



# OCCUPATIONAL RESEARCH AGENDA

## FOR NORTHWEST FORESTLANDS

PREPARED BY

**The Pacific Northwest Agricultural Safety and Health Center**

**Department of Environmental Health**

**School of Public Health and Community Medicine**

**University of Washington**



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PREPARED BY

THE PACIFIC NORTHWEST AGRICULTURAL SAFETY AND HEALTH CENTER

DEPARTMENT OF ENVIRONMENTAL HEALTH

SCHOOL OF PUBLIC HEALTH AND COMMUNITY MEDICINE

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# FOREWORD

WORK IN LOGGING OR FORESTRY CAN BE A REWARDING WAY OF LIFE, and in many ways a healthy one. Yet each year, thousands of men and women in the United States are injured or made ill by hazards encountered during routine work activities in forestlands. Many logging and forestry tasks are inherently dangerous, but through proper skills training, equipment and process modifications, and greater safety awareness, we have the opportunity to prevent many injuries and illnesses. Well-focused research can produce the scientific knowledge that is essential to such preventive strategies, and to the improvement of our quality of life.

In 1989, the US Congress directed the Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health (NIOSH) to create new programs designed to prevent illness and injury in agriculture. NIOSH, in turn, created a network of regional centers for research and education in agricultural safety and health. The Pacific Northwest Agricultural Safety and Health Center was established in 1996 as a new resource for the region. The Center's purpose is to assist employers, workers, health professionals, and government agencies in the identification of hazards, and the implementation of practical solutions that will prevent or reduce workplace injury and illness rates. In our application to NIOSH, we emphasized the need to extend our work beyond farming, to include both forestry and fishing, recognizing the critical importance of these industries for our region. In fact, the Center was the first of the nine regional NIOSH centers to propose a focus on logging and forestry activities.

The Occupational Research Agenda for Northwest Forestlands, described in the following pages, is the result of a process that involved key stakeholders throughout the region. We hope this document will serve as a useful guide for anyone concerned with health and safety in the Northwest. The Agenda can improve the use of existing resources by focusing our efforts in areas that can be effectively addressed by research. We thank all of the participants in our telephone interviews, surveys and Forest Safety Workshop, held in Seattle in early 2000. We look forward to continued collaborations and partnerships aimed at investigating and solving the most pressing health and safety problems in our region's forestry communities.

*Richard Fenske, PhD, MPH, Director*

# ABOUT THE OCCUPATIONAL RESEARCH AGENDA FOR NW FORESTLANDS

## *What is the Occupational Research Agenda for Northwest Forestlands?*

The Occupational Research Agenda for Northwest Forestlands identifies health and safety research priorities for logging and forest work in Alaska, Idaho, Oregon, and Washington. The Agenda process elicited the views of land managers, field/contract workers, labor unions, academicians, health care professionals, tribes, government agencies, and others familiar with the region's forestry health and safety issues. The Agenda focuses on areas where research and training can make a difference in reducing disease and injury.

## *How can research make a difference in forestry health and safety?*

Research is the systematic application of scientific principles to answer well-defined questions. It normally involves developing a study design, and collecting and analyzing data. When there is a lack of basic knowledge about injuries or illness, research efforts are aimed at a new understanding of causes. Why are injury rates higher for one occupation than for another? Why do workers in a particular industry develop serious lower back problems? What are the long-term effects of vibration? When we have a clear understanding of why illnesses and injuries occur, research can also help test solutions. Does a new work practice designed to reduce back stress really reduce injury rates and time lost from work? Do new regulations produce changes that improve health and safety? What are effective training practices? Does new equipment reduce vibration exposure or struck-by injuries? The systematic evaluation of interventions has become an important part of public health research, and is particularly valuable to the forestry industry.

## *How was the Agenda developed?*

The Agenda was initiated by the Pacific Northwest Agricultural Safety and Health Center, one of nine regional centers in the United States charged with improving health and safety among farming, fishing, forestry workers and their families. The agenda process was modeled on the successful National Occupational Research Agenda (NORA) developed by the National Institute for Occupational Safety and Health (NIOSH). Our own process was guided by the following goals:

- Gather key stakeholders of the Northwest's forestry industry
- Identify the range of health and safety concerns in forestry
- Understand the priorities of interested and affected parties
- Discuss research questions and approaches to address priority concerns
- Establish an occupational safety and health research agenda for NW forestry
- Identify individuals who can serve as technical advisors to the Center

The Center elicited the concerns and ideas of Northwest constituents through telephone interviews, the Forest Safety Workshop, and surveys. More than 100 telephone interviews were conducted by Center staff between October 1999 and January 2000. Participants were first asked to name the most significant health and safety hazards in the

region; recommend research, training, and other interventions that would identify and reduce the risks; and provide sources of health and safety information. In addition, each respondent was asked to suggest other individuals to interview, and the majority of those people were contacted and interviewed.

The Forest Safety Workshop, held February 3–4, 2000 in Seattle, Washington, was attended by 50 participants. Guided by Center staff and professional facilitators, the Workshop combined breakout groups and plenary sessions to identify and prioritize concerns and to develop research questions and approaches.

In order to have greater input from contract loggers and other fieldworkers, the Center generated a survey from the extended list of concerns developed by Workshop participants. This survey was distributed to Northwest contract logging associations. The Center received 59 completed surveys.

*What priorities has the Agenda identified for Northwest forestlands?*

Upon reviewing the results of the telephone interviews, the Forest Safety Workshop, and surveys, Center staff met with an advisory committee and identified 17 research priorities, which fell within four major categories. The priority areas are not ranked.

CATEGORY	PRIORITY RESEARCH AREAS
Disease & Injury	Hearing Loss Heat & Cold Stress Musculoskeletal Disorders Skin Disorders Traumatic Injuries
Work Environment & Work Force	Environmental Hazards Hazardous Operations Training Workplace Behaviors Work Organization
Economic & Policy Factors	Government Policy Industry Trends Top Level Commitment
Research Tools & Approaches	Hazardous Control Technology Intervention Effectiveness Medical Service Surveillance, Data Collection & Reporting



### *Why is the Agenda important?*

Logging and forest service work places high demands on the men and women whose livelihood depends on the forest resources industry. This industry is affected by many external factors that are beyond the control of the individual employer or worker. These include environmental factors, national and global market changes, technological changes, labor supply, and legislation. Those working in the forest are subject to a variety of workplace hazards that can result in illness and injury, most of which are preventable.

The systematic study of health and safety hazards in forestry communities has emerged as a new and important public health field. The forest industry has high rates of fatal and nonfatal injuries and a high prevalence of certain work-related diseases when compared with other occupations. There is an extraordinary opportunity for well-focused research and education programs to improve health and safety while maintaining a productive industry.

### *How will the Agenda be used?*

We hope that the Agenda will serve as a useful guide to anyone concerned with occupational health and safety in the Northwest forest resources industry. This document will be distributed to participants in the telephone interview, Workshop, and survey, and will be made available to the public. The Agenda will be particularly useful for researchers throughout the region, as it focuses attention on issues where research can make a difference in reducing disease and injury, and provides specific suggestions for research activities. We hope that regional policymakers and employers will find the Agenda valuable in their efforts to effectively reduce incidents of injury and illness.

The Center will use the Agenda to direct resources to relevant research and education activities. For example, we sponsor a pilot project program that provides initial funding for new projects in agricultural health and safety. The Agenda will serve as an important tool to guide pilot project applicants and Center investigators to consider research in specific areas of need. We support graduate students who can use the Agenda to develop project ideas. The Agenda will also guide future planning of our continuing education courses and outreach efforts.

### *How can I be involved in forestry health and safety research and education?*

We hope that the distribution of the Agenda marks the beginning of a process that stimulates new thinking and efforts in the area of health and safety in the forestry resources industry. The Center can facilitate these efforts and provide linkages across the region. Please contact us and we will be happy to work with you to find common interests and new resources to prevent disease and injury in our region.

# INTRODUCTION

THE NORTHWEST, SPECIFICALLY ALASKA, IDAHO, OREGON, AND WASHINGTON, houses some of the nation's most beautiful and productive forests. The region's loggers, foresters, and their families contribute to the health of our forests and to local and national economies. Yet the management and harvesting of timber places these groups at risk for a variety of health and safety hazards.

The forest resources industry is one of the most hazardous industries in the United States. For example, the fatality rate of loggers (including fallers, limbers, buckers, choker setters, truck drivers, general laborers, and machine operators) in 1997 was approximately 27 times the national average for all occupations (128 vs. 5 per 100,000). Nationally, nonfatal injuries in logging between 1992 and 1996 dropped from 4,537 (injuries per year) to 2,136 (injuries per year), however these rates continue to be greater than many occupations.<sup>1</sup>

In the Northwest, fatality and injury data confirm the dangers prevalent in this industry. Washington state workers' compensation claims data indicate that agricultural and forestry workers are at greater risk for fatal and nonfatal injuries, systemic poisoning, and dermatitis than are nonagricultural workers. A study of logging fatalities in Washington state indicated that employees of smaller logging firms were at higher risk for mortality.<sup>2</sup> Based on Washington state workers' compensation claims data, the rate of nonfatal lost time injuries for loggers (13.5 per 100 full time equivalents [FTE]) is more than 3.5 times that of all industries combined (3.8 per 100 FTE).<sup>3</sup>

Between 1993 and 1997 agriculture, forestry and fishing occupations in Oregon were among those industries with the highest fatality rates (19.0 per 100,000, second only to construction at 19.4 per 100,000).<sup>4</sup> According to the *Characteristics of Work Injuries and Illnesses for Logging Camps and Logging Contractors*, Oregon reported an injury rate of 20.6 (for every 100 workers) in 1997. The average costs per claim for logging occupations in 1997 included \$10,612 in medical expenses, \$7,257 in time loss, and \$3,188 in permanent partial disability amounting to \$21,057 per claim. Average time lost was 104 days.<sup>5</sup>

The *Occupational Injury and Illness Report*, published by the Alaska Department of Labor, reported that in 1994, loggers represented almost half of the injury and illness cases in the manufacturing of wood products and lumber industry (170 cases out of 273) and 23 percent of logging cases involved more than 11 days away from work. The median days away from work were six.<sup>6</sup> In a review of the Alaska Trauma Registry for 1991 through 1995, logging had the highest average annual injury rate (2.5 for every 100 workers) of all occupations in Alaska.<sup>7</sup>

Efforts to decrease the number of health and safety hazards for loggers and foresters at the federal, state, and local levels are complicated by the lack of a skilled workforce, a fluctuating timber supply, and geographical demands inherent to the region. Overall, many industries are struggling to develop a qualified workforce in this period of low unemployment rates. The challenge is heightened in logging by low wages, occupational hazards, influx of young workers not committed to the profession, reduction of older,

more skilled labor, and high turnover.<sup>8</sup> In addition, a significant decline in available timber over the past 20 years has closed operations and displaced workers. In the near future, many industrial and nonindustrial stands will reach maturity and be available for thinning, and selective or final harvest.<sup>9</sup> This increase in activity may be a boon to the industry if contractors can develop and retain skilled crews.

The Northwest forest resources industry also faces unique geographical demands with high mountain elevations, steep slopes, and dramatic climate changes. These environmental demands have prompted innovations within the industry such as skyline yarding, feller-bunchers, and helicopter logging. Yet even these adaptations generate new and, perhaps, unforeseen occupational hazards, which place loggers and foresters at continued risk for injury.

Setting priorities for health and safety research and education in the Northwest's forest industry is a challenging task. However, many of the occupational diseases, injuries, and hazardous working conditions in this region's forest industry are similar to those identified in other regions, nationally and worldwide. In our efforts to develop priorities, we turned to a process recently implemented on the national level.

## THE NORA PROCESS

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency within the Centers for Disease Control and Prevention, and serves as the nation's primary research organization for occupational health and safety. NIOSH created a new process in 1996, the National Occupational Research Agenda (NORA), to better identify and prioritize significant health and safety hazards for research and public policy purposes. This Agenda process encompasses input from representatives of scientific, corporate, labor, and health care organizations. In the first phase, NIOSH compiled the results of committee meetings, public gatherings, and written comments to develop and refine the 21 research priorities (Table 1).

The criteria employed to guide the evaluation and selection of possible NIOSH NORA topics included some or all of the following:

- Seriousness of the hazard based on death, injury, disease, disability, and economic impact
- Number of workers exposed or magnitude of risk.
- Potential for risk reduction
- Expected trend in importance of the research area.
- Sufficiency of existing research
- Probability that research will make a difference

The NORA process has proven very successful, and serves as a model of broad stakeholder influence in priority setting. Most recently the process has encouraged the National Institutes of Health and other federal agencies to join NIOSH in sponsoring a number of focused research programs directly relevant to workplace health and safety.

Table 1. NIOSH NORA Priority Research Areas

CATEGORY	PRIORITY RESEARCH AREAS
Disease & Injury	Allergic and Irritant Dermatitis Asthma and Chronic Obstructive Pulmonary Disease Fertility and Pregnancy Abnormalities Hearing Loss Infectious Diseases Low Back Disorders Musculoskeletal Disorders of the Upper Extremities Traumatic Injuries
Work Environment & Work Force	Emerging Technologies Indoor Environment Mixed Exposures Organization of Work Special Populations at Risk
Research Tools & Approaches	Cancer Research Methods Control Technology and Personal Protective Equipment Exposure Assessment Methods Health Services Research Intervention Effectiveness Research Risk Assessment Methods Social and Economic Consequences of Workplace Illness and Injury Surveillance Research Methods

## PACIFIC NW AGRICULTURAL SAFETY & HEALTH CENTER

An early aim of the Pacific Northwest Agricultural Safety and Health Center (PNASH) was to identify and prioritize health and safety hazards in the region. Starting with farming, we turned to the NORA process for guidance. Our process, like NORA, was designed to elicit the perspectives of employers, labor, health care professionals, academicians, public agency officials, and others familiar with the region's farming health and safety issues. A similar process was then applied to the forestry resources industry. We hoped, as in our experiences with Northwest farming, to find common ground among these groups in the identification of significant hazards workers face in the forest, for which new research could make a difference at a regional level. The following discussion summarizes the process used to create an occupational research agenda relevant to Northwest forestlands.

## SETTING A RESEARCH AGENDA FOR NORTHWEST FORESTLANDS

The development of the Occupational Research Agenda for Northwest Forestlands encompassed several stages. Center staff began planning the Agenda process in March 1999. The aims included:

- Obtain information on health and safety concerns in regional logging and forestry, including technical, social, and economic dimensions
- Involve stakeholders in identifying issues that could be addressed by occupational safety and health research
- Establish a priority list, or agenda, of occupational safety and health research topics relevant to Northwest forestlands
- Assemble a technical advisory panel for the Center

Center staff provided individuals working in forest operations in the four-state region with a forum to identify the most significant safety and health topics and contribute ideas for prevention and intervention research. These views were elicited from land managers, field/contract workers, labor union representatives, academic researchers, health care professionals, tribes, government agency workers, and others through telephone interviews, the Forest Safety Workshop, and field worker surveys.

Center staff conducted telephone interviews with 109 constituents between October 1999 and January 2000. The interview consisted of six questions. Respondents were asked to name the most significant agricultural health and safety hazards in the region. The interview also included questions about types of research, training and other interventions that would identify and help reduce the risks, and sources of health and safety information. In addition, each respondent was asked for suggestions for other individuals to question; the majority of those people were contacted and interviewed.

The Center was assisted in planning by an external planning committee, which met on November 5, 1999 in Seattle, Washington. The committee made important revisions to the project's scope (subsequently limited to logging and forestry work) and the design of the Forest Safety Workshop.

The selection of participants for the Forest Safety Workshop was shaped by the Center's aim to have an equal representation of constituent groups from the Northwest. An invitation list was compiled from individuals recommended during the telephone interviews and suggestions for Center researchers and staff. Invitations were sent to 121 individuals throughout the Northwest and included representatives from timber companies, labor organizations, health care, academia, land management agencies, safety and health agencies, and contract logger associations.

The Forest Safety Workshop, February 3-4, 2000 in Seattle, attracted 50 participants. They were assigned to breakout groups of about 10 people where they were asked to prioritize key agricultural health and safety problems. Facilitators helped combine the small-group lists into the top 10 priority items. Participants then selected two of the ten breakout sessions to discuss the topics in-depth and formulate research questions and approaches.

Although the telephone interviews and Workshop captured the views of a variety of people throughout the region, Center staff identified a need for greater representation from contract loggers and other field workers. To reach them, the Center distributed a survey

generated from the extended list of concerns developed by Workshop participants at regional logging association meetings to obtain field worker input. The survey asked participants to identify the top five issues and any additional concerns that may not have been presented on the survey. Currently, the Center has received 59 survey responses from people who attended the Washington Contract Logging Association, Association of Oregon Loggers, Associated Logging Contractors of Idaho, Intermountain Logging Association, and Alaska Forestry Association meetings.

The information gathered in the telephone interviews, Forest Safety Workshop, and surveys was analyzed by Center staff. The information was then summarized as forestry safety and health research priority areas for the region. A second external planning committee met on April 1, 2000, in Seattle to review this information and developed the final list of priorities described in the following section.

## RESEARCH PRIORITY AREAS FOR NORTHWEST FORESTLANDS

Seventeen research priorities for the Occupational Research Agenda for Northwest Forestlands were selected, based on the telephone interview, Forest Safety Workshop, and surveys. The three major NIOSH NORA categories, *Disease and Injury*, *Work Environment and Work Force*, and *Research Tools and Approaches*, were retained as a framework for organizing the priorities, and a new category, *Economic and Policy Factors*, was employed to capture three areas that were identified as distinct priorities. Each category included research priority areas, as presented in Table 2.

The first category, *Disease and Injury*, included hearing loss, heat and cold stress, musculoskeletal disorders, skin disorders, and traumatic injuries as research priority areas. The second category, *Work Environment and Workforce*, included environmental hazards, hazardous operations, training, workplace behaviors, and work organization. The third category, *Economic and Policy Factors*, included government policy, industry trends, and top-level commitment. The fourth category, *Research Tools and Approaches*, included hazard control technology, intervention effectiveness, medical service, and surveillance, data collection and reporting.

These priorities are not ranked. However, certain topics surfaced more frequently in the telephone interviews and Forestry Workshop discussions. These included musculoskeletal disorders, traumatic injuries, hazardous operations, training, workplace behaviors, industry trends, and top-level commitment. The remainder of this document provides a brief overview of the 17 research priorities. Each overview describes the importance of the priority to the Northwest, and presents examples of research ideas provided by telephone interview and survey respondents, and Forest Safety Workshop attendees. We have also included a limited list of resources for additional information.

**Table 2. Occupational Research Agenda for NW Forestlands: Priority Research Areas**

<b>CATEGORY</b>	<b>PRIORITY RESEARCH AREAS</b>
<b>Disease &amp; Injury</b>	Hearing Loss Heat & Cold Stress Musculoskeletal Disorders Skin Disorders Traumatic Injuries
<b>Work Environment &amp; Work Force</b>	Environmental Hazards Hazardous Operations Training Workplace Behaviors Work Organization
<b>Economic &amp; Policy Factors</b>	Government Policy Industry Trends Top Level Commitment
<b>Research Tools &amp; Approaches</b>	Hazard Control Technology Intervention Effectiveness Medical Service Surveillance, Data Collection & Reporting

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- Pacific Northwest Agricultural Safety and Health Center homepage: <http://depts.washington.edu/pnash>.
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# PRIORITY RESEARCH AREAS FOR NW FORESTLANDS

## DISEASE & INJURY



HEARING LOSS

HEAT & COLD STRESS

MUSCULOSKELETAL DISORDERS

SKIN DISORDERS

TRAUMATIC INJURIES

## WORK ENVIRONMENT & WORKFORCE



ENVIRONMENTAL HAZARDS

HAZARDOUS OPERATIONS

TRAINING

WORKPLACE BEHAVIORS

WORK ORGANIZATION

## ECONOMIC & POLICY FACTORS



GOVERNMENT POLICY

INDUSTRY TRENDS

TOP LEVEL COMMITMENT

## RESEARCH TOOLS & APPROACHES



HAZARD CONTROL TECHNOLOGY

INTERVENTION EFFECTIVENESS

MEDICAL SERVICE

SURVEILLANCE, DATA COLLECTION & REPORTING

# DISEASE & INJURY



HEARING LOSS

HEAT & COLD STRESS

MUSCULOSKELETAL DISORDERS

SKIN DISORDERS

TRAUMATIC INJURIES

THE DISEASES AND INJURIES experienced in forestland work range widely in type, severity, and frequency. The incidents experienced by those in forestry and logging can be tragic or disabling. A great strength of the forestry industry, demonstrated through this project and in previous work conducted by industry and government, is the willingness to share information and learn from experience to prevent future occurrences.

Participants identified five priority research areas in this category including hearing loss, heat and cold stress, musculoskeletal disorders, skin disorders, and traumatic injuries.



# HEARING LOSS

*Hearing loss is one of the most common occupational diseases in the United States, and once the loss is acquired, it is irreversible. Noise induced hearing loss, while widespread, is completely preventable. Although hearing loss may result from an acute traumatic injury, it is more likely to develop gradually as a result of chronic exposure to agents which damage the ear or hearing process. Noise is the most important occupational cause of hearing loss, but solvents, metals, asphyxiants (causing illness or death from lack of oxygen), and heat may also play a role.*

[NIOSH NORA: Hearing Loss]

## IMPORTANCE

Noise Induced Hearing Loss (NIHL) is a great concern for those who work in the forest industry as it is one of the most common occupational diseases in the United States and is irreversible once acquired. Hearing loss hinders personal communication, which can negatively affect social interactions and present a safety hazard. Temporary, reversible hearing loss may result from short-term exposure; however, prolonged occupational exposures, lasting 40 years or more, can gradually produce permanent damage. Noise is the most important occupational cause of hearing loss, but solvents, metals, asphyxiants and heat may also play a role. Exposure to noise, combined with other forces or substances, can result in hearing losses greater than those resulting from exposure to noise or other agents alone.

A Center-funded study on vibration and noise exposure in western Washington state found that forestry workers have substantial over exposures to noise (by OSHA and NIOSH criteria) and, with

continued exposure, these workers will likely experience noise induced hearing loss.<sup>10</sup> While this condition is irreversible once acquired, it can be prevented through the use of personal protective equipment, engineering, and administrative controls. Recommended strategies include:

- enclosure of operator cabs and engine compartments on heavy equipment
- active noise control headsets, incorporating communications capability
- effective hearing conservation and training programs
- consistent and proper use of appropriate hearing protection devices
- increased distance between workers and equipment producing high noise levels
- purchase and use of quieter equipment

Project participants expressed general concern about noise induced hearing loss among forest workers frequently exposed to noise from chain

saws and other machinery. Many participants advocated proper use of hearing protection among workers.

## RESEARCH OPPORTUNITIES

- Define and gather more data on noise induced hearing loss risk associated with various forestry and logging tasks
- Develop new methods and technologies for controlling noise and improving hearing protector effectiveness
- Define the prevalence of noise exposure and the risk of occupational hearing loss in the forest industry
- Examine the relationship between middle ear function and visual perception
- Aggregate and assess currently available databases
- Correlate worker performance with communication ability
- Investigate the relationship between noise and non-auditory effects such as hypertension and psychological stress
- Define hazardous parameters of impulsive-versus continuous-type noise exposures
- Analyze ear damaging properties of industrial chemicals and agents and their interaction with noise
- Develop methods for determining nonoccupational contributors to hearing loss

## TRAINING OPPORTUNITIES

- Train clinicians, physicians, and nurses on noise induced hearing loss, including how to refer patients for hearing tests
- Educate workers on a regular basis regarding the causes of noise induced hearing loss and appropriate preventative measures
- Use behavioral survey tools to develop training and education programs that address workers' beliefs, attitudes, and intentions about hearing loss prevention

- Develop materials and programs that involve the worker in the hearing conservation and noise control processes
- Refine strategies to overcome barriers to wearing hearing protection

## ADDITIONAL INFORMATION

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# HEAT & COLD STRESS

*Working under hot or cold conditions is part of the normal routine of any outdoor occupation in the Northwest. These temperature extremes can affect both worker performance and health. Cold extremes can cause hypothermia, while hot temperatures can lead to heat exhaustion. Both heat and cold are known to decrease manual dexterity, increase discomfort, and in some cases, affect cardiovascular health. Heat stress can be aggravated by the use of personal protective equipment. Other contributing factors to negative health effects from heat and cold stress include level of hydration, duration of exposure, degree of physical demand, age of worker, and worker health. Injury and illness associated with heat and cold stress are generally underreported.*

[NIOSH NORA: None]

## IMPORTANCE

The Northwest has a diverse geography and is affected by all types of weather. The western coastline and mountainous regions generally experience milder temperatures with heavy rainfall, while the inland northwest and lowland areas are typically dry and hot. Alaska stands out from the lower northwest, with greater temperature extremes, heavy winds, and snowfall.

Cold extremes can cause hypothermia, frostbite, and immersion foot (from cold water immersion). Hypothermia occurs at temperatures as high as 65 degrees Fahrenheit, especially when conditions are wet or the worker has been sweating. General risk factors for cold-related illnesses include inadequate or wet clothing, drug use, another illness, gender (male death rates are greater than female), age and immobilization. In the Northwest, Alaska hosts one of the most hazardous environments for cold-related injury with its low temperatures, great distances, seasonal

darkness, heavy rains, high winds and icing. This is reflected in the Alaska Trauma Registry for the period 1991 to 1995 where 327 persons were hospitalized from cold-related injuries, of which 40 were injured while working.<sup>11</sup>

Hot temperatures can impact a worker's performance by reducing strength, accuracy, alertness, and mental capacity. Specific health problems include heat exhaustion, heat cramps, fainting, heat rash, and heat fatigue. In addition, hot weather can promote incidents from slick, sweaty palms or fogged safety glasses. Heat stress can be aggravated by the use of personal protective equipment that is commonly used in logging occupations. Heat stress can be reduced by the following interventions:

- adopting work-rest cycles
- improving air flow
- using engineering controls (i.e., enclosed cabs)

- providing cool rest areas and water
- ensuring workers are acclimatized and in good physical condition

## RESEARCH OPPORTUNITIES

- Examine the relationship between cold and vibration
- Assess the impact of temperature extremes on the body (i.e., hypothermia, frostbite, immersion foot, heat exhaustion, and heat stroke)
- Assess the impact of temperature extremes on injuries (i.e., back injuries)
- Examine the role of hydration on heat and cold injuries
- Investigate the role of sleep on heat and cold injuries

## TRAINING OPPORTUNITIES

- Train workers and supervisors about the risk factors for injury and illness when exposed to hot and cold environments
- Develop training programs targeting prevention and mitigation of injury and disease from the heat and cold

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# MUSCULOSKELETAL DISORDERS

*Work-related musculoskeletal disorders are common in the forest industry and can be quite costly. Existing scientific evidence identifies some work activities and awkward postures as significant contributors to the problem. The prevalence of back injuries and strains and sprains among forestland workers appears high in the Northwest. Tasks that are strenuous or require repetitive motion are of particular concern. The scientific field that evaluates and finds solutions to such problems is known as ergonomics. Ergonomics is the study of the interaction of people and their work environments, and requires a sound understanding of human factors engineering, work physiology, biomechanics, and mechanical and production engineering.*

[NIOSH NORA: Lower Back Disorders, Musculoskeletal Disorders of the Upper Extremities]

## IMPORTANCE

Work-related musculoskeletal disorders are common and costly for all industries. The US Bureau of Labor Statistics shows that for each year from 1994 to 1998, musculoskeletal disorders were the second most commonly reported occupational illness (next to repeated trauma), constituting 13–14% of illnesses across all industries.<sup>12</sup> Workers' compensation costs may significantly underestimate the actual magnitude of these disorders. The causes for such disorders are complex. Existing scientific evidence identifies some work activities and awkward postures as significant contributors to the problem. A recent employer survey in Washington state showed that, in the agriculture industry (excluding forestry), those establishments reporting musculoskeletal disorders in the previous three years reported that 16.5% of injuries were to upper extremities and 15% to the back, while 61% were sudden onset injuries.<sup>13</sup> While these numbers suggest that traumatic musculoskeletal injuries are

more prevalent than chronic injuries, Washington state workers' compensation claim statistics indicate that the logging industry is one of the top 25 industries in terms of non-traumatic soft tissue disorders of the neck, back and upper extremity between 1990 to 1998.<sup>14</sup> This indicates that musculoskeletal disorders resulting from chronic injury are common among Washington loggers. Tasks that are either strenuous or require repetitive motion are of particular concern for forestland workers.

A Center-funded study looking at vibration and noise exposures in western Washington state found that forestry workers are overexposed to hand/arm and whole body vibration (according to criteria from the American Conference of Governmental Industrial Hygienists [ACGIH] and International Organization for Standardization [ISO]). ISO predicts the appearance of vascular symptoms in 10% of the monitored workers after 6 years, and

50% after 14 years of exposure at the measured hand/arm vibration levels. The ACGIH and ISO whole-body standards indicate that negative health effects are likely to occur at the levels of vibration measured at logging operations in Washington state.

## RESEARCH OPPORTUNITIES

- Examine chronic conditions which contribute to, or are a precursor to an acute injury
- Establish effective risk identification procedures for forestry jobs
- Investigate methods to reduce chronic pain
- Assess the effects of vibration levels on health
- Identify the causes of musculoskeletal injuries
- Investigate long-term injuries, such as carpal tunnel syndrome or arthritis from machinery operation
- Evaluate the regulatory impacts of Washington state's new ergonomic rule
- Investigate ergonomic issues in saw handling

## TRAINING OPPORTUNITIES

- Instruct workers on body mechanics and proper lifting, pulling, climbing, and jumping techniques
- Focus training on prevention strategies
- Conduct a back school similar to those provided to other professions, such as nursing home employees
- Train workers to think ahead when faced with known hazards, such as uneven terrain, soft soil, falling trees and limbs

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## SKIN DISORDERS

*Work in the forest results in frequent exposure to sun, plants, and chemicals. Contact with plants and some chemicals can produce allergic and irritant dermatitis, otherwise known as contact dermatitis. Contact dermatitis is the most important cause of occupational skin diseases nationally, and accounts for 13–14% of all reported occupational diseases. Sun exposure can cause additional irritation and over time can lead to skin cancer, the incidence of which has steadily increased over the last half century. Foresters and loggers' chronic exposure to ultraviolet rays and their demographic characteristics (primarily white males) identifies them as a high risk group for skin cancer.*

[NIOSH NORA: Allergic and Irritant Dermatitis]

### IMPORTANCE

Work in the forest results in frequent exposure to sun, plants, and chemicals. Each of these agents can cause skin injury and disease. The US Bureau of Labor Statistics shows that for each year from 1994 to 1998 skin disorders have been the second most commonly reported occupational illness, constituting 13 to 14% of reported illnesses.<sup>15</sup> In Washington, agriculture (farming, fishing, and forestry) has the highest rate of occupational dermatitis among the major industrial sectors and it is estimated that this data under-represents the number of occupational skin disorders by more than four times.<sup>16</sup>

Contact with plants, and some chemicals, can produce allergic and irritant contact dermatitis. Susceptibility may be increased if there is exposure to broken skin (cuts and scrapes are common in forest work). Contact dermatitis is the most important cause of occupational skin disease across the nation, and accounts for 90% of all occupational

dermatoses.<sup>17</sup> Frequent skin contact with moisture, chemicals, friction, or dirt, all of which are common in forestland work, have been previously associated with an increased risk of hand eczema and contact dermatitis. Selected Northwest trees are known to cause dermatitis, particularly among workers who are exposed to airborne wood particles.<sup>18</sup> There is additional evidence that some forest product workers who are exposed to liverwort (related to mosses) and lichens may develop irritant contact dermatitis.<sup>19</sup> Allergic contact dermatitis is also caused by sensitizing agents and Northwest forests are abundant in two highly sensitizing plants: poison oak and poison ivy.

Sun exposure can cause additional irritation and skin cancer, the incidence of which has steadily increased over the last half century. Basal and squamous cell carcinomas are the most common malignancies, with an annual incidence

of more than 600,000 cases in the US.<sup>20</sup> These nonmelanoma skin cancers are directly related to chronic overexposure to ultra-violet rays, which makes these cancers easily preventable if workers avoid direct sun exposure and wear protection.<sup>21</sup> Melanoma represents only about 5% of all skin cancers in the United States, but it accounts for about 75% of all skin cancer deaths, about 6,900 deaths per year.<sup>22</sup> In the United States, the reported incidence of melanoma from 1973 to 1991 for white males rose 124%; a rate of increase that leads all other cancers.<sup>23</sup> The increased risk for skin cancer among people who work outdoors is well documented for certain occupations. Although there are few studies specific to forest workers, forest-land work encompasses known risk factors, which place foresters and loggers at high risk for cancer.

#### RESEARCH OPPORTUNITIES

- Assess exposure to hydrocarbons (oil, gasoline, grease) and its relationship to dermal conditions and cancers
- Identify the prevalence and causes of dermatitis in forestland work to improve exposure assessment and diagnostic methods
- Develop and test efficacy of barrier lotions for poison oak and poison ivy
- Investigate the long-term effects of chemical exposure on respiratory and dermal systems
- Develop cost-effective screening programs

#### TRAINING OPPORTUNITIES

- Develop training that emphasizes hazard identification, personal predisposition, avoidance, protective clothing, barrier creams and hygiene
- Provide health care professionals with training in occupational-related skin disorder diagnosis
- Conduct physician training in cutaneous malignancies, including basal and squamous cell carcinomas, melanoma, and their precursor lesions

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# TRAUMATIC INJURIES

*Injury takes a huge toll in many US workplaces, including the forestry industry. Multiple factors contribute to traumatic injuries, such as the characteristics of the workforce, job design, work organization, economics, and other social factors. Fatalities and nonfatal traumatic injuries resulting from human contact with machinery, equipment, trees, and parts of trees are common in forestry and logging. Overexertion, stress, fatigue, lack of training, and operator attitude can all serve as precursors for injuries.*

[NIOSH NORA: Traumatic Injuries]

## IMPORTANCE

The forest resources industry is one of the most hazardous in the United States, the fatality rate of loggers in 1997 was approximately 27 times the national average (128 vs. 5 per 100,000). Nationally, nonfatal injuries between 1992 and 1996 declined from 4,537 injuries per year to 2,136 injuries per year, yet rates are still high and injuries severe, resulting in a median number of 11 days away from work.<sup>24</sup> A study of logging fatalities in Washington state indicated that employees of smaller logging firms had a higher risk for mortality.<sup>25</sup> This trend for small businesses is apparent on a national level, with logging in the top five of all small businesses with high risk for injury or death.<sup>26</sup>

Based on Washington state workers' compensation claims data, the rate of nonfatal lost time injuries for loggers (13.5 per 100 full time equivalents [FTE]) is more than 3.5 times that of all industries combined (3.8 per 100 FTE).<sup>27</sup> In Oregon, the average fatality rate by industry for 1993 through 1997 finds agriculture, forestry and

fishing as having one of the highest fatality rates (19.0 per 100,000, just below construction at 19.4 per 100,000).<sup>28</sup>

In a review of the Alaska Trauma Registry for 1991 through 1995, logging had the highest average annual injury rate (2.5 for every 100 workers) of all occupations in Alaska.<sup>29</sup> The types of injuries sustained by those individuals working in forestlands range from frequent minor injuries to very severe incidents. A review of patients examined at Harborview Medical Center in Seattle found that of 51 logging-injured patients, 67% were injured by falling or rolling trees and 16% were chain saw-related. Of these patients, 43% experienced serious head injuries (22% had major brain injury) and 30% were found to have spinal injuries (50% having neurologic deficit). Chest and extremity injuries were also common and two-thirds of the patients had two or more parts of their bodies which were severely injured. In a six-month follow-up on 43 of these patients, 58% were considered permanently disabled.<sup>30</sup>

Oregon's disabling claims indicated loggers most frequently experienced sprains and strains, struck-bys and back injuries.<sup>31</sup> Likewise, in a review of nonfatal injuries in Alaska, struck-bys and falls led in causes of all severe injuries with fractured bone being the most common injury and most injuries impacting the lower extremities.<sup>32</sup> In British Columbia from 1991 to 1995, serious claims in logging included strains (37%), bruises (21%), cuts (14%), and fractures and dislocations (11%).<sup>33</sup>

Project participants identified traumatic injuries as one of the top priorities for research. Concerns included both fatal and nonfatal injuries, with an emphasis on eye injuries. Traumatic incidents were attributed to struck-by injuries, slips, trips and falls. Overexertion and fatigue were also noted as predispositions to forestry-related incidents. Participants felt that research should focus on leading causes and high-risk groups and effective interventions may require collaboration among different academic disciplines and cooperation among many organizations.

## RESEARCH OPPORTUNITIES

- Examine the relationship between harvesting system and injury
- Explore relationship between fatigue and injury rate
- Conduct epidemiological analysis of injuries to determine the leading causes and high risk groups
- Develop reliable and valid systems to measure extent of injuries, which includes measuring the hazards
- Conduct a quality state-by-state study of serious injury and fatality causes
- Investigate injury timing (within a day and week) by job category
- Describe injuries in nonfatal cases as most injury data is based on fatality data

## TRAINING OPPORTUNITIES

- Develop effective interventions through collaboration among organizations
- Provide training in hazard recognition (recognizing snags, widowmakers [hung-up limbs and trees], etc.)
- Instruct workers on techniques for falling with less potential for injury
- Provide employees with medical information documenting the serious nature of chain saw cuts and when to seek medical aid

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# WORK ENVIRONMENT &

# WORKFORCE



ENVIRONMENTAL HAZARDS

HAZARDOUS OPERATIONS

TRAINING

WORKPLACE BEHAVIORS

WORK ORGANIZATION

THE SUBTOPICS IN THIS CATEGORY REFLECT HAZARDS in the forestland work environment, and factors that may, directly or indirectly, affect health and safety risks. Research is necessary to understand the new risks that are associated with the industry, technology, and work practices. The organization of work is increasingly recognized as an important component in promoting health and safety, but insufficient research is available to provide guidance to managers, employers, and employees. Individual behaviors can contribute to the overall risk for injury on the work site. And lastly, training is essential to the successful implementation of workplace changes designed to prevent injury and illness.



# ENVIRONMENTAL HAZARDS

*Loggers and foresters are subject to many hazards associated with working in the forest. Some key Northwest environmental hazards identified in this project were remote location, climate and weather, animals, plants, insects, terrain, stand characteristics, fire, and other forest users. The extent of some of these hazards differ depending on the region.*

[NIOSH NORA: None]

## IMPORTANCE

Workers in Northwest forests can experience a range of terrain and stand characteristics, including the challenges of steep slopes, dense stands, snags, wind falls, thick underbrush and a maze of downed wood. These conditions affect the individual worker, work organization and the operation and design of equipment and vehicles, such as helicopters. The extent of environmental hazards differs depending on the region. For example, Alaskans appear to have more problems with animals and terrain, while more populated areas such as western Washington and Oregon have greater concerns with other forest users, including recreationalists and environmental activists, who may pose a danger to the worker and themselves.

One telephone interview participant provided a good sense of the dangers associated with Alaskan logging operations. He noted that workers who fall and buck timber in this state are at considerable risk for injury. Some of the causes include operating in an old forest, which may consist of decayed, dead and broken timber located on steep and unstable ground. In order to

remove a merchantable tree, numerous other dead trees may have to be removed. He also noted that, since helicopters can only carry a certain weight, workers must buck the trees on steep terrain placing the worker at risk for slipping timber, mud slides, and unreliable footing.

## RESEARCH OPPORTUNITIES

- Identify plants that pose a harm to workers
- Assess the impact of temperature extremes on the body and on injuries
- Develop improved barrier lotions for poison oak
- Design new shoe tread for all weather conditions and develop improved footwear
- Develop guidelines for movement through non-trailed lands
- Determine the impact of small-diameter trees on safety
- Correlate fatalities to stand characteristic data
- Identify the characteristics that make snags hazardous

- Evaluate causes documented in fatality and accident reports (for example, role of species, size and number of rocks, tree grade)
- Develop new logging techniques which incorporate methods to mitigate selective cutting hazards

#### TRAINING OPPORTUNITIES

- Provide bear safety and wilderness survival training
- Educate workers on woods work preparation including proper dress, water, etc.
- Conduct fire safety training

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## HAZARDOUS OPERATIONS

*Timber harvesting tasks are complicated and inherently hazardous, and can result in an incident, even when the utmost care is taken by management and the worker. Project participants shared their knowledge of these activities, and identified specific high risk tasks, such as timber falling, log hauling, chain-saw operation, thinning, hazardous materials handling, trucking, and helicopter logging (both for helicopter aircrew and ground crew). Frequently, concerns related to equipment. The harvesting crew has to work closely among skidders, cables, processors, trucks, and other heavy equipment, and the risks presented by the presence of this potentially dangerous equipment can be exacerbated by terrain, type of logging (i.e., selective logging) and limited landing space. Another frequently cited hazard was rolling, falling, or flying objects (typically trees and limbs). These hazards can result in struck-by incidents that are fatal or that cause disabling injuries.*

[NIOSH NORA: None]

### IMPORTANCE

In recent years, the forest resources industry has achieved great improvements in the prevention of injury and illness; however, certain tasks continue to place workers at extremely high risk. The Bureau of Labor Statistics' 1984 analysis of 1086 logging employees in the US found the top five activities at the time of injury were falling (23%), limbing (15%), choker setting (14%), bucking (12%), and skidding (9%).<sup>34</sup> Although statistics for Alaska, Idaho, Oregon and Washington are limited in this area, the incidents identified in British Columbia may provide insights for the US Northwest's operations. In British Columbia, from 1991 to 1995, the top four logging occupations by number of serious workers' compensation claims were fallers (33%), loaders and sorters (17%), logging laborers (12%), and foreman (10%). Log truck

drivers suffered 9% of serious claims and 19% of fatal claims, over the same period. For this same group, incidents frequently resulted from being struck by an object, chain saw, or trees and parts of trees (33%); falling from a tree, log, or vehicle, (21%); and overexertion (11%).

Helicopter logging is a useful means for harvesting timber in the Northwest where terrain is often steep, rugged, or roadless. Unfortunately, in the past two decades, this newly emerged industry has seen high rates of incidents, which often result in death. Of the 65 helicopter accidents from 1980 to 1995, 25 resulted in fatalities: to the pilot (18), logger passengers (5), and ground crew (2). The helicopter logging industry has been working closely with the Alaska NIOSH field station to identify hazards and prevention measures, and



have seen a drop in incidents in recent years, demonstrating the success of government-industry teamwork.<sup>35</sup>

Participants in the telephone interviews, Workshop, and surveys suggested measures to reduce the risk of injury, such as using appropriate equipment for the terrain and the job; conducting routine equipment inspection and maintenance; and increasing awareness, and good skills. Participants noted that the available personal protective equipment has limited effectiveness for protecting forestland workers.

## RESEARCH OPPORTUNITIES

- Examine the dynamics of falling trees
- Assess harvesting systems and hazard abatement
- Analyze current harvesting practices to determine which activities increase safety
- Determine frequency and timing of hazards
- Evaluate and adapt successful international solutions
- Survey training impact on near-miss rates
- Develop a reporting structure for near-misses and identify how many near-misses occur prior to an incident
- Investigate ergonomic issues in saw handling
- Conduct hazard assessment of manual timber felling
- Conduct review of accidents and causes over the past ten years
- Develop a new method for identifying logs to replace the branding hammer
- Modify saw design to include a fire-control device
- Identify good handling techniques for chain saws
- Develop methods to improve lockout/tag out procedures
- Review transportation injuries, including prevalence and causal factors
- Identify methods to reduce road hazards, including brush clearance and curve markings
- Investigate the long-term effects of chemical exposure on respiratory and dermal systems

## TRAINING OPPORTUNITIES

- Educate worker and supervisor to perform collaborative review of new task
- Provide guidance on work practices that reduce strength requirements
- Ensure that workers understand the felling process and how cuts affect the fall
- Instruct workers on proper machinery inspection and maintenance
- Couple sale of equipment with training
- Inform workers about the need for and proper use of personal protective equipment
- Develop helicopter and plane crash survival training
- Provide defensive driving instruction

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# TRAINING

*Most forestry and logging workers develop skills through on-the-job training from experienced coworkers. Loggers need to learn complex skills related to the task, tree site, machinery, and equipment. Further research is needed to identify the best ways to communicate safety and health information to workers in the forest, as well as those individuals who may affect the job, such as landowners, management, government officials, and others. Participants identified several effective methods of training, including tailgate sessions, videos, internet, checklist, and hands-on experiences. They also emphasized that these training sessions can be valuable opportunities for workers to share their knowledge, both with each other and with trainers.*

[NIOSH NORA: Control Technology & Personal Protective Equipment, Intervention Effectiveness Research]

## IMPORTANCE

Effective skills training is a key prevention and intervention tool as expressed by participants of the telephone interviews, Workshop, and surveys. In fact, skills training emerged as a top priority issue in the Workshop, and personal interviews identified many training improvement suggestions. Most forestry and logging workers develop skills through on-the-job training from experienced coworkers. The development of skills and techniques as a means for improving safety outcomes is an association that has not been well studied, yet inadequate or inappropriate training is frequently cited as a cause of injury in forestry.<sup>36</sup> Safety training per se was not viewed as highly beneficial, but safety training that is incorporated into a broader skills training program was considered to be an effective means of reducing injury and illness.

Workers in the Northwest forest industry rely on training provided by their employers, trade

associations, contract logger associations, unions, and state and federal government programs. Yet, the recommendations that were raised suggest that there are gaps in reaching some workers and there should be an increased emphasis on skills training. Specific training issues raised by participants included: risk communication, formalized skills training, hazard recognition, training appropriate to work and region, emergency medical aid, effective educational tools, bilingual materials and an executive training program. It was also suggested that additional funds are needed to support training efforts.

## RESEARCH OPPORTUNITIES

- Determine if safety practices are influenced by skills training
- Perform training needs assessment
- Identify obstacles to training

- Evaluate effectiveness of behavior-based safety training
- Develop training methods that are economical and include incentives for their implementation
- Identify the characteristics of successful training programs and what makes them work
- Develop strategies to get information to remote areas
- Identify the resources needed for employers to conduct good training programs
- Develop training that is appropriate to specific worksite and workgroup
- Assess if advanced wilderness first aid courses improve injury outcomes
- Design various formats for video, computer, on-the-job instruction, train-the-trainer sessions, and trainer teams
- Compile a resource list of available training sources and libraries
- Use videos with short graphic messages that identify specific hazards associated with each job task
- Incorporate checklists into training manuals.
- Use the internet for training
- Provide accident scenarios and possible solutions

## TRAINING OPPORTUNITIES

- Replicate Swedish model with graded, multi-year training
- Develop certification and apprenticeship programs
- Provide continuous training, particularly on new equipment and changing technology
- Conduct safety training for top management
- Implement individualized training in the field
- Increase first aid and other emergency procedure training
- Instruct workers about hazard recognition
- Conduct tailgate sessions
- Teach injury response planning
- Provide guidelines for risk assessment and decision-making
- Develop self-training methods
- Design incremental training to avoid over-training and burnout
- Conduct pre-employment job skills testing to assess worker's training needs
- Partner new worker with experienced workers

## TRAINING MATERIALS

- Integrate more senses into training, using scale models, sight and sound, and hands-on training
- Develop materials for safety meetings
- Use pocket-size worker guides with color, illustrations, and useful format

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# WORKPLACE BEHAVIORS

*The most basic level of health promotion lies in the hands of individual workers. The behavioral sciences study workers' actions as influenced by knowledge, perceptions, motivations, skills, and environment. The field of behavioral safety has been applied in the forest industry with good results and indicates that the science of occupational psychology is an important direction for future research.*

[NIOSH NORA: None]

## IMPORTANCE

Timber harvesting requires technical skill, teamwork attitude, strength, agility, and quick mental responses. Along with all these demands, workers hold the responsibility for behavior that will save themselves and their coworkers from injury or loss of life. The concept that people's attitudes and behaviors affect their personal safety is intuitive and well documented, yet the contribution of an individual's behavior to their overall risk is not well understood. The field of behavioral safety has been applied to managers and employees in the forest industry with positive results, and indicates that the science of occupational psychology is an important direction for future research and holds a place within a safety program.

A member of the industry noted the importance of integrating behavior-based training into the workplace. He commented that, as an industry, we "...should provide as safe environment as possible and try to maintain a conscious level of safety in each individual.... The real problem is people being aware and alert of safety issues to themselves and others. Not just knowing safety first, but

knowing and acting. Since [we] have started behavioral safety...there has been a reduction in accidents."

Participants expressed concern about the following behaviors they consider are hazardous in Northwest forestlands: substance abuse, crew attentiveness, risk taking, safety attitude, violence in the workplace, and personal accountability.

## RESEARCH OPPORTUNITIES

- Develop strategies to identify and overcome barriers to wearing hearing protection
- Investigate the relationship between substance abuse and injury
- Identify measures that decrease substance abuse
- Develop methods to identify and measure positive safety behaviors
- Create methods and incentives to overcome resistance to modifying work habits

- Design behavior research to determine risk perceptions and attitudes toward taking safety precautions
- Investigate causes of workplace violence

#### TRAINING OPPORTUNITIES

- Conduct substance abuse interventions
- Implement behavior-based safety training techniques
- Resolve workplace violence through conflict resolution and mediation
- Use diagrams and fatalgrams (notice of fatal accidents) to keep industry informed about accidents

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# WORK ORGANIZATION

*Organization of work refers to how work processes are structured and managed. In addition to the long recognized job stress associated with aspects of work organization, studies are now identifying contributions to other health problems, including musculoskeletal disorders and cardiovascular diseases. Research is needed to better understand how the organization of work is influenced by the changing economy and workplace, and how the potential effects impact worker safety and health.*

[NIOSH NORA: Organization of Work]

## IMPORTANCE

The priority concerns on this topic, which were expressed by constituents, included long hours, speed of work, emotional stress, working alone, ground communications, harvesting design, and the decentralized nature of work. One participant noted the effect of exhaustion on injury rates in his operation. He said that the most common time of day for reported injuries was Monday morning and at the conclusion of workers putting in “bonus hours” on Wednesday afternoon. He suggested that researching the time and date of injuries by job category may provide new knowledge to reduce injuries in the workplace.

During the telephone interviews, a governmental agency representative raised the importance of orientation programs for new employees and for those new to a particular job. He emphasized that this initial training would alert workers to the specific hazards of the tasks; inform them about correct work procedures; and point out the precautionary measures that must be taken to ensure their safety and the safety of their cowork-

ers. He also stated that workers should be able to demonstrate their competence and that diligent supervision of safe work procedures is essential to preventing injuries.

A contractor who was interviewed during this project described how certain tasks were inherently dangerous and the solutions his company found to mitigate the dangers. He noted that “(T)he biggest hazard we have is line skidding on steep ground. I haven’t seen anything come along that will make it any safer. [We] need people who will do the job safely and not take any chances. A lot of this goes back to the fact that we pay higher wages and try to hire the best people available. Safety is one of our biggest long-term costs. It will really get you if you don’t take care of it. We will adopt new equipment if it is as safe and as productive as what we are already doing.”

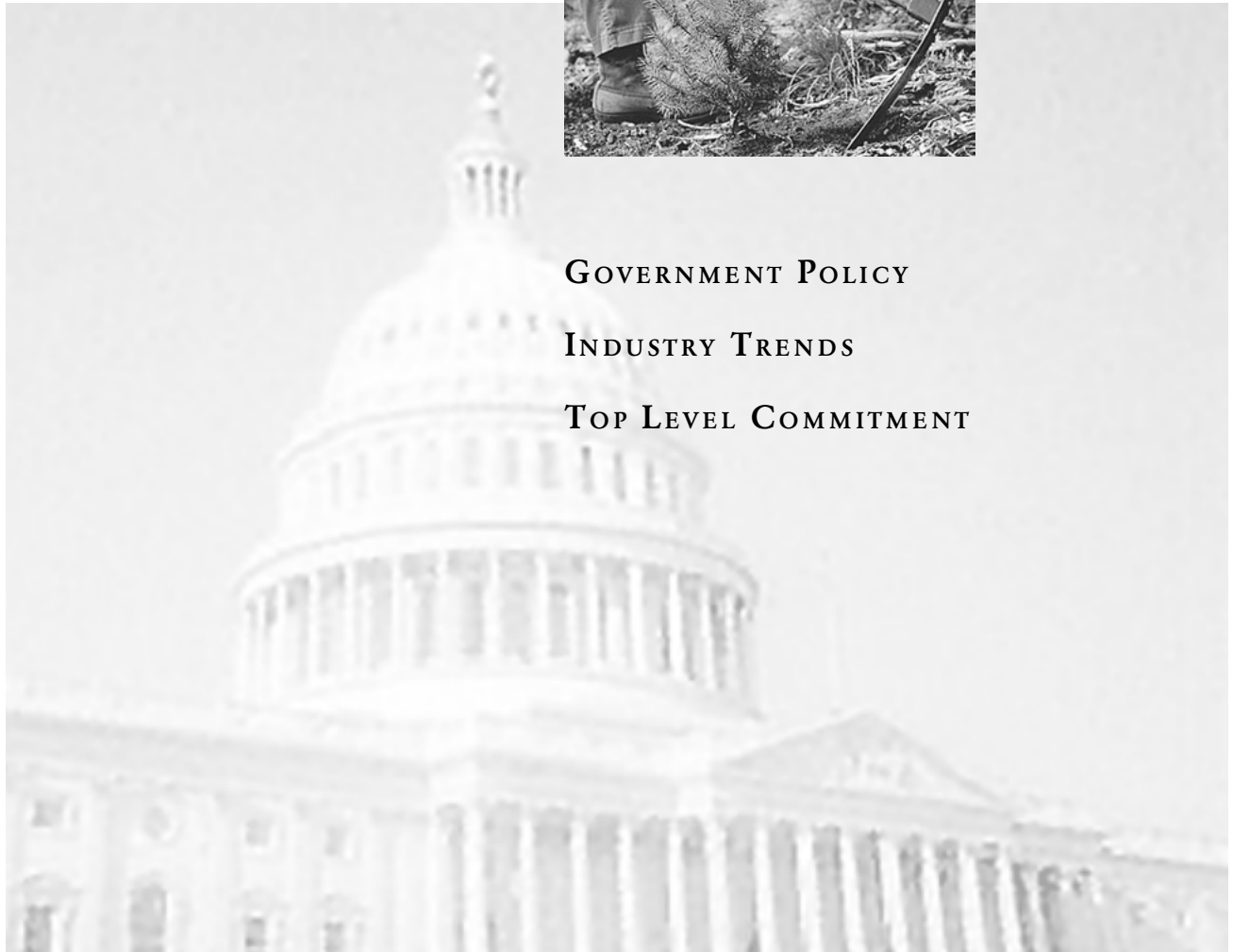
Other participants recommended that safety is always a priority and should be placed before the prescription for the sale.

## RESEARCH OPPORTUNITIES

- Identify organizational models that may contribute to workers' safety
- Examine the relationship between work organization and job type
- Investigate how small companies can be organized to improve safety
- Examine how work organization can reduce fatigue
- Determine how many employees work alone, the hazards of working alone, and how to reduce the hazards
- Develop a sensor that identifies presence of worker in operating area
- Develop signal system that tells workers if they are an appropriate distance from pull
- Establish framework that demonstrates impact on workers, cost/benefit analysis for required policies, and how factors can be mitigated with current technologies
- Look for correlation between fatalities and injuries and differences in forest prescriptions

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GOVERNMENT POLICY

INDUSTRY TRENDS

TOP LEVEL COMMITMENT

UNDERSTANDING HOW ECONOMIC AND POLICY FACTORS INFLUENCE the forest industry is vital to developing a clear picture of the safety and health issues facing workers in the woods. This category is composed of three priority areas: government policy, industry trends, and top level commitment, which provide the foundation for occupational safety and health in the forest industry. This section of the Agenda is a call for research as well as for support from management and policy makers.





# GOVERNMENT POLICY

*Sound public policy decisions about the forest industry require an understanding of the best science and a synthesis of ecological health, human health, and economic values. Both federal and state policies have had a tremendous influence on the economy and practices of the forest industry, which in turn, affect the safety and health of foresters and loggers. One participant detailed the hazards associated with the selective cutting policies enforced on US Forest Service lands in Alaska. He noted that selective harvesting on a site with overripe and decayed trees (as is common in Alaska), places fallers and rigging workers in serious jeopardy.*

[NIOSH NORA: None]

## IMPORTANCE

Both federal and state policies have had a tremendous influence on the economy and practices of the forest industry. Every worker in this industry has been personally touched by two types of legislation and regulation, those directed at improving ecological health and those aimed at improving the safety and health. Initiatives for forest health and worker health are often developed in isolation from one another and there can be conflicts in regulations, such that a task cannot meet the demands of an ecological regulation and be done safely.

Participants repeatedly identified a lack of communication between land management professionals, policymakers and forest managers, and the limited logging safety training and awareness among federal and state land management staff. Frequently, participants felt that miscommunication and misunderstandings were the basis for disagreement among loggers, purchasers, and land managers. Participants felt a need for greater

recognition that timber harvesting is now conducted on a multi-employer worksite. Also, they called for more practical standards for safety and health regulations and improved enforcement of existing regulations. Participants also expressed a need for greater access to consultation and training staff.

## RESEARCH OPPORTUNITIES

- Investigate why the logging industry is not treated as a multi-employer work site
- Evaluate the regulatory impacts of Washington state's new ergonomic rule

## TRAINING OPPORTUNITIES

- Implement safety training and awareness for all involved in timber sales
- Train land managers on the health and safety considerations and regulations that loggers face

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United States General Accounting Office. Search GAO Archives: [http://www.access.gpo.gov/su\\_docs/](http://www.access.gpo.gov/su_docs/).



## INDUSTRY TRENDS

*Over the past twenty years, the forest industry has experienced dramatic changes affecting employment, silvicultural approaches, and logging operations. Northwest constituents felt that some of the trends affecting the forest industry contribute to a worker's risk for injury and illness. These changes were acknowledged by a member of the industry noting that "(T)here is new technology and machinery that will eventually reduce most of the hazards. There will still be problems with steep ground [and] we will have to address existing and potential hazards in new machinery [with] more slips and falls, entanglement in machinery, communication problems between machines, [and] ergonomic issues for operators."*

[NIOSH NORA: Emerging Technologies, Social and Economic Consequences of Workplace Illness and Injury, Special Populations at Risk]

### IMPORTANCE

Increased public interest in sustainability and ecological concerns has affected land-use policies and resulted in the decline of available timber, and changes in silvicultural and logging practices. The decrease in timber supply has caused drastic cuts in employment and company shutdowns. In turn, this same trend has created new employment opportunities in ecological restoration. The industry has also seen a decrease of loggers employed directly by land management companies and an increasing number of contract logging companies.

Another recent trend is the increased mechanization of operations in the lower Northwest. This development may affect safety in both positive and negative ways, and may reduce employment, especially in labor-intensive tasks. Timber harvesting has a long history of technical and operational

changes. With each innovation (e.g., chain saw, high-line logging, helicopter logging) the hazards faced by workers have changed.

The industry also struggles with recruitment and retention of a well-qualified workforce because of competing job opportunities, aging workers, public perception of the industry, and low wages. The changing workforce has also seen the increase of minorities, especially Hispanic workers. In the past, these employees worked primarily in tree planting and tree nurseries. In recent times, their presence has expanded throughout the forest industry in more job sectors and as business owners.

Participants highlighted the following issues as major contributors to forestland workers' safety and health: low wages, lack of qualified and skilled workforce, public perception of industry,

special populations (in particular Hispanics and the older workforce), political and economic climate, changes in methods and technology, long hours (including commute) and small-diameter trees.

## RESEARCH OPPORTUNITIES

- Examine difference in hazards between virgin and second-growth forests
- Analyze whether frequency and severity of injury is related to pay structure (hourly vs. piecework)
- Investigate the correlation between physical fitness and injuries on the job
- Identify demographic changes in the workforce, particularly with Hispanic populations
- Document existing knowledge and special skills of older, possibly migrant or European workforce
- Demonstrate how changes in work practices affect productivity
- Determine the impact of small diameter trees on safety

## TRAINING OPPORTUNITIES

- Train all new workers on equipment operation and general safety
- Implement pre-employment job skills testing
- Partner new workers with experienced workers
- Provide conditioning programs for new workers or those entering jobs involving strenuous work
- Translate materials into appropriate Spanish dialects
- Scale materials to appropriate literacy levels, particularly for non-English-speaking workers

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## TOP LEVEL COMMITMENT

*The management of any organization (industry or agency) contributes to the foundation of a safety culture. Top level commitment can ensure that employee safety and health is more than a peripheral program through its integration into the overall management system. As one industry leader summarized, “We’ve tried to develop a clear message that safety has to be a value, nothing is worth getting hurt, and that we can make improvements in productivity in other ways.” Another industry representative reinforced this point, “I think the number one priority is to make safety one of the things we do. We are in a global economy and can’t afford to do anything that will lower our cost-effectiveness. Keeping healthy workers on the job is part of cost-effectiveness.”*

[NIOSH NORA: None]

### IMPORTANCE

The forest industry has made important advances nationwide to improve safety and health for its workers, and many Northwest industry leaders have demonstrated a strong commitment to this change. This topic, Top Level Commitment, was frequently raised by participants, and became one of the primary areas for discussion. Participants emphasized that top management of any organization, industry, or agency, has the authority and leadership capabilities to integrate safety and health into the overall management processes. Top administrators of an organization can have a profound effect on worker safety and health. As one participant noted, “[In] the first year, people in the field don’t have the capacity to change their work. You can tell them about the hazards associated with their jobs, [but it is] not simple to change. If you convince a manager that safety is a management responsibility, then

employees concerned about a hazard have a recourse, as the manager has the capacity to change. Management commitment is an important factor in safety rates.”

Participants spent significant time describing their concerns and suggestions. Issues identified included top management safety awareness, forestry stakeholder cooperation and communication, clear accountability for safety, financial incentives for safety, leadership, incident investigation and reporting, and recognizing excessive demands for productivity as an injury risk factor. These issues often extended beyond occupational safety and health research, and resulted in some interesting suggestions that may be useful to industry employers and associations. We have included the category “Suggestion Box,” which lists the ideas that did not fall specifically in the categories of research or training.

## RESEARCH OPPORTUNITIES

- Develop methods for building safety into business operations and accounting systems
- Establish method to collect “near-miss” information
- Investigate which accidents were attributable to contract language vs. environmental factors
- Examine how to overcome barriers to safety (such as fear of repercussions and time burden) through incentives, insurance breaks, and regulatory relief
- Develop a common template for employers to assist in data collection, analyses, and training
- Investigate the correlation of safe practices with productivity levels
- Assess the cost effectiveness of training
- Investigate how safety concerns can be integrated with management decisions, (such as how a stand is harvested, what techniques are used, and who is responsible for safety on-site)
- Identify most effective communication techniques

## TRAINING OPPORTUNITIES

- Focus on in-house training—need to teach preventive vs. reactionary measures
- Ensure training for all new employees
- Invest in top-level trainers
- Conduct leadership training
- Support better accident investigation training for agencies and contractor associations
- Convince management that safety awareness is part of their job and to use this knowledge to support employees
- Design management safety training to include worker involvement
- Develop internet-based safety and health training for managers

## SUGGESTION BOX

- Ensure that worker safety is given equal consideration with environmental safety
- Identify and highlight “best cases”
- Partner business with best companies for mentoring and technical assistance
- Establish coalition with mandate to resolve key safety issues
- Gather industry-wide support, including Labor and Industries, landowners, banks, state government, environmental and conservation groups, and loggers
- Make time and resources available for safety
- Develop written commitment to company safety
- Conduct a leadership forum on safety
- Make agencies accountable for contractors operating on public lands
- Assure agreement between contract language and policies
- Improve working relationship between agencies and timber companies
- Ensure that the plan and policies for harvest are “doable” and that cutting safely is possible
- Increase involvement and accountability of landowner
- Require that safety policies be incorporated into contracts
- Publish available information on safety violations
- Develop a checklist for contractors to verify that employees have been trained—including content, time, and mode of training
- Develop incentives for proactive safety behavior and not only low accident rates
- Identify communication barriers
- Encourage communication through suggestion boxes, tailgate sessions, safety committees and industry meetings
- Ensure top management has open door policy for all workers
- Make safety meeting minutes widely available

- Ensure safety manager has authority equal to other managers
- Increase interaction with safety specialists before policies are made
- Encourage industry-wide improvement of safety related accident reporting and use information to increase accountability for safety
- Determine how to improve communication and safety responsibility between contractor and landowner
- Design a better way of sharing information between regions, organizations, etc.
- Improve safety communication between companies

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HAZARD CONTROL TECHNOLOGY

INTERVENTION EFFECTIVENESS

MEDICAL SERVICE

SURVEILLANCE, DATA COLLECTION &  
REPORTING

THIS FINAL CATEGORY addresses four areas that are necessary for occupational health and safety research to reduce worker injuries and illnesses. Industry and policy changes rely on novel methods to identify current hazards, control recognized hazards, and identify and prevent the adverse consequences of emerging hazards. Hazard controls that are practical for the industry can dramatically reduce injury and illness. Evaluation of the strengths and weaknesses of interventions provide information to shape improved programs, regulations, and technologies. The ability to provide accurate and timely health care and emergency aid plays a vital role in the wellness of workers and the prevention of further harm. Finally, surveillance programs are a cornerstone of public health practice in areas such as infectious disease control, but have yet to be systematically established for injuries and disease related to forestry. Basic demographic, incidence, and prevalence data are needed to inform research and intervention programs.





# HAZARD CONTROL TECHNOLOGY

*A variety of engineering, administrative, and worker protection techniques can be used to manage health and safety hazards. These may include design changes to equipment, modifications to training efforts, or the design and proper use of personal protective equipment. Important concerns in Northwest forestland work include equipment modifications, and improved techniques for selective cutting, and the establishment of site-specific falling techniques. Basic and applied research is needed to identify, evaluate, and develop both health- and cost-effective control strategies for specific hazards, and to ensure their wide dissemination in the forestry community.*

[NIOSH NORA: Control Technology and Personal Protective Equipment]

## IMPORTANCE

Workplace health and safety hazards are normally mitigated by a hierarchy of control techniques, with engineering controls as the most preferred method, followed by administrative controls, and personal protection employed as a last resort. Engineering controls offer an opportunity to design a hazard out of the production process. The replacement of a hazardous product, for example, can reduce risk for workers across an entire industry. Technologies that reduce equipment noise or minimize repetitive motion can have an immediate effect on illness rates. Guard devices on equipment can prevent injuries and save lives. Administrative controls focus on proper management of the workplace. For instance, some of the project participants felt that the use of site-specific falling techniques could prevent many serious injuries. Finally, personal protective equipment can be an important strategy for reducing exposures when engineering and administrative

methods are not practical. The use of protective equipment, such as earplugs, caps, and muffs, can be an effective means for reducing noise exposure, for example, but any personal protection program must include extensive initial training, periodic retraining, continuous oversight, and regular maintenance.

## RESEARCH OPPORTUNITIES

- Investigate new methods and technologies to control noise and improve hearing protection
- Develop new logging techniques to mitigate selective logging hazards
- Establish site-specific falling techniques
- Generate new techniques for falling with less potential for injury
- Design new shoe tread for all weather conditions and improve existing footwear
- Develop new techniques to identify logs

- Conduct preventative research on handling chain saws incorporating body mechanics, use, etc.
- Identify how to adjust workload to avoid the detrimental effect of fatigue on safety
- Modify saw design to include a fire-control device

## TRAINING OPPORTUNITIES

- Implement personal protective equipment training
- Improve manufacturer guidelines for safe operation of equipment
- Follow Swedish model with graded, multi-year training
- Establish a formal certification and apprenticeship program
- Conduct a continuous training, particularly on new equipment and changing technology
- Translate materials into appropriate Spanish dialects
- Scale information to appropriate literacy levels, particularly for non-English speaking workers
- Individualize site-specific training in the field
- Implement work conditioning programs for new workers or those entering new jobs involving strenuous work

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# INTERVENTION EFFECTIVENESS

*Various health and safety interventions can prevent workplace illnesses and injury. Interventions can include control technologies, guidelines and regulations, worker participation programs, and training. Interventions in current use can be validated or improved through research that assesses their effectiveness. Evaluations can lead to improved control technologies, government regulations, enforcement procedures, and educational methods.*

[NIOSH NORA: Intervention Effectiveness Research]

## IMPORTANCE

Changes are often introduced into production with the intent of preventing or reducing illness and injury. Yet in many cases, the effectiveness of these changes remains unknown. Evaluation of interventions is a relatively new area of research in occupational health and safety. Such investigations can be expensive, and may seem unnecessary, particularly in cases where the intervention is relatively straightforward. Yet, there can be several intervention options, and their relative impact is an open question. Project participants identified training programs and hazard control technologies as priority areas for evaluation research.

## RESEARCH OPPORTUNITIES

- Evaluate and adapt European solutions
- Identify good handling techniques for chain saws
- Evaluate effectiveness of behavior-based and other forms of safety training

- Determine if an increase in first aid training and wilderness first aid training improve injury outcomes
- Determine if safety practices are influenced by training
- Evaluate hazard reductions from mechanical harvesting techniques

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## MEDICAL SERVICE

*Quality health care and timely emergency aid are essential for the well-being of workers, including loggers and foresters. Obtaining emergency aid and evacuation for acute injuries can be a significant challenge given the mountainous and rural forestlands in the Northwest. Many diseases and injuries can be caused by a combination of workplace and non-workplace exposures combined with preexisting conditions, so accurate diagnosis depends on rural health care professionals' understanding of workplace hazards.*

[NIOSH NORA: None]

### IMPORTANCE

Forestlands in the Northwest encompass large areas with relatively sparse populations. Emergency services in many regions are in great demand, and cannot always provide assistance fast enough for life-threatening situations, especially those in remote locations. Evacuation for acute injuries in the mountainous and rural forestlands in the Northwest is particularly problematic. Research can assist in identifying gaps in service and developing or expanding new services.

Also, many diseases and injuries can be caused by a combination of workplace and non-workplace exposures, combined with preexisting conditions. Research is needed to develop new methods of diagnosis, and to link diagnoses with specific workplace exposures. Rural health care professionals need further training in this area and in the identification and treatment of the diseases and injuries that affect Northwest loggers and foresters. One participant recommended further involvement by the medical community. He noted

that health care professionals need to “...understand job descriptions [and that] the medical community needs to ask the right questions and workers need to be able to describe [the incident]. Care providers need to be able to speak the same language.”

### RESEARCH OPPORTUNITIES

- Design prospective studies to determine which injuries would involve rural physicians, clinics, and hospitals
- Develop new medical care options
- Conduct response-time surveys to determine the effectiveness of emergency services on a regional basis

### TRAINING OPPORTUNITIES

- Offer education to rural health care professionals on job tasks and language of logging

- Conduct medical community training on workers' compensation system
- Increase first aid and other emergency procedure training
- Train clinicians, physicians, and nurses on noise-induced hearing loss, including how to refer patients for hearing tests

## ADDITIONAL INFORMATION

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# SURVEILLANCE, DATA COLLECTION & REPORTING

*Surveillance systems are essential for setting research priorities, as they provide answers to the questions, “who,” “what,” “why,” “where,” and “how.” The public health community relies on surveillance information to set research and prevention priorities, however gaps in many existing systems limit their usefulness. Surveillance systems in forestry need to be updated and expanded, and new methods for data collection and evaluation need to be developed. Creative efforts between the public and private sectors need to be initiated to develop effective systems.*

[NIOSH NORA: Surveillance Research Methods]

## IMPORTANCE

Surveillance systems have been a central tool in public health. The ongoing collection of injury, morbidity, and mortality data facilitates the identification and prioritization of public health efforts. When based on common definitions, surveillance data can point to unusual patterns or trends and guide decisions regarding the prioritization and direction of follow-up epidemiological investigations. When possible, the ongoing, large-scale collection of risk factor and hazard information can provide valuable guidance for the design and evaluation of prevention programs. This requires that the surveillance system be based on standardized definitions of risk factors, hazards, injury, illness, and disease, and standardized and comprehensive methods of data collection. Some of the best surveillance systems in the forest industry are administered within corporations and agencies. These systems are independent and do not allow for easy comparison. Further, information on near-miss

cases may suggest ways to prevent injuries and fatalities. New methods are needed to address the unique characteristics of surveillance systems that are administered by small businesses. Creative collaborative efforts of the public and private sectors need to be initiated to develop effective systems and to incorporate near-miss reporting in injury surveillance.

## RESEARCH OPPORTUNITIES

- Develop systematic and timely reporting of data collection results
- Develop a state-by-state study of the causes of serious injuries and fatalities
- Create a reporting structure for near-misses and identify how many near-misses occur prior to an incident
- Determine frequency, severity, and cost of incidents
- Develop a system that will help target research and prevention priorities

## ADDITIONAL INFORMATION

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# APPENDIX 1

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