Partnerships to Examine Pesticide Exposure and Risk Perceptions among Latinx Farmworkers. Poster Preparation Abstract, PISEE Conference, 2022 Sep 21; 2022(1). Article accepted for publication.

SMOKE & AIR QUALITY

Schollaert C, Austin E, Seto E, Spector J, Waller S, Kasner E. Wildfire Smoke Monitoring for Agricultural Safety and Health in Rural Washington. J Agromedicine. 2023 Jul;28(3):595-608. doi: 10.1080/1059924X.2023.2213232. Epub 2023 May 20. PMID: 37210597; PMCID: PMC10395649.