

Needs Analysis

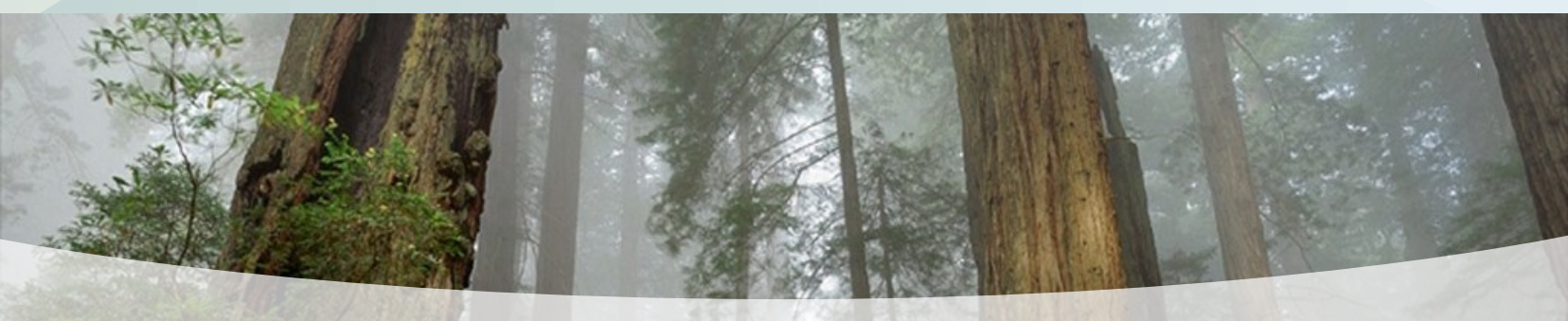
regarding

Silviculture Industry Health and Safety

in British Columbia

prepared for the
Forest Industry Safety Association
in partnership with
Western Silviculture Contractors' Association

prepared by
Shawn Morford, FORREX
Doug Ellis, Malaspina University College
Jennifer Turner, FORREX
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THE FOREST INDUSTRY SAFETY ASSOCIATION

*Helping Build a Professional,
Safe, Healthy Forest Industry*

Forest Industry Safety Association
1488 4th Avenue, Suite #602
Prince George, BC V2L 4Y2
www.forestsafe.ca

telephone: (250) 562 3215
toll-free: 1 877 324 1212
fax: (250) 562 9237
e-mail: fisa@forestsafe.ca



Contacts:

Shawn Morford
FORREX
506 W. Burnside Road
Victoria, B.C. V8Z 1M5
Tel: 250-363-0769
Fax: 250-363-3665
Email: shawn.morford@forrex.org

Doug Ellis
Director/Instructor
Forestry Extension
Faculty of Science and Technology
Malaspina University-College
900 Fifth Street
Nanaimo, B.C. V9R 5S5
Tel: 250-740-6198
Fax: 250-740-6480
Email: ellisd@mala.bc.ca

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Needs Analysis regarding Silviculture Industry Health and Safety in British Columbia

1 Introduction

In May 2003, the B.C. Forest Industry Safety Association (FISA) commissioned FORREX (Forest Research Extension Partnership) in partnership with Malaspina University College Forestry Extension Program to conduct a needs analysis of the health and safety issues of the silviculture industry in British Columbia. The results of the analysis are expected to aid FISA and its partner, the Western Silviculture Contractors Association (WSCA), in developing interventions aimed at reducing the frequency, cost, and severity of injuries and workers' compensation claims in this industry. The analysis focuses on workers in four classification units recognized by the Workers' Compensation Board:

CU 703001	Chemical brushing, weeding, tree thinning, and spacing
CU 703002	Mechanical brushing, weeding, tree thinning, and spacing
CU 703005	Forest fire fighting
CU 703016	Tree planting/cone-picking

Similar to silviculture work across Canada, this industry in B.C. is dominated by independent contractors whose crews work seasonally and whose work is typically remote and geographically dispersed. Workers in three of four classification units are primarily paid on a piece-work basis, with fire fighting (CU 703005) as the exception, which is hourly. The industry employs a range of ages, and workers are predominately male, although there are notable gender exceptions. It is generally thought that the silviculture industry in B.C., particularly tree planting, has a unique culture with identifiable social norms.

There is wide agreement that injury rates, claim costs, and severity of injuries are unnecessarily and unacceptably high in this sector. FISA/WSCA's goal is to design interventions such as training and education that have the greatest potential for reducing accidents and claims. The challenge of the study was to see beyond the statistics to the root causes of accidents so that interventions can be more than band-aid fixes.

A major thrust of this study was to identify accident patterns among workers in the four classification units and to identify links between worker/work environment characteristics and injury rates/characteristics. The study also includes a comprehensive review of research literature and interviews with key informants in B.C. The study also included a scoping exercise to root out other organizations with similar mandates, and to identify innovative approaches to improve safety.

1.1 How the report is organized

There were seven components of this project:

- Deliverables 1 and 2. Analysis of injury trends and patterns and injury "base case."
- Deliverable 3. Literature synthesis of occupational health and safety research
- Deliverable 4. A review of innovative approaches to reducing injuries elsewhere in Canada
- Deliverable 5. Summary of relevant training in the U.S. and elsewhere

Deliverable 6. Interviews with key informants in the industry
 Deliverable 7. Summary of B.C.'s safety outreach programs

The report is divided into six sections (Deliverable 1 and 2 are joined), each with a collection of support materials. A hard copy with the supporting materials collected from websites and mailed directly from other organizations is compiled in a binder; the written report is also available electronically in Microsoft Word.

1.2 Safety challenges of this industry

The silviculture industry in British Columbia can be considered as a “non-standard” type of industry that includes temporary, seasonal, fixed term contracts, self employment, home based businesses, work camps, and telecommuting. There are many career silviculture workers who supplement their incomes in the off season. Specific safety challenges for this sector identified by Lavioie (Lavioie 2002) include:

- A relatively high proportion of younger, inexperienced workers, including many from outside of the province. Inexperienced employees are likely to have relatively limited knowledge of the job hazards, can be unaware of their rights as workers, and are not unionized (except during a brief period under the NDP government in the late 1990s on the coast).
- Worksites are typically on steep and uneven terrain in remote areas. Falls, trips, and ATV accidents are common.
- Owner-managers often perform functions that are interrelated and interdependent. Many small businesses and workers are highly mobile.
- The work year includes short, intense seasons with significant pressure to perform at high levels for repeated days. The work is highly repetitive.

Given these challenges, interventions to improve the safety record will need to be creative, “out-of-the-box” approaches, with evaluation built in to any program to assess its effectiveness. This will include creative prevention partnerships and alliances with organizations that share in the mandate.

2 Methods used in this study

To accomplish the seven components, we conducted the following kinds of data collection and analyses.

Deliverables 1 and 2	Collection of Workers' Compensation Board Statistics, entering data into SPSS statistical software, running cross tabulations, interpreting results, presenting in tables, and summarizing in paragraph form.
Deliverable 3	Web and library based bibliographic searches, collecting and compiling academic articles on factors affecting safety in silviculture and effectiveness of intervention programs.

Deliverable 4	Phone interviews, emails, and letters to various contacts in Canada, collecting audio-visual materials, annual reports and other written materials. Summarizing key features of each.
Deliverable 5	Phone interviews, emails, and letters to various contacts in the U.S and elsewhere, collecting audio-visual materials, annual reports and other written materials. Summarizing key features of each.
Deliverable 6	Phone interviews with key informants in the B.C. silviculture industry. Compiling results.
Deliverable 7	Phone interviews, emails, and letters to various contacts in B.C, collection of audio-visual materials, annual reports and other written materials. Summarizing key features of each.

3 Limitations of the study

While silviculture is a well-recognized industry in British Columbia, there are many gaps in our knowledge about the industry. A 1997 Coopers and Lybrand study profiled the industry quite comprehensively, however, after five years and many changes in the province, the study is outdated and the statistics are likely less than perfectly reliable for this analysis as a result.

There are many factors that could influence injury rates that cannot be accounted for in secondary data that has been collected through the Workers' Compensation Board (WCB). Analysing the variables that are available from WCB only tells part of the story. We have relied on limited key informant interviews and literature review to fill in the gaps in the most reliably way possible. WCB accident forms have terminology that is open to interpretation; many parts of the forms have been left incomplete by employers. Near misses and accidents that don't result in a WCB claim are not recorded or included in the analysis.

Despite these limitations, we have done our best to present what is currently known about the state of safety in the silviculture industry in British Columbia using existing data sources and primary data through interviews.

4 Secondary Data Analysis and Base Case (Deliverables 1 and 2)

4.1 Introduction

The goal of this section was to review the secondary data available from the B.C. Worker's Compensation Board that describes the nature of claims and characteristics of claimants in the four classification units to identify trends and patterns and to "paint a picture" of the silviculture accident and safety situation in B.C. The WCB statistics we examined were available in two distinct kinds of sets:

- *Aggregated* data (that is, five years figures totaled together) on injury claims by individual classification unit between 1998-2002. This format allowed us to sort the data to address the question, "How is the industry hurting itself, how badly, and what is it costing?"
- Data on *individual* claims for 2001-2002. Individualized data (where we track several variables about individual claimants) were used to create what is called "cross tabulations" that enabled us to draw conclusions about the relationships between worker characteristics such as age and gender against injury characteristics, using the SPSS software (Statistical Package for Social Sciences). To draw statistical conclusions about these kinds of associations, individualized claim data is necessary. We were able to obtain individualized claim data for the period of 2001-2002.

The WCB data was based on information provided by employers on Form 7, "Employer's Report of Injury or Occupational Disease" that describes worker characteristics and the nature of the accident. While this data is limited, it does help paint a picture about some key factors associated with injuries.

This section addresses the following questions:

1. What is the nature of the safety situation in the silviculture industry based on the available statistics?"

More specifically,

- a. What was the most **frequent** type of accident, type of injury, and body part affected in the last five years? What is the trend?
- b. What was the most **costly** type of accident, type of injury, and body part affected in the last five years? What is the trend?
- c. What was the type of accident, type of injury, and body part affected that result in the **most lost time** in the last five years? What is the trend?
- d. How do claims statistics in the classification units compare with each other?

Data from WCB helps to answer the following questions for each of the following classification units as well as across all four classification units.

2. What are the linkages between certain worker factors and injury rates/days of work lost?

Based on 2001-2002 data on individual injury cases, we were able to present cross tabulations about the relationships between these factors:

- age of worker **X** type of accident
- age of worker **X** type of injury
- age of worker **X** body part

- gender **X** type of accident
- gender **X** type of injury
- gender **X** body part

- frequency of a particular type of accident **X** frequency of body part affected
- frequency of a particular type of accident **X** frequency of type of injury
- frequency of a particular type of accident **X** frequency of body part

3. What *doesn't* the existing data tell us (or, what data is unavailable?)

There are many factors that could be associated with injury other than those analysed in this section, but we were limited by the scope of this project to the available secondary quantitative data. Primary quantitative data collection on other factors such as work experience, time of season when accident occurred, amount of pre-season training and physical conditioning, and number of consecutive work days are sorely needed in order to get a full picture of the linkages between factors. The literature search in Deliverable 3 and qualitative data collected in the interviews in Deliverable 6 did help bridge this gap, however, and the data from those sources of information are discussed in those sections and in the conclusions and recommendations section of the report.

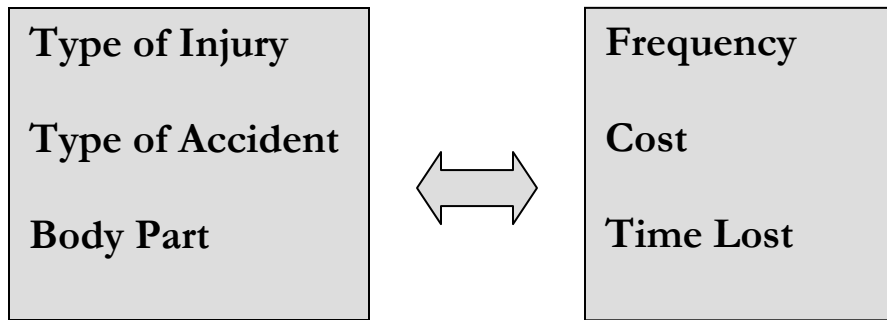
4. What would be the most efficient and effective points of intervention, given what we have learned about the “accident and safety picture?”

Given that the secondary data analysis is only one part of this overall needs assessment and the data is limited, we were careful not to make conclusive statements about possible points of intervention without incorporating information from the other sources of data. However, we make statements about what we believe *this* data is telling us. In the conclusions and recommendation sections of our overall report, we will present our overall recommendations.

4.2 How this section is organized

In the first part of the analysis, we focused on the **type of accident**, **type of injury**, and **body part affected** for each classification unit and for all classification units for 1998-2003 and arranged them by:

- frequency
- cost
- time lost



The data are presented through a series of tables and discussed in paragraph form.

In the second part of the analysis, we presented the frequency data through series of cross tabulations such as “gender by accident type.”

4.3 Limitations of the data

One of the most significant limitations of the data is that injury frequency numbers only tell part of the story without knowing the current total number of workers in each CU. The Cooper and Lybrand report from 1997 discusses partial (and now, outdated) information on age classes and gender for tree planting and non-tree planting companies. We assume that there are more still about 75 percent men and 25 percent women in the industry. We assume that the age breakdowns of workers in the industry are still the same now as in 1997, but this assumption is a limitation. More accurate calculations would be possible if we had access to current “injuries rates per capita in each CU,” but those figures are not available. Without a complete inventory of those in the industry, it’s limiting to make conclusions based on this data.

A second limiting factor is that Form 7 is apparently not being filled out completely or is being filled out improperly by many employers, according to WCB. Many accident descriptions on completed forms were sketchy at best, and definitions may have been open to interpretation by employers.

Other limitations:

- Did not have information on near miss incidents
- Did not have access to first aid report reports completed by employers (only ones that were resulted in a WCB claim)
- Did not have access to doctor’s reports
- Did not have access to individualized claim data except for 2001-2002

4.4 Results of the statistical analysis

Overall, mechanical spacing and brushing (CU 703002) appeared to have the highest average injury rate among the four classification units over the five-year period of 1997-2001.

Classification unit	Average injury rate
Chemical spacing and brushing (CU 703001)	18.8
Mechanical spacing and brushing (CU 703002)	24.7
Forest fire fighting (CU 703005)	17.4
Tree planting/cone picking (CU 703016)	17.6

The following table shows the relative number of employees, level of employment, and average claim costs per classification unit. It shows that while chemical spacing had a small number of employees relative to other CUs, claim costs per person year were considerably higher. Tree planting claims, by contract were the lowest per person year of employment.

Classification Unit	Average number of employers over five years '97-02	Average person years of employment over five years '97-02	Average claim costs over five years '97-02	Average claim costs per person years of employment
Chemical spacing	18	92	\$81,153	\$882
Mechanical spacing	47	945	\$1.68 million	\$1,777
Forest fire fighting	38	91	\$90,167	\$990
Tree planting	257	1,828	\$1.52 million	\$830

There are several ways to present data that shows the nature of the accident situation across all four classification units. We have chosen to show the accidents here under the headings, "Type of Accident, Type of Injury, and Body Part."

4.4.1. Type of Accident

The following eight Types of Accidents account for 89 percent of the accidents for all four Classification Units.

Struck By

The most frequent Type of Accident across all classification units is Struck By accidents (21 percent). These kinds of accidents cause injuries most frequently to fingers/wrists across all CUs. Eyes and knees are moderately subject to Struck By incidents, followed by legs, ankles/toes and arms. The most frequent injuries associated with these accidents are Cuts, Scratches and Abrasions, and Dislocations and Fractures. Crushes and Bruises are moderately linked with Struck By accidents.

This Type of Accident costs \$2.94 million or 23 percent of total claims costs, and it ranks #1 in claims costs. It also ranks #1 in the time lost category with 20,696 work days lost.

Fall: same level

These accidents cause injuries primarily to the knees, which in turn are strongly linked to strains. The next body part most frequently injured is fingers and wrists. Back, chest and arms are also injured in these kinds of incidents. Other Strains is by far the most frequent type of injury associated with this type of accident followed by Cuts, Crushes and Bruises, and Dislocations and Fractures. Back Strains also make up a minor component of Fall; same level incidents.

This type of accident costs \$1.4 million or 11 percent of total claim costs and it ranks #3 in the cost category. It ranks #2 in the time lost category with 16,344 work days lost.

Fall: from elevation

These accidents are described as accidents where the person fell from one elevation to another. The body parts most likely to be injured in these events are knees, ankle/toes and the back. Other Strains are by far the most common type of injury associated with these accidents. Dislocation and Fractures, followed by Back Strains and Crushes and Bruises are moderately associated with Fall; from elevation incidents.

This type of accident costs \$1.24 million or 10 percent of total claim costs and it ranks #4 in the cost category. It ranks #3 in the time lost category with 14,226 work days lost.

Overexertion

Overexertion accidents are those resulting from the application of force to some object and are the most frequent cause of back injuries in all four Classification Units. Other body parts moderately associated with overexertion are fingers/wrists and shoulders. When we look at the frequencies of Type of Injury associated with overexertion, we find that Back Strains is the most prevalent followed closely by Other strains.

This type of accident costs \$1.13 million or nine percent of total claim costs and it ranks #5 in the cost category. It ranks #5 in the time lost category with 7,173 work days lost.

Repetitive motion

The Body Part most frequently injured by Repetitive Motion accidents is the finger/wrists. The arms and elbows are less frequent, followed by shoulders and ankles/toes. Tendinitis is by far the most frequent Type of Injury experienced across all the classification units. The average claim cost of mechanical spacers is considerably higher than the average cost of tree planter claims (\$2,600 verses \$9,200), possibly because of the vibration of chainsaws, and possibly because we believe that spacers tend to be older workers.

This type of accident costs \$589,000 or five percent of total claim costs and it ranks #9 in the cost category. It ranks #6 in the time lost category with 7,067 work days lost.

Involuntary Motion

These are accidents that result from slips and other loss-of-balance events with no fall to the ground; they primarily result in injuries to the ankles/toes and knees. The back is the next most frequently injured body part followed by leg injuries. Involuntary Motion events are the cause of the majority of strain injuries (Other Strains and Back Strains).

This type of accident costs \$922,644 or seven percent of total claim costs and it ranks #6 in the cost category. It ranks #7 in the time lost category with 6,283 work days lost.

Other Voluntary Motion

This type of accident is defined as a single motion, like reaching, bending, walking, and twisting, causing injuries primarily to the back. These accidents are also linked to the ankles/toes and knees. The most frequent injury related to these accidents is Other Strains and Back Strains.

This type of accident costs \$261,360 or two percent of total claim costs and it ranks #11 in the cost category. It ranks #8 in the time lost category with 3,621 work days lost.

Vehicle Accidents

Vehicle Accidents often result in traumatic and severe injuries and have associated high claims costs. They often involve several workers per accident. All four fatalities in the industry were vehicle-related and occurred in classification unit 703016 (Tree Planting and Cone Picking). Two were motor vehicle accidents, one was an ATV and the other was related to a tractor.

These accidents are associated with a high incidence of Other Strains, followed by dislocations and fractures. Crushes and Bruises and Back Strains were also associated with Vehicle Accidents.

From 1998-2002 there were 115 claims involving highway vehicles. Thirty percent of these claims occurred in 1998 and 31 percent occurred in 2000. Of all the vehicle claims, 47 percent were jack-knifed or overturned. In 2000, the jack-knifed or overturned claims accounted for 66 percent of all claims for that year or 21 percent of all claims over the five-year period. In the year 2000, Classification Unit 703016 Tree planting accounted for 50 percent of the total number of claims over the five-year period. Also 65 percent of the claims in this CU over the five-year period are linked to overturned or jack-knifed incidents. Fifty-two percent of all vehicle claims are linked to the treeplanting CU.

Seventy-one percent of 'vehicles moving in opposite directions' claims occurred in 1998. Of the 14 'vehicles moving in opposite directions' claims, 13 (93 percent) happened in Classification Unit 703002 (Mechanical Spacing). Of these 13 claims, 69 percent happened in 2000.

ATVs are also significantly linked to accidents, including one death in the industry. Forty-one claims associated with ATVs were filed over the 1998-2002 period. Of these, 66 percent happened in Classification Unit 703016 (Tree planting). 1998 and 2000 were the worst years for incidents involving ATVs. These two years accounted for 62 percent of the claims. Of

the 41 total ATV claims, 51 percent were related to jack-knifed or overturned. The years 2001 and 2002 saw a declining rate of incidents involving ATVs.

These ATV accident statistics are certainly significant; these accident statistics would be useful to include in a handout at an ATV training targeted at silviculture workers.

The claims cost for all Vehicle Accidents was \$2.0 million or 16 percent, and this type of accident ranks #2 in the claims costs category. A total of 11,758 days were lost to vehicle accidents, and this accident type ranks #4 in the time lost category.

4.4.2 Type of injury

The following six types of injuries account for 87 percent of the claims in all Classification Units. In order of frequency they are:

Other Strains

The most frequent Type of Injury in all Classification Units is Other Strains at 28 percent of total number of injuries. These injuries occur primarily to the knees, ankles, toes, fingers/wrists, and shoulders. They occur less frequently to the leg, neck, chest, arm, and hips. The majority of other strains are caused by Falls from the same level and Falling from elevation. Other causes of strains are Overexertion, Other Voluntary Motions (such as reaching, bending walking or twisting), Involuntary Motion (slips, trips and other loss-of-balance events with no fall to the ground) and Vehicle Accidents. The 26-35 year old group experiences the highest number of Other Strains.

Other Strains is also the most frequent type of injury in **each** Classification Unit.

This type of injury costs \$2.4 million or 19 percent of total costs, and ranks #2 in the cost category. It ranks #1 in the time lost category with 26,560 work days lost.

Cuts

The second most frequent Type of Injury in all Classification Units is Cuts. The most frequent cause of cuts in all CUs is Struck By at 16 percent of total number of injuries. Cuts occurred mainly to fingers/wrists (40 percent of total number of cuts), and knees, followed by legs, then arms. Cuts accounted for 13 percent of injuries in the Tree Planting CU, nine percent in chemical brushing CU and two percent in the firefighting CU.

The occurrence of cuts in the Mechanical Spacing CU was higher than any other CU, with 23 percent of the total in mechanical spacing compared to 16 percent for all classification units. Seems to be very few cuts to the eyes, (eyes had more scratches and abrasions).

Most of the cuts in tree planting occur to the finger/wrist. Across the CUs, cuts are linked to tools (chainsaws, hand tools), and ground/vegetation. Most of the cuts occur to the younger 17-25 year age group.

This type of injury costs \$1.05 million or eight percent of total costs, and ranks #5 in the cost category. It ranks #3 in the time lost category with 12,023 work days lost.

Back Strains

Back Strains are the third most frequent type of injury across the classification units. Back Strains are attributable to overexertion, falls, other voluntary motion, involuntary motion and are also linked to vehicle accidents. Back Strains are linked to lifting and carrying heavy objects, pulling, slips and trips, bending, uneven weight distribution and terrain.

Back Strains cost \$1.2 million or nine percent of total costs, and rank #4 in the cost category. It ranks #3 in the time lost category with 1,185 days lost.

Tendinitis

Tendinitis is the fourth most frequent type injury. By far, the majority of these claims is linked to fingers, hands and wrists. The next most common body parts injured are arms, elbows and shoulders with some cases knees and ankles/toes. The major type of accident causing tendinitis is Repetitive Motion. The other cause of these injuries is overexertion. In tree planting, by far the most frequent cause of tendonitis is caused by repetitive use of the shovel. In the other CU's this injury is most closely linked to the use of power (chainsaws) and other tools.

Tendinitis costs \$589,292 or five percent of total costs, and rank #9 in the cost category. It ranks #6 in the time lost category with 7,067 days lost.

Crushes and Bruises

Crushes and bruises account for 10 percent of the overall claims. These injuries are caused primarily by falls; Struck By is the second most frequent accident. Some crush and bruise claims are also linked to vehicle accidents. The chest, finger/wrists, and knees are the most common parts of the body that are crushed and bruised.

This type of injury costs \$781,292 or six percent of total costs, and ranks #7 in the cost category. It ranks #6 in the time lost category with 6,706 work days lost.

Dislocations and Fractures

This type of injury rates second overall for time lost. Because these injuries are often traumatic, they also result in some of the highest individual and average claim costs. For frequency across the classification units, these injuries rank sixth overall (compared with fourth in Chemical Spacing and Firefighting and fifth in Mechanical Spacing).

The accidents most likely to cause dislocations and fractures are, in order of frequency of claims, Struck by, Fall: same level, Fall: from height, and Vehicle Accidents. The fingers/wrists and chest are highly susceptible to injury. Other body parts often subjected to dislocations and fractures are ankles/toes, shoulder, knees and back.

4.4.3 Body Parts

The following five body parts account for 65 percent of the claims.

Wrists and Fingers

The most frequently injured body part is the wrists and fingers. Tendinitis caused by repetitive motion is the most common injury. Cuts, crushes and bruises and dislocations and fractures to the fingers and wrists are caused mainly by struck by and fall incidents. Strains to the fingers and wrists are linked to falls and overexertion. Slips and trips, terrain, and tools and equipment are the cause of the majority of wrist/finger injuries.

Injuries to these body parts cost \$1.2 million or 10 percent of total costs, and ranks #4 in the cost category. It ranks #2 in the time lost category with 13,556 work days lost.

Knees

The second most frequent body part injured are the knees accounting for 15 percent of the claims. Strains are the most frequent type of knee injury and are linked mainly to falls and struck by incidents. Knees also have a tendency to become cut, crushed and bruised by Falls and Struck Bys.

Struck By accidents affect knees in mechanical spacing CU more than any other CU, and are related to the use of saws/machetes.

In tree planting there is a higher incident of strains to knee injuries from involuntary motion (slips and trips). Knee injuries are connected to terrain, ground conditions (holes, logs, vegetation), slopes, slips and trips, mud and wet conditions.

Injuries to these body parts cost \$1.7 million or 13 percent of total costs, and ranks #2 in the cost category. It ranks #1 in the time lost category with 21,449 work days lost.

Back

The next most frequent body part injured is the back. Overexertion is the primary cause of back injuries in all Classification Units. Back injuries are linked to Falls, Involuntary Motion and Voluntary Motion a few repetitive motion. Vehicle accidents also account for some back injuries.

Injuries to these body parts cost \$1.4 million or 11 percent of total costs, and ranks #3 in the cost category. It ranks #3 in the time lost category with 11,996 work days lost.

Ankles, Toes

These body parts are by far the most likely to be injured by Other Strain events. Dislocations and Fractures, Tendinitis, and Crushes and Bruises make up a small component of ankle/toe injuries. Involuntary Motion (slips, trips and twists) and Falls are the main cause of injury to these body parts.

Struck By incidents cause many cuts, crushes, and bruises to ankles and toes in mechanical spacing operations (mainly by saws). Workers also injure these body parts by falling into

holes, falling on slopes, falling on logs and vegetation, as well as tripping and slipping and, jumping.

Injuries to these body parts cost \$1.8 million or 14 percent of total costs, and ranks #1 in the cost category. It ranks #6 in the time lost category with 6,754 work days lost.

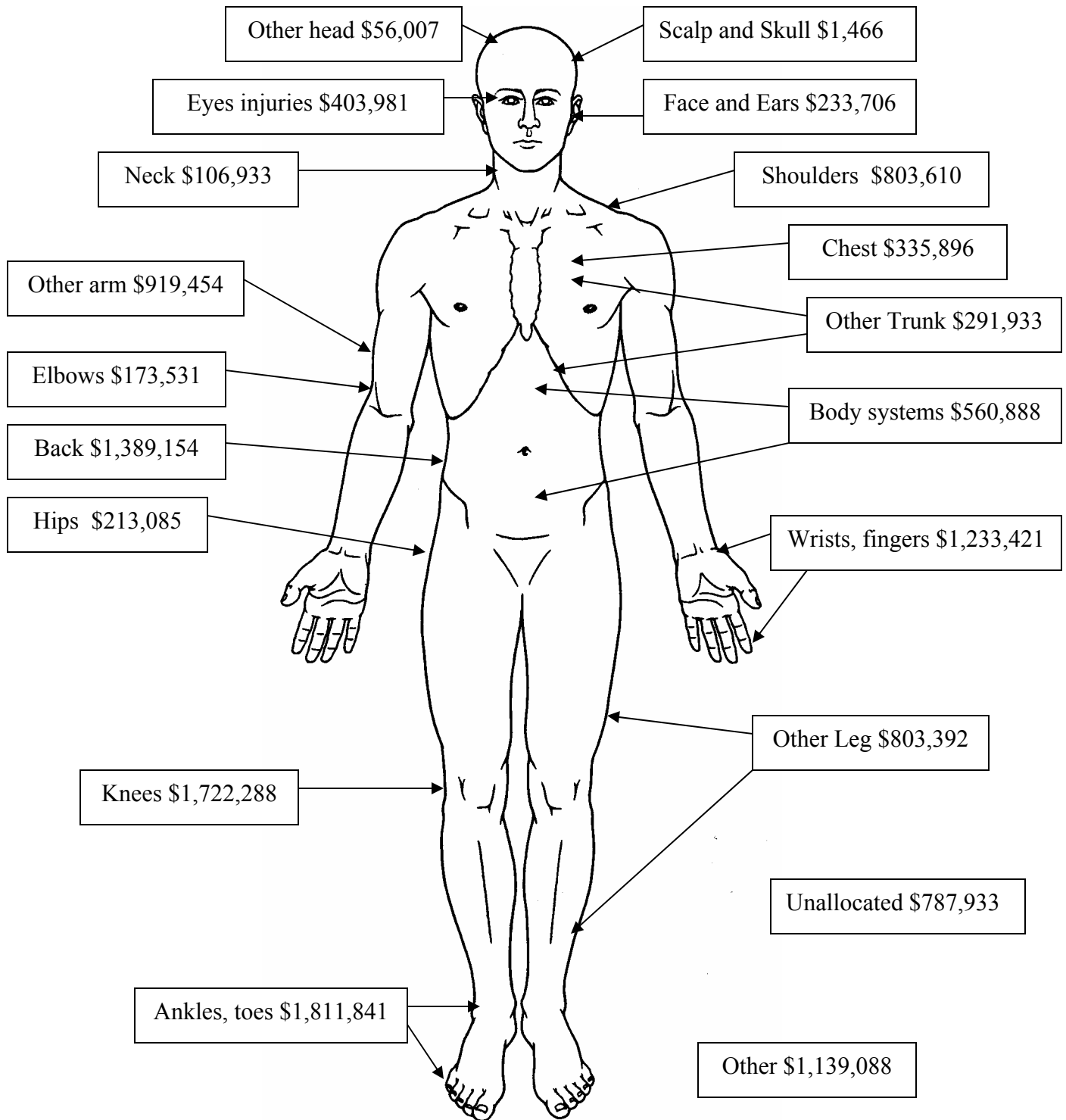
Eyes

Scratches and abrasions are the most frequent type of eye injury. Eyes are injured mainly by sticks and branches. There are also some claims associated with matter in the eye (such as dirt, wood chips rocks and non woody plants). The most frequent Type of Accident causing eye injuries is Struck by followed by Strike against.

Injuries to these body parts cost \$404,000 or three percent of total costs, and ranks #11 in the cost category. It ranks #4 in the time lost category with 1,893 work days lost.

Total Claims Paid \$12.8 million

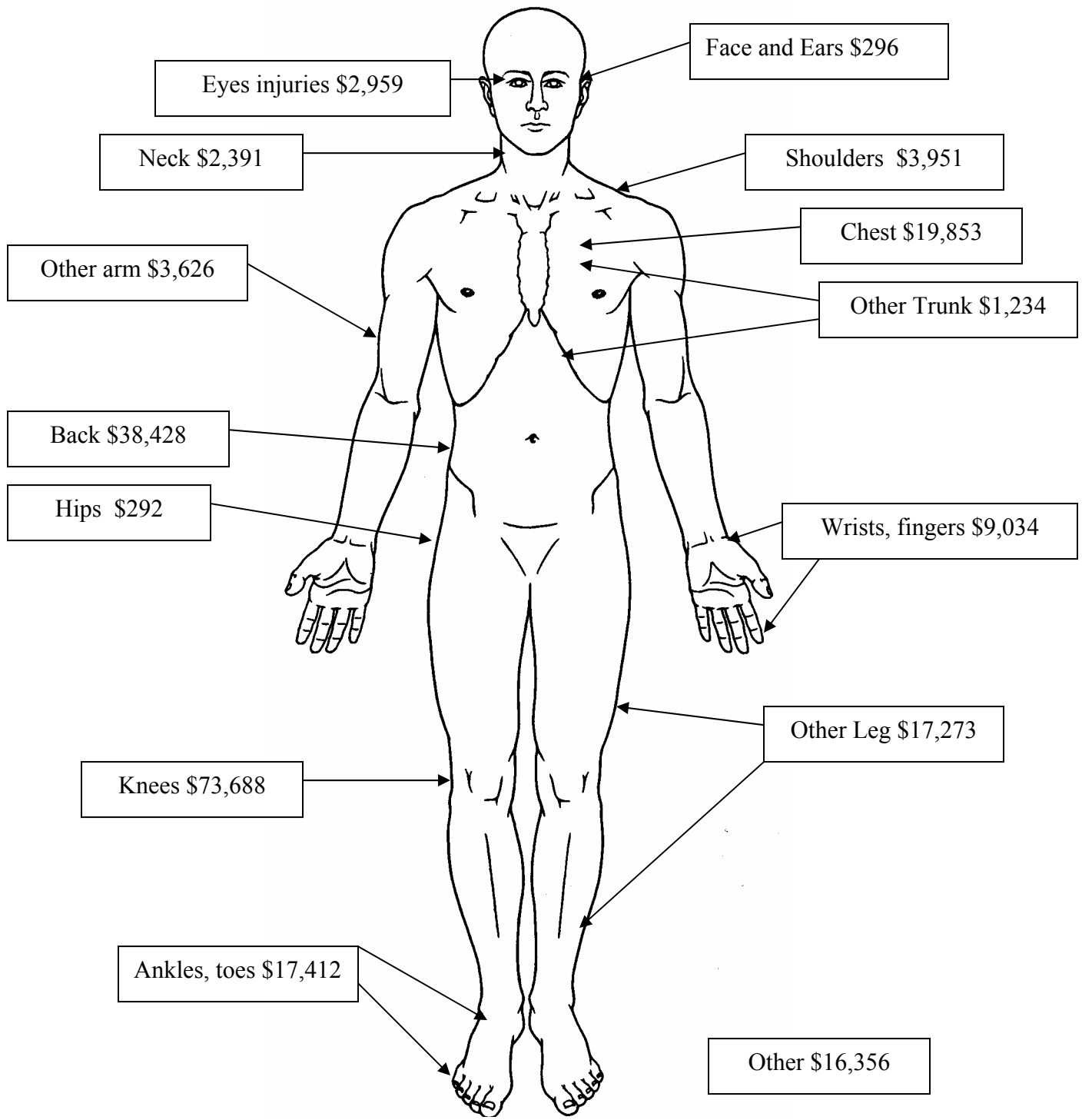
Source: Workers' Compensation Board of British Columbia
July 2003



**CLAIMS COSTS BY BODY PART-
All Classification Units, 1998-2002**

Total Claims Paid \$206,803

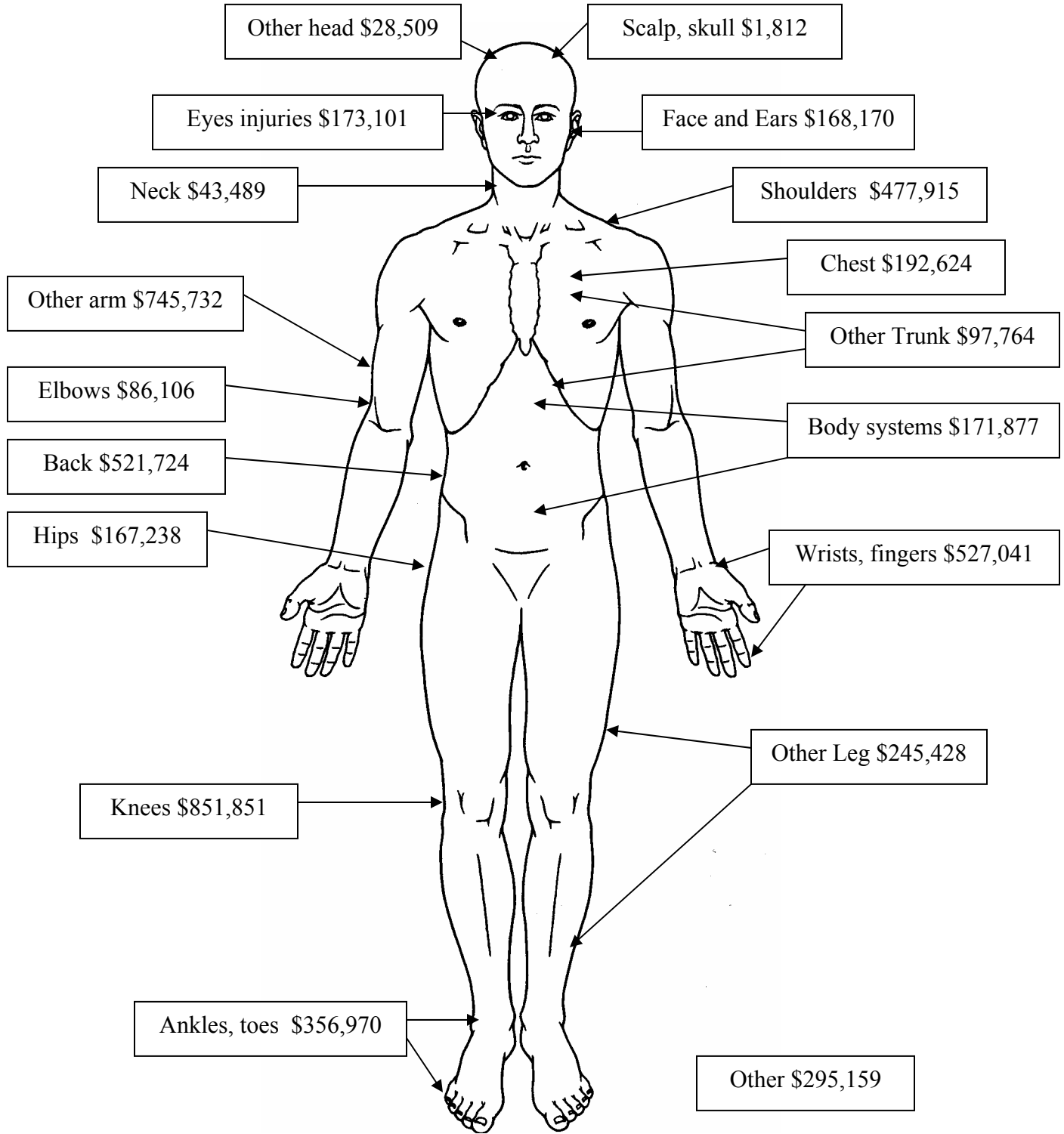
Source: Workers' Compensation Board of British Columbia
July 2003



**CLAIMS COSTS BY BODY PART – CU 703001
Chemical Spacing/Thinning 1998-2002**

Total Claims Paid \$5.1 million

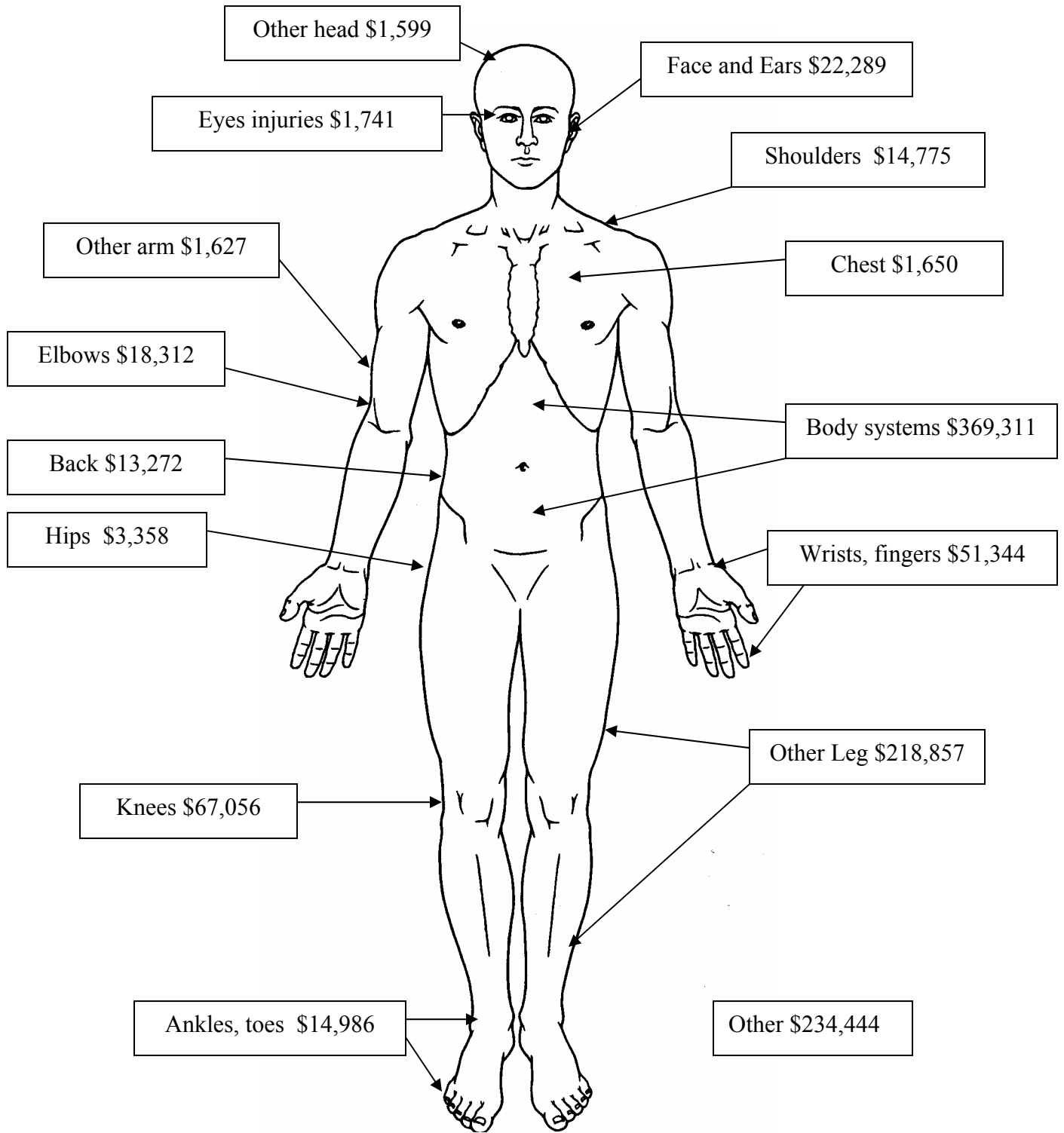
Source: Workers' Compensation Board of British Columbia
July 2003



**CLAIMS COSTS BY BODY PART – CU 703002
Mechanical Spacing/Thinning 1998-2002**

Total Claims Paid \$1.8 million

Source: Workers' Compensation Board of British Columbia
July 2003

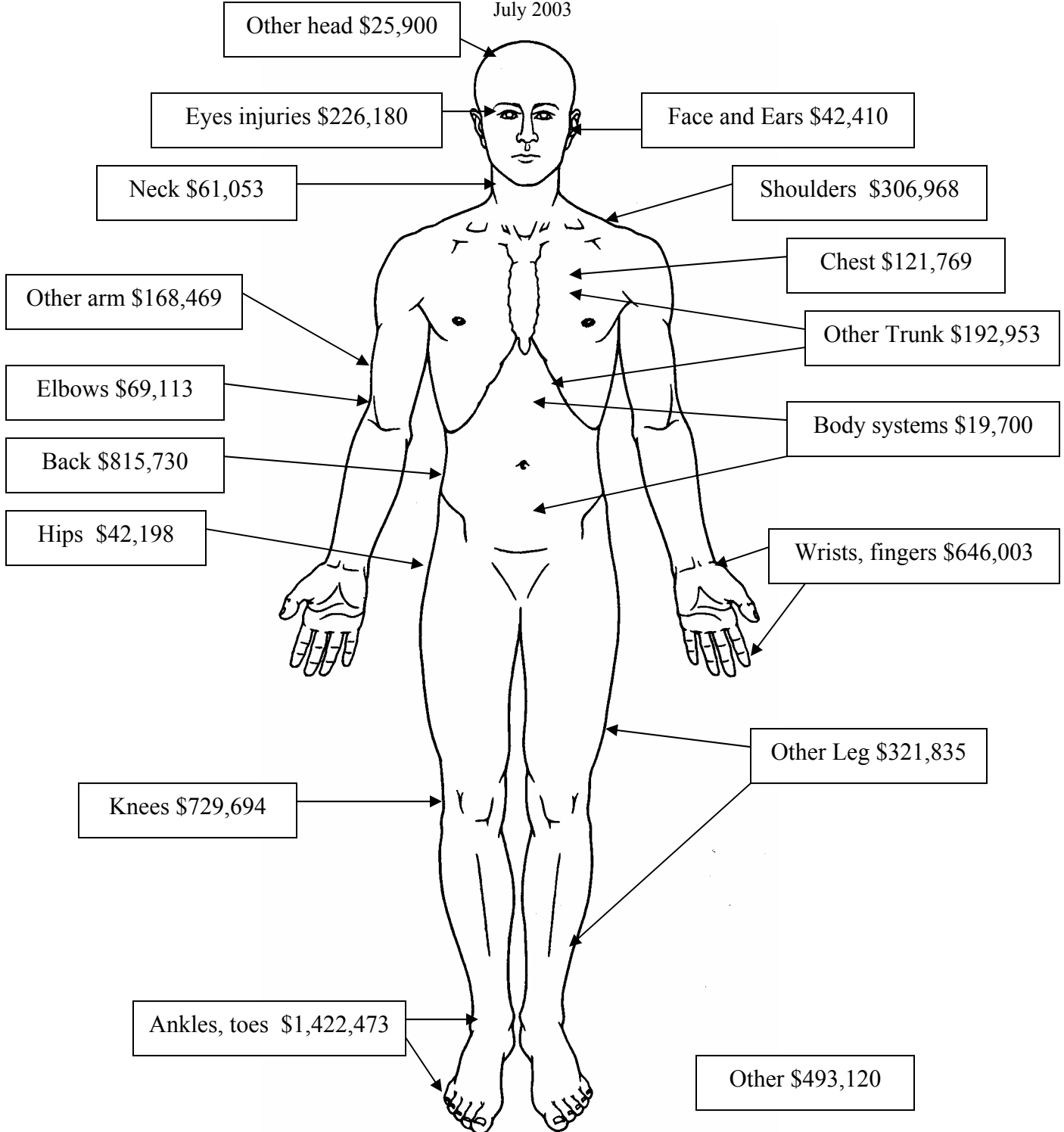


CLAIMS COSTS BY BODY PART – CU 703005
Fire Fighting 1998-2002

Total Claims Paid \$5.7 million

Source: Workers' Compensation Board of British Columbia

July 2003



**CLAIM COSTS BY BODY PART- CU 703016
Tree Planting/Cone Picking 1998-2002**

4.5 Gender comparisons

The best information available on gender profile is the 1997 Coopers/Lybrand report that states that females make up roughly 23 percent of the workforce across the industry. Using this statistic, there is a lower number of accidents in females proportional to the population than males in most categories. However, women have higher incidence of repetitive motion, overexertion and other voluntary motion (slips and trips) than males, and males are more frequently injured in vehicle accidents than females (93 percent of total). These calculations were made using the 2001-2002 WCB individualized data.

Males have higher incidents of Cuts (90 percent of total) and Dislocations and Fractures (92 percent). Females have a higher likelihood of Tendinitis (33 percent) injuries than males.

Males tend to have higher incidents of injuries to the eyes (90 percent) and hips (94 percent) than women.

4.6 Age comparisons

Using the Coopers Lybrand data as a baseline and comparing it to current statistics, we found several things relating to age worth noting. 36-45 year olds have a moderately higher chance of being injured in falls from elevation and involuntary motion than other age groups. For repetitive motion, the 17-25 year-old age groups were injured more often than other age groups (52 percent of total). Given that the Coopers Lybrand report states this age group constitutes 43 percent of the tree planting industry (and 40 percent overall), it appears that younger people are becoming injured by repetitive motion in greater rates than older workers. Unfortunately, we do not know if the age profile of the industry changed since 1997. It is possible that more young people are coming into the industry? Regardless, it seems clear that young tree planters would be appropriate targets for interventions regarding repetitive motion.

According to the same study, the 17-25 year age group accounts for 40-43 percent of the industry but accounts for 54 percent of the Tendinitis injuries. This injury has a strong relationship with repetitive motion.

By using the same methodology, several body parts/age group relationships are worth noting. Forty-eight percent of all finger/wrists injuries occur to workers in the 17-25 age group. Knees, 25 percent and Chest, 27 percent in the 36-45 age group (CL states this group comprises 15-22 percent of the workforce) and Eye at 45 percent for the 26-35 age group (CL 39 percent).

Comparison of frequencies of “Types of Accidents” by Rank for all Classification Units

Rank	All CUs	703016 Tree Planting	703001 Chemical Spacing	703002 Mechanical Spacing	703005 Fire Fighting
1st	Struck by	Fall:same level	Struck by	Struck by	Fall:same level
2nd	Fall:same level	Repetitive motion	Fall:same level	Fall:same level	Fall:from elevation
3rd	Fall:from elevation	Struck by	Fall:from elevation	Fall:from elevation	Struck by
4th	Overexertion	Overexertion	Vehicle accident	Overexertion	Involuntary motion
5th	Repetitive motion	Fall:from elevation	Overexertion	Involuntary motion	Other voluntary motion
6th	Involuntary motion	Involuntary motion	Caught in	Vehicle accident	Overexertion
7th	Vehicle accident	Other voluntary motion	Involuntary motion	Repetitive motion	Unallocated
8th	Other voluntary motion	Vehicle accident	Repetitive motion	Struck against	Caught in
9th	Struck against	Struck against	Toxics,noxious	Other voluntary motion	Vehicle accident
10th	Toxics,noxious	Toxics,noxious	Struck against	Matter in eye	Struck against
11th	Caught in	Caught in	Other voluntary motion	Toxics,noxious	Noise exposure
12th	Matter in eye	Rubbed,abraded	Matter in eye	Caught in	Toxics,noxious
13th	Rubbed,abraded	Matter in eye		Noise exposure	Rubbed,abraded
14th	Noise exposure	Heat, cold		Rubbed,abraded	Matter in eye
15th	Heat, cold	Other		Heat, cold	Repetitive motion
16th	Other			Other	
17th	Unallocated				
Total	2567	1468	81	954	64

Comparison of frequencies of “Types of Injuries” by Rank for all Classification Units

Rank	All CUs	703016 Tree Planting	703001 Chemical Spacing	703002 Mechanical Spacing	703005 Fire Fighting
1st	Other strains	Other strains	Other strains	Other strains	Other strains
2nd	Cuts	Tendinitis,related	Crush, bruise	Cuts	Crush, bruise
3rd	Back strains	Back strains	Back strains	Crush, bruise	Back strains
4th	Tendinitis,related	Cuts	Dislocations, fractures	Back strains	Dislocations,fractures
5th	Crush, bruise	Crush, bruise	Cuts	Dislocations, fractures	Other disease
6th	Dislocation,fracture	Dislocation,fracture	Scratch,abrasion	Scratch,abrasion	Unallocated
7th	Scratch,abrasion	Scratch,abrasion	Tendinitis,related	Tendinitis,related	Scratch,abrasion
8th	Other disease	Other disease	Chemical burn	Other injury	Other injury
9th	Other injury	Other injury	Other disease	Other disease	Tendinitis,related
10th	Chemical burn	Chemical burn		Hearing loss	Hearing loss
11th	Hearing loss	Multiple injuries		Chemical burn	Cuts
12th	Multiple injury			Multiple injuries	
13th	Unallocated				
Total	2567	1468	81	954	64

Comparison of frequencies of “Body Parts” by Rank for all Classification Units

Rank	All CUs	703016 Tree Planting	703001 Chemical Spacing	703002 Mechanical Spacing	703005 Fire Fighting
1st	Wrist,fingers	Wrist,fingers	Back	Wrist,fingers	Ankle,toes
2nd	Knees	Knees	Knees	Knees	Knees
3rd	Back	Back	Wrist,fingers	Back	Wrist,fingers
4th	Ankle,toes	Ankle,toes	Ankle,toes	Ankle,toes	Back
5th	Eye injuries	Other leg	Eye injuries	Eye injuries	Eye injuries
6th	Other leg	Other arm	Chest	Other leg	Unallocated
7th	Other arm	Eye injuries	Other	Other arm	Face and ears
8th	Shoulders	Shoulders	Other leg	Chest	Shoulders
9th	Other	Other	Neck	Other	Other leg
10th	Chest	Elbows	Other arm	Shoulders	Other arm
11th	Elbows	Chest	Shoulders	Face and ears	Other
12th	Neck	Neck	Hips	Hips	Other head
13th	Face and ears	Hips	Other trunk	Neck	Elbows
14th	Hips	Face and ears	Face and ears	Other head	Chest
15th	Other head	Other trunk		Other trunk	Hips
16th	Other trunk	Other head		Elbows	
17th	Body systems	Body systems		Body systems	
18th	Unallocated			Scalp, skull	
Total	2567	1468	81	954	64

4.7 Regional comparisons

We compared accident claim statistics across regions of the province through a cross tabulation of variables using 2001-2002 individualized claim data. While cross-region comparisons without considering relative size of the industry in each region can be misleading, some observations for each classification unit are notable.

1. CU 703001 – Chemical Spacing

Of the 26 claims in Chemical Spacing Classification Unit, 15 (58%) occurred in the Fraser/Prince George Region. This could indicate that the use of herbicides is more common in this region, or that some other factors account for the high percentage of claims.

2. CU 703002 – Mechanical Spacing

Forty-eight percent of the claims in mechanical spacing occurred in six of the 25 regions. They are ranked in order of frequency:

1. Cariboo
2. Nanaimo – (36 percent of accident occurred to age group 36-45)
3. Bulkley
4. Fraser/Prince George
5. Kitimat

6. Thompson

It's also notable that five of the 14 claims in the Peace River region were related to vehicle accidents.

3. CU 703005 – Contract Fire Fighting

No anomalies were noted.

The tables for each classification unit are found in Appendix E.

4. CU 703016 – Tree Planting

Notable findings:

- In the Fraser/Prince George region, 75 percent of the claims occurred to the 17-25 age group
- Sixty-three percent of the “repetitive injury” accidents occurred in the Fraser/Prince George and Vancouver regions (35 percent Fraser/PG, 28 percent Vancouver)
- 55 percent of “other strains” occurred in these same regions (25 percent Fraser/PG, 30 percent Vancouver.)
- 59 percent of the tendonitis claims also originated in these regions (33 percent Fraser/PG, 26 percent Vancouver)
- “Struck by” and “overexertion” claims were more frequent in the Kootenays (by percent of overall claims) than in the other regions. It is possible that this related to difficult terrain or vegetation in this region
- 26 percent of the “cuts” claims occurred in the Fraser/PG region

4.8 Company size (activity levels) and injury rate comparisons

Is there a relationship between the size of companies and safety records? Are larger companies less or more likely to have injuries than smaller companies?

To answer these questions, we obtained a payroll spreadsheet from WCB for each classification unit that included data on injury rates for each company. We sorted by payroll beginning with the larger companies and descending to smaller companies. There did not appear to be any patterns or trends that would link injury rates to payroll size.

Large companies have larger workforces therefore they have greater exposures to the hazards of the workplace. Since Risk = Hazard x Exposure, therefore increased exposure (number of workers) = increased risk. We must also acknowledge that job functions, terrain, and other workplace factors vary greatly across the province and classification units. These variables make it difficult to draw reliable conclusions about the relationship between company size and injury unless we can find a way to isolate other variables for the analysis.

These variables include:

- tendencies for underreporting injuries to WCB.
- Turn-over rate in employees. Do some employers lay off injured workers (so they can collect EI) rather than have them file for a lost time injury?
- Magnitude of individual claims. A high injury rate for smaller companies could result from one accident.

To get reliable information to show possible company size/injury rate linkages, it would be helpful to profile each CU to identify the services that individual companies provide and inherent risks, dangers and exposures of the workplace.

It would also be useful to conduct case studies to investigate why certain companies have zero injury rates and identify what they are doing that other companies are not.

4.9 Our interpretation of the data

When we look at the frequencies of Accident Types across all the classification units we see some patterns. Accidents that involve falls and being hit are the most frequent. This is very high across all CUs. This data begs the question: are these Falls and Struck Bys related to fatigue? Stress? Improper equipment? We don't know. Repetitive motion injuries show up very frequently in tree planting, but not as high ranking in other CUs. We were surprised that repetitive motion injury wasn't ranked as highly in other CUs, especially in fire fighting where repetitive motions ranks at the bottom.

Slips and trips are also a common type of accident and are linked to weather and terrain – in some ways “comes with the territory.” Increasing awareness and knowledge of hazards among workers could help reduce the exposure to risks.

By far, the most costly accidents per claim are vehicle accidents especially those involving traumatic injuries. Claims worth over \$100,000 for vehicle accidents is not uncommon. Struck by accidents are also more expensive per claim and there are many more of them than vehicle accidents. Repetitive motion injuries, while frequent, have considerably lower costs per claim (\$2,600 for tree planting, \$9,200 for spacing for the five year period 1998-2002). While having fewer accidents, older workers tend to have higher costs per injury.

There are logical links between high frequency of various types of accidents, kinds of injuries, and body parts injured – for example, repetitive motion accidents, tendinitis injuries, and wrists and fingers are prominent in tree planting. Knee injuries are the second most frequent body part injured in all classification units, and are linked to strains. Ankles/toes are also very frequent body parts injured across all CUs. Injuries to ankles and toes are ranked highest in terms of frequency among fire fighting, compared with other body parts (in other words, if fire fighters are going to hurt any body part, it would most likely be ankles/toes that are linked to falls).

Eye injuries ranked fifth compared with other body parts across most CUs, but in tree planting it ranks seventh.

Injuries to the head (other than eyes) do not appear to be frequent. At least two key informants spoke of workers removing hard hats during planting. The ranking of head injuries is slightly higher in fire fighters and several descriptions of the injuries referred to hearing loss.

In the small sample of chemical spacers in the data set, back strains are the most frequent injury type. We expect that back strains are linked to overexertion.

4.10 Implications of the data

-Simply stated, --tree planters and mechanical spacers need to find ways to avoid repetitive use injuries.

-Workers in all four Classification Units need to avoid overexertion. This appears as high-ranking issue across all CUs. Back injuries are particular issues across the board in all CUs.

- Most types of accidents are linked to falls. Workers need to avoid falling, including the kind of falling that involves any kind of level change (such as jumping off the back of a pick-up) or falling from the same level (such as twisting an ankle on level ground). Information to workers on frequency and causes of slips and trips could help reduce these kinds of injuries.

-The highest number of accidents are related to Struck By incidents. Workers are being hit by something or are falling against something and many struck by incidents are serious. This includes examples such as kick backs from chainsaws, getting hit by branches and limbs, crushes and bruises to fingers, jumping away from a wasp nest, and hitting oneself with scythe. Workers need to increase their awareness about the tools and hazards and be self-motivated for their individual safety. They need to be made aware of the inherent personal safety risks and how to avoid them.

-Vehicle accidents, both on and off the job, (including ATVs) result in serious injuries and deaths in this industry. The WCB data, combined with the information gathered in the interviews, confirm that this is an obvious point of intervention. Workers need to slow down, learn to properly load vehicles, and understand vehicle limitations. Workers need especially to know the limitations of ATVs. Employers need to establish and enforce tighter guidelines for vehicle operations and allow use of vehicles that are matched to the worksite (i.e. vans were not recommended by several interviews).

-As stated earlier, the data collected for this study only provides one perspective of the safety picture for silviculture workers. There are many variables that could influence safety records, and we have listed several below.

4.11 Further research

Desirable relationships to examine	Potential source of data (future projects)
Number of ATV accidents and injury types	Form 7 to include box to complete if ATV accident (so data is quantitative and can be run statistically)
-Size of company and injury accident characteristics	Improve Form 7 form to include this data
-How long they have been on the job and injury/accident characteristics	Improve wording of Form 7 to specify this data
-Whether they use the D shovel and injury/accident characteristics	Survey of workers or case study
-Indicators of worker attitude about safety and injury/accident characteristics	Identify likely indicators through literature then conduct survey of workers
-Indicators of managers' attitude about safety and injury/accident characteristics	Identify likely indicators through literature then conduct survey of managers

4.12 Statistical descriptions by Classification Unit

4.12.1 Classification Unit 703001: Chemical Brushing and Weeding or Chemical Thinning or Spacing

Description

- Number of Employers: 24 (June, 2003)
- Base Rate in 2003: \$6.51 per \$100 of assessable earnings, to a maximum of wage per worker of \$60,100
- Injury rate trends (average number of short term disability claims per 100 person years of WCB-covered employment):

1998	1999	2000	2001	2002	Total
25.7	13.5	13.7	19.3	24.2	20.0

- Services provided

Beetle eradication	Chemical conifer release
Chemically clear undergrowth	Chemically space trees
Chemically thin trees	Hack and squirt
Mistletoe eradication	Vegetation control
Woodlot brushing	Woodlot spacing
Woodlot thinning	Woodlot weeding

- Inputs or materials used

Chemicals	Sprays	Herbicides
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- Equipment used

Chemical sprayer	Global positioning system (GPS) receiver
Hack & squirt equipment	Spray truck

- Tasks performed

1. Brushing and weeding: spraying herbicide on undergrowth and weed species to reduce competition for conifers.
2. Thinning and spacing (hack & squirt): cut a wound into unwanted trees and spray herbicide into the wound.

Summary Table for Frequency

Source: Workers compensation Board of British Columbia, July, 2003

Year	Frequency (# of short and long-term disability claims accepted)	Claim costs	Days lost in year
1998	34	\$67,882	977
1999	17	\$42,160	894
2000	7	\$21,204	237
2001	9	\$18,761	259
2002	14	\$56,795	613
Total	81	\$206,803	2,980

1. Frequency

Type of Accident	Number of claims	Percent of total
Struck by	14	17
Fall: same level	14	17
Fall: from elevation	14	17
Vehicle accident	13	16
Overexertion	8	10
Caught in	4	5
Involuntary motion	4	5
Repetitive motion	4	5
Toxics, noxious	3	4
Struck against	1	1
Other voluntary motion	1	1
Total	81	100

Type of Injury	Number of claims	Percent of total
Other strains	29	36
Crush, bruise	12	15
Back strains	10	12
Dislocations, fractures	9	11
Cuts	7	9
Scratch,abrasion	6	7
Tendinitis,related	4	5
Chemical burn	2	2
Other disease	1	1
Total	81	100

Body Part	Number of claims	Percent of total
Back	13	16
Knees	13	16
Wrist,fingers	10	12
Ankle,toes	9	11
Eye injuries	7	9
Chest	7	9
Other	5	6
Other leg	4	5
Neck	3	4
Other arm	3	4
Shoulders	3	4
Hips	1	1
Other trunk	1	1
Face and ears	0	0
Total	81	100

2. Costs

Type of Accident	Cost of claims	Percent of total
Fall: from elevation	\$75,147	36
Involuntary motion	\$30,674	15
Fall: same level	\$29,876	14
Vehicle accident	\$22,021	11
Struck by	\$18,202	9
Overexertion	\$15,019	7
Toxics, noxious	\$5,797	3
Repetitive motion	\$5,581	3
Caught in	\$2,078	1
Struck against	\$1,495	1
Other voluntary motion	\$904	0
Matter in eye	\$9	0
Total	\$206,803	100

Type of Injury	Cost of claims	Percent of total
Other strains	\$93,704	45
Back strains	\$35,494	17
Dislocation,fracture	\$31,432	15
Crush, bruise	\$17,966	9
Cuts	\$14,862	7
Tendinitis, related	\$5,581	3
Chemical burn	\$4,563	2
Scratch,abrasion	\$1,967	1
Other disease	\$1,234	1
Total	\$206,803	100

Body Part	Cost of claims	Percent of total
Knees	\$73,688	36
Back	\$38,428	19
Chest	\$19,853	10
Ankle,toes	\$17,412	8
Other leg	\$17,273	8
Other	\$16,365	8
Wrist,fingers	\$9,034	4
Shoulders	\$3,951	2
Other arm	\$3,626	2
Eye injuries	\$2,959	1
Neck	\$2,391	1
Other trunk	\$1,234	1
Face and ears	\$296	0
Hips	\$292	0
Total	\$206,803	100

3. Time lost

Type of Accident	Days lost	Percent of total
Fall: from elevation	1,220	40.9
Fall: same level	461	15.5
Vehicle accident	363	12.2
Struck by	257	8.6
Involuntary motion	256	8.6
Overexertion	153	5.1
Repetitive motion	103	3.5
Toxics, noxious	72	2.4
Other voluntary motion	55	1.8
Caught in	24	0.8
Struck against	16	0.5
Matter in eye	0	0.0
Total	2,980	100

Type of Injury	Days lost	Percent of total
Other strains	1,262	42
Dislocation,fracture	528	18
Crush, bruise	495	17
Back strains	381	13
Cuts	115	4
Tendinitis, related	103	3
Chemical burn	49	2
Scratch,abrasion	23	1
Other disease	23	1
Total	2,980	100

Body Part	Days lost	Percent of total
Knees	858	29
Other	490	16
Back	411	14
Other leg	291	10
Ankle,toes	275	9
Chest	215	7
Neck	120	4
Other arm	87	3
Wrist,fingers	73	2
Shoulders	60	2
Eye injuries	39	1
Hips	23	1
Other trunk	23	1
Face and ears	15	1
Total	2,980	100

C. Cross tabulations between worker and work environment and injury characteristics- CU 703001

Injury Type by Body Part – CU 703001

	finger, wrist	other leg	knees	back	Other	O trunk	ankle, toe	eye	shoulder	chest	neck	
other strains			3		1		3		1	2	1	11
Back strains				1								1
crush. bruises	1	1	1		1					1		5
cuts	1									1		2
other disease						1						1
dislocation, fractures										2	1	3
chemical burn					1			1				2
Scratch, abrasion								1				1
	2	1	4	1	3	1	3	2	1	6	2	26

Type of Accident by Type of Injury – CU 703001

	other strains	Back strains	crush. bruises	cuts	other disease	dislocation, fractures	chemical burn	Scratch, abrasion	
fall, same level	4			1		1			6
vehicle accident	3		1						4
toxics, noxious					1		2		3
struck by			1	1		2		1	5
fall, from elevation	2		1						3
overexertion	1								1
caught in			1						1
other vol motion		1							1
Involuntary motion	1								1
strike against			1						1
	11	1	5	2	1	3	2	1	26

Type of Accident by Body Part- CU 703001

	finger, wrist	other leg	knees	back	Other	O trunk	ankle, toe	eye	shoulder	chest	neck	
fall, same level	1		2				2			1		6
vehicle accident					2					1	1	4
toxics, noxious					1	1		1				3
struck by	1							1		2	1	5
fall, from elevation			2						1			3
overexertion										1		1
caught in										1		1
other vol motion				1								1
Involuntary motion							1					1
strike against		1										1
	2	1	4	1	3	1	3	2	1	6	2	26

4.12.2 Classification Unit 703002: Brushing and Weeding or Thinning or Spacing

Description

- Number of Employers: 457 (June, 2003)
- Base Rate 2003: \$6.51 per \$100 of assessable earnings, to a maximum of wage per worker of \$60,100
- Injury rate trends (average number of short term disability claims per 100 person years of WCB-covered employment):

1998	1999	2000	2001	2002	Total
27.3	24.6	24.8	19.6	14.1	22.6

- Services provided

Girdle Bushes	Girdle trees
Manual brushing & weeding	Manual conifer release
Manual tree slashing	Manually clear undergrowth
Manually space trees	Manually thin trees
Mechanical brushing & weeding	Mechanical conifer release
Mechanically clear undergrowth	Mechanically space trees
Mechanically thin trees	Mistletoe eradication
Pruning	Scarification
Slash burning	Vegetation control
Woodlot brushing	Woodlot spacing
Woodlot thinning	Woodlot weeding

- Equipment used

4WD truck	All-terrain vehicle
Backpack sprayer	Brush cutter
Brush hook	Brush saw
Bunch saw	Chains
Chainsaw	Climbing gear
Clinometer	Crawler tractor
Drip torches	Excavator
Fencing material	Girdles
Global Positioning System equipment	Grass whip
Hand saw	Hand sickle
Hand tools	Hopper
Horse	Hose
Machete	Mattock
Pole saw	Portable band saw mill
Pruning lopper	Pruning saw
Scythe	Sheep

Skill saw	Tractor
Tree pruner	

- Occupations

Brush cutter	Brusher
Pruner	Spacer

- Tasks performed

1. Brushing and weeding: spraying herbicide on undergrowth and weed species to reduce competition for conifers.
2. Thinning and spacing (hack & squirt): cut a wound into unwanted trees and spray herbicide into the wound.

Summary Table for Frequency

Source: Workers compensation Board of British Columbia, July, 2003

Year	Frequency (# of short and long-term disability claims accepted)	Claim costs	Days lost in year
1998	224	\$756,441	7,275
1999	217	\$693,702	8,771
2000	224	\$1,306,437	9,223
2001	192	\$1,220,098	7,919
2002	97	\$1,175,832	5,819
Total	954	\$5,152,510	39,007

1. Frequency

Type of Accident	Number of claims	Percent of total
Struck by	314	33
Fall: same level	169	18
Fall: from elevation	118	12
Overexertion	73	8
Involuntary motion	55	6
Vehicle accident	52	5
Repetitive motion	41	4
Struck against	37	4
Other voluntary motion	29	3
Matter in eye	22	2
Toxics, noxious	15	2
Caught in	13	1
Noise exposure	8	1
Rubbed, abraded	3	0
Heat, cold	2	0
Other	2	0
Total	954	100

Type of Injury	Number of claims	Percent of total
Other strains	229	24
Cuts	215	23
Crush, bruise	114	12
Back strains	108	11
Dislocations, fractures	94	10
Scratch,abrasion	90	9
Tendinitis, related	53	6
Other injury	25	3
Other disease	15	2

Hearing loss	8	1
Chemical burn	4	0
Total	954	100

Body Part	Number of claims	Percent of total
Wrist, fingers	160	17
Knees	139	15
Back	118	12
Ankle, toes	92	10
Eye injuries	89	9
Other leg	67	7
Other arm	55	6
Chest	47	5
Other	43	5
Shoulders	40	4
Face and ears	23	2
Hips	19	2
Neck	18	2
Other head	15	2
Other trunk	14	1
Elbows	10	1
Body systems	4	0
Scalp, skull	2	0
Total	954	100

2. Costs

Type of Accident	Cost of claims	Percent of total
Struck by	\$1,900,601	37
Fall: from elevation	\$708,600	14
Overexertion	\$551,667	11
Vehicle accident	\$536,785	10
Fall: same level	\$534,138	10
Involuntary motion	\$203,723	4
Toxics, noxious	\$172,830	3
Repetitive motion	\$164,790	3
Caught in	\$133,656	3
Struck against	\$75,330	1
Other	\$53,694	1
Noise exposure	\$51,898	1
Other voluntary motion	\$49,987	1
Matter in eye	\$7,605	0
Heat, cold	\$5,335	0
Rubbed, abraded	\$1,873	0
Total	\$5,152,510	100

Type of Injury	Cost of claims	Percent of total
Dislocations, fractures	\$2,106,633	41
Other strains	\$847,651	16
Cuts	\$638,449	12
Crush, bruise	\$496,332	10
Back strains	\$487,017	9
Tendinitis, related	\$210,452	4
Other disease	\$175,127	3
Other injury	\$111,603	2
Hearing loss	\$51,898	1
Scratch,abrasion	\$32,944	1
Chemical burn	\$3,250	0
Total	\$5,152,510	100

Body Part	Cost of claims	Percent of total
Knees	\$851,851	17
Other arm	\$745,732	14
Wrist,fingers	\$527,041	10
Back	\$521,724	10
Shoulders	\$477,915	9
Ankle,toes	\$356,970	7
Other	\$295,159	6
Other leg	\$245,428	5
Chest	\$192,624	4
Eye injuries	\$173,101	3
Body systems	\$171,877	3
Face and ears	\$168,170	3
Hips	\$167,238	3
Other trunk	\$97,764	2
Elbows	\$86,106	2
Neck	\$43,489	1
Other head	\$28,509	1
Scalp, skull	\$1,812	0
Total	\$5,152,510	100

3. Time lost

Type of Accident	Days lost	Percent of total
Struck by	11,817	30
Fall: same level	6,195	16
Fall: from elevation	5,886	15
Vehicle accident	4,858	12
Repetitive motion	2,585	7
Involuntary motion	2,364	6
Overexertion	1,872	5
Struck against	830	2

Other voluntary motion	813	2
Caught in	717	2
Toxics, noxious	649	2
Other	243	1
Matter in eye	87	0
Heat, cold	65	0
Rubbed, abraded	26	0
Total	39,007	100

Type of Injury	Days lost	Percent of total
Dislocations, fractures	10,260	26
Other strains	8,861	23
Cuts	7,796	20
Crush, bruise	3,491	9
Back strains	3,278	8
Tendinitis, related	2,832	7
Other disease	1,049	3
Other injury	989	3
Scratch,abrasion	395	1
Total	39,007	100

Body Part	Days lost	Percent of total
Knees	8,738	22
Wrist,fingers	6,616	17
Other	3,776	10
Back	3,457	9
Ankle,toes	2,491	6
Other leg	2,247	6
Other arm	2,038	5
Chest	1,674	4
Shoulders	1,252	3
Elbows	1,238	3
Other trunk	1,206	3
Body systems	994	3
Neck	930	2
Hips	891	2
Face and ears	868	2
Eye injuries	375	1
Other head	205	1
Scalp, skull	11	0
Total	39,007	100

C. Cross tabulations between worker and work environment and injury characteristics- CU 703002

Type of Injury by Body Part - CU 703002

	finger wrist	other leg	knees	other head	back	Other	O trunk	ankle toe	Other arm	eye	elbow s	hips	Shoul -der	Sys- tems	chest	neck	face and ear	
other sprains	8	2	24			11	1	18	2			4	4			4		78
Back sprains					30													30
crush. bruises	3	2	6	1	3	3		3	2		1		1		7			32
Tendinitus	8		1					1	1		1	1	2					15
cuts	20	11	13					5	9	1		2	1				2	64
other disease	1							1						1				3
dislocation , fractures	8		2			2		3	2		1	1	5		7			31
chem burn									1									1
other injury	1			7						1		3						12
Scratch, abrasion			2					1		22								25
Hearing loss																	2	2
	49	15	48	8	33	16	1	32	17	24	3	11	13	1	14	4	4	293

Type of Accident by Type of Injury- CU 703002

	other strains	Back strains	crush. bruises	Tendinitus	cuts	other disease	dislocation, fract	chem burn	other injury	Scratch, abrasion	Hearing loss	
fall, same level	15	3	13	1	11		6		2	1		52
vehicle accident	8		3	1	1	1	4		1			19
toxics, noxious						1		1				2
struck by	9		7		43		12		6	15		92
fall, from elevation	12	5	7	1	4		7					36
Overexertion	14	17					1		2			34
caught in	3		2		1							6
other vol motion	5	2										7
Involuntary motion	12	3					1					16
repetitive motion				12								12
heat, cold									1			1
matter in eye										4		4
strike against					4					4		8
rubbed, abraded						1				1		2
noise exposure											2	2
	78	30	32	15	64	3	31	1	12	25	2	293

Type of Accident by Body Part- CU 703002

	finger wrist	other leg	knees	other head	back	Other	O trunk	Ankle toe	Other arm	eye	elbow	hips	Shoul- -der	Sys- -tems	chest	neck	face and ear	
fall, same level	10	2	13	2	3	2		2	6		1	1	1		7		2	52
vehicle accident			1	1	1	8		1				1	3	1	1	1		19
toxics, noxious	1								1									2
struck by	21	8	16	5		3		11	5	17		1	1		1	3		92
fall, from elevation	3	2	7		7	1		5			1	3	2		5			36
Overex- -ertion	3		2		17	2	1		2			3	4					34
caught in	1	2	1					2										6
other vol -motion		1	1		2			2				1						7
Involuntary -motion			5		3			6				1	1					16
repetitive -motion	8							1	1		1		1					12
heat, cold	1																	1
matter in -eye										4								4
strike -against	1		2						2	3								8
rubbed, -abraded								2										2
noise -exposure																	2	2
	49	15	48	8	33	16	1	32	17	24	3	11	13	1	14	4	4	293

4.12.3 Classification Unit 703005: Forest Fire Fighting

Description

- Number of Employers: 36 (June, 2003)
- Base Rate in 2003: \$6.51 per \$100 of assessable earnings, to a maximum of wage per worker of \$60,100
- Injury rate trends (average number of short term disability claims per 100 person years of WCB-covered employment):

1998	1999	2000	2001	2002	Total
15.6	20.7	7.0	10.1	8.5	12.4

- Services provided

Burn fire lines	Controlled burns
Fell trees	Track lightning strikes
Fight fires	Fight forest fires
Investigate forest fires	

- Inputs or materials used

Fire retardants	Water
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- Equipment used

Backhoe	Bulldozer
Chainsaw	Fire fighting equipment
Helicopter	Hose
Shovel	Specialized computer
Trucks	Water bomber airplane
Water pump	Water truck

- Occupations

Firefighter	Pilot
Rap-attack crewman	Smoke jumper

Employees in this classification unit are typically paid hourly, are paid to attend regular safety activities, and engage in ongoing training exercises to maintain optimum physical fitness. Safety is considered a on-going part of the fire “culture.” B.C. Ministry of Forest protection staff are not included in this classification unit.

Summary Table for Frequency

Year	Frequency (# of short and long-term disability claims accepted)	Claim costs	Days lost in year
1998	25	\$570	\$314,132
1999	16	\$1,138	\$1,101,130
2000	6	\$500	\$155,298
2001	11	\$671	\$66,155
2002	6	\$468	\$186,437
Total	64	\$3,347	\$1,823,153

1. Frequency

Type of Accident	Number of claims	Percent of total
Fall: same level	10	16
Fall: from elevation	10	16
Struck by	8	13
Involuntary motion	8	13
Other voluntary motion	4	6
Overexertion	4	6
Unallocated	4	6
Caught in	3	5
Vehicle accident	3	5
Struck against	2	3
Noise exposure	2	3
Toxics, noxious	2	3
Rubbed, abraded	1	2
Matter in eye	1	2
Repetitive motion	1	2
	64	100

Type of Injury	Number of claims	Percent of total
Other strains	26	41
Crush, bruise	8	13
Back strains	6	9
Dislocation, fracture	4	6
Other disease	4	6
Unallocated	4	6
Scratch, abrasion	3	5
Other injury	2	3
Tendinitis, related	2	3
Hearing loss	2	3
Cuts	1	2
Chemical burn	1	2
Total	64	100

Body Part	Number of claims	Percent of total
Ankle,toes	12	19
Knees	10	16
Wrist,fingers	7	11
Back	7	11
Eye injuries	5	8
Unallocated	4	6
Face and ears	3	5
Shoulders	3	5
Other leg	3	5
Other arm	2	3
Other	2	3
Other head	1	2
Elbows	1	2
Chest	1	2
Hips	1	2
Body systems	1	2
Total	64	100

2. Costs

Type of Accident	Cost of claims	Percent of total
Unallocated	\$787,993	43
Caught in	\$213,808	12
Toxics, noxious	\$206,294	11
Involuntary motion	\$174,499	10
Other	\$161,187	9
Struck by	\$113,281	6
Overexertion	\$54,502	3
Fall: same level	\$32,047	2
Noise exposure	\$22,719	1
Vehicle accident	\$17,253	1
Repetitive motion	\$16,227	1
Fall: from elevation	\$16,199	1
Other voluntary motion	\$3,959	0
Struck against	\$1,176	0
Rubbed, abraded	\$1,169	0
Matter in eye	\$839	0
Total	\$1,823,153	100

Type of Injury	Cost of claims	Percent of total
Unallocated	\$787,993	43
Other disease	\$378,186	21
Dislocation, fracture	\$314,146	17
Other injury	\$151,282	8
Other strains	\$100,802	6
Multiple injury	\$31,059	2
Hearing loss	\$22,719	1
Tendinitis, related	\$17,279	1
Back strains	\$9,401	1
Crush, bruise	\$7,976	0
Cuts	\$1,169	0
Scratch, abrasion	\$1,034	0
Chemical burn	\$106	0
Total	\$1,823,153	100

Body Part	Cost of claims	Percent of total
Unallocated	\$787,993	43
Body systems	\$369,311	20
Other	\$234,444	13
Other leg	\$218,857	12
Knees	\$67,056	4
Wrist, fingers	\$51,344	3
Face and ears	\$22,829	1
Elbows	\$18,312	1
Ankle, toes	\$14,986	1

Shoulders	\$14,775	1
Back	\$13,272	1
Hips	\$3,358	0
Eye injuries	\$1,741	0
Chest	\$1,650	0
Other arm	\$1,627	0
Other head	\$1,599	0
Total	\$1,823,153	100

3. Time lost

Type of Accident	Days lost	Percent of total
Unallocated	575	17
Struck by	531	16
Caught in	507	15
Fall: from elevation	364	11
Fall: same level	363	11
Involuntary motion	245	7
Vehicle accident	219	7
Overexertion	208	6
Repetitive motion	151	5
Matter in eye	96	3
Other voluntary motion	58	2
Struck against	19	1
Rubbed, abraded	10	0
Toxics, noxious	2	0
Total	3,347	100

Type of Injury	Days lost	Percent of total
Other strains	953	28
Dislocation,fracture	951	28
Unallocated	575	17
Other disease	200	6
Back strains	189	6
Tendinitis, related	160	5
Crush, bruise	143	4
Scratch,abrasion	98	3
Other injury	67	2
Cuts	10	0
Chemical burn	1	0
Multiple injury	0	0
Hearing loss	0	0
Total	3,347	100

Body Part	Days lost	Percent of total
Knees	956	29
Unallocated	575	17
Other leg	436	13
Back	278	8
Shoulders	222	7
Ankle,toes	192	6
Wrist,fingers	173	5
Elbows	161	5
Eye injuries	105	3
Body systems	103	3
Hips	49	1
Other head	38	1
Other arm	23	1
Other	23	1
Chest	12	0
Face and ears	1	0
Total	3,347	100

C. Cross tabulations between worker and work environment and injury characteristics- CU 703005

Type of Injury by Body Part- CU 703005

	finger, wrist	other leg	knees	back	Other	ankle, toe	eye	elbows	face and ear	
other strains	1	1	3		1	5				11
Back strains				2						2
crush. bruises	1									1
Tendinitus								1		1
other disease	1								1	2
chem burn							1			1
Hearing loss									1	1
	3	1	3	2	1	5	1	1	2	19

Type of Accident by Type of Injury- CU 703005

	other strains	Back strains	crush bruises	Tendinitus	other disease	chem burn	Hearing loss	
fall, same level	2							2
vehicle accident	1							1
toxics, noxious					1	1		2
struck by	1							1
fall, from elevation	5	1						6
Overexertion		1			1			2
caught in			1					1

other vol motion	1							1
Involuntary motion	1							1
repetitive motion				1				1
noise exposure							1	1
	11	2	1	1	2	1	1	19

Type of Accident by Body Part- CU 703005

	finger, wrist	other leg	knees	back	Other	ankle, toe	eye	elbows	face and ear	
fall, same level	1		1							2
vehicle accident					1					1
toxics, noxious							1		1	2
struck by			1							1
fall, from elevation		1	1	1		3				6
Overexertion	1			1						2
caught in	1									1
other vol motion						1				1
Involuntary motion						1				1
repetitive motion								1		1
noise exposure									1	1
	3	1	3	2	1	5	1	1	2	19

4.12.4 Classification Unit 703016: Tree planting/Cone Picking

Description

- Number of Employers: 244 (June, 2003)
- Base Rate in 2003: \$3.30 per \$100 of assessable earning, to a maximum per worker of \$60,100
- Injury rate trends (average number of short term disability claims per 100 person years of WCB-covered employment):

1998	1999	2000	2001	2002	Total
17.6	16.0	19.2	16.6	15.3	17.0

- Services provided

Forestry seedling maintenance	Pick pine cones
Plant trees	Reforestation
Vexar maintenance	Woodlot tree planting

- Materials used

Seedlings
Vexar tubing

- Equipment used

All-terrain vehicle	Tree planting bag
Tree planting shove	

- Occupations

Cone picker	Crew leader
Tree planter	

Summary Table for Frequency

Year	Frequency (# of short and long-term disability claims accepted)	Claim costs	Days lost in year
1998	309	\$1,420,433	10,631
1999	277	\$877,076	10,040
2000	343	\$1,612,436	10,102
2001	298	\$743,975	8,722
2002	241	\$1,051,284	9,037
Total	1468	\$5,705,203	48,532

1. Frequency

Type of Accident	Number of claims	Percent of total
Fall: same level	261	18
Repetitive motion	219	15
Struck by	195	13
Overexertion	185	13
Fall:from elevation	152	10
Involuntary motion	106	7
Other voluntary motion	97	7
Vehicle accident	94	6
Struck against	70	5
Toxics, noxious	29	2
Caught in	19	1
Rubbed, abraded	19	1
Matter in eye	9	1
Heat, cold	7	0
Other	7	0
Total	1,468	100

Type of Injury	Number of claims	Percent of total
Other strains	447	30
Tendinitis, related	250	17
Back strains	201	14
Cuts	184	13
Crush, bruise	118	8
Dislocation,fracture	105	7
Scratch,abrasion	81	6
Other disease	42	3
Other injury	31	2
Chemical burn	6	0
Multiple injury	4	0
Total	1,468	100

Body Part	Number of claims	Percent of total
Wrist,fingers	309	21
Knees	228	16
Back	215	15
Ankle,toes	149	10
Other leg	99	7
Other arm	92	6
Eye injuries	80	5
Shoulders	67	5
Other	58	4
Elbows	36	2
Chest	34	2
Neck	23	2
Hips	22	1
Face and ears	17	1
Other trunk	16	1
Other head	15	1
Body systems	8	1
Scalp, skull	-1	0
Total	1,468	100

2. Costs

Type of Accident	Cost of claims	Percent of total
Vehicle accident	\$1,503,783	26
Struck by	\$908,168	16
Fall: same level	\$807,553	14
Involuntary motion	\$513,749	9
Overexertion	\$508,213	9
Fall:from elevation	\$447,022	8
Repetitive motion	\$402,694	7
Caught in	\$263,726	5
Other voluntary motion	\$206,511	4
Struck against	\$82,100	1
Toxics, noxious	\$23,640	0
Heat, cold	\$16,080	0
Rubbed, abraded	\$13,651	0
Other	\$4,187	0
Matter in eye	\$4,126	0
Total	\$5,705,203	100

Type of Injury	Cost of claims	Percent of total
Other strains	\$1,377,682	24
Cuts	\$396,818	7
Crush, bruise	\$259,018	5

Scratch,abrasion	\$180,374	3
Dislocation,fracture	\$835,239	15
Multiple injury	\$221,909	4
Other injury	\$363,271	6
Tendinitis, related	\$1,359,167	24
Chemical burn	\$5,530	0
Other disease	\$31,815	1
Back strains	\$674,381	12
Total	\$5,705,203	100

Body Part	Cost of claims	Percent of total
Ankle,toes	\$1,422,473	25
Back	\$815,730	14
Knees	\$729,694	13
Wrist,fingers	\$646,003	11
Other	\$493,120	9
Other leg	\$321,835	6
Shoulders	\$306,968	5
Eye injuries	\$226,180	4
Other trunk	\$192,935	3
Other arm	\$168,469	3
Chest	\$121,769	2
Elbows	\$69,113	1
Neck	\$61,053	1
Face and ears	\$42,410	1
Hips	\$42,198	1
Other head	\$25,900	0
Body systems	\$19,700	0
Total	\$5,705,203	100

Age range	Cost of claims	Percent of total
25-29	2,028,755	23
30-34	1,579,116	17.9
20-24	1,288,513	14.6
55-59	1,143,171	13
40-44	648,699	7.4
35-39	604,079	6.9
60-64	498,604	5.7
50-54	413,331	4.7
45-49	296,400	3.4
19 or less	291,640	3.3
Uncoded	7,262	.1
65 or greater	2,334	0
Total	8,801,905	100

3. Time lost

Type of Accident	Days lost	Percent of total
Fall: same level	9,326	19
Struck by	8,091	17
Fall:from elevation	6,757	14
Vehicle accident	6,318	13
Overexertion	4,940	10
Repetitive motion	4,229	9
Involuntary motion	3,418	7
Other voluntary motion	2,695	6
Struck against	1,305	3
Caught in	737	2
Toxics, noxious	270	1
Rubbed, abraded	153	0
Heat, cold	146	0
Other	76	0
Matter in eye	70	0
Total	48,532	100

Type of Injury	Days lost	Percent of total
Fall: same level	9,326	19
Struck by	8,091	17
Fall: from elevation	6,757	14
Vehicle accident	6,318	13
Overexertion	4,940	10
Repetitive motion	4,229	9
Involuntary motion	3,418	7
Other voluntary motion	2,695	6
Struck against	1,305	3
Caught in	737	2
Toxics, noxious	270	1
Rubbed, abraded	153	0
Heat, cold	146	0
Other	76	0
Matter in eye	70	0
Total	48,532	100

Body Part	Days lost	Percent of total
Knees	10,896	22
Back	7,849	16
Wrist,fingers	6,694	14
Other leg	4,348	9
Ankle,toes	3,796	8
Other	3,304	7
Shoulders	2,611	5
Other arm	1,771	4

Chest	1,636	3
Eye injuries	1,373	3
Other trunk	955	2
Neck	883	2
Elbows	836	2
Hips	567	1
Face and ears	452	1
Other head	450	1
Body systems	112	0
Total	48,532	100

C. Cross tabulations between worker and work environment and injury characteristics- CU 703016

Type of Injury by Body Part - CU 703016

	finger, wrist	other leg	knees	other head	back	Other	O trunk	ankle, toe	Other arm	eye	elbow	hips	Shoul- -der	Sys- -tems	chest	neck	face and ear	Total
other strains	17	15	66			11	4	38	6		1	3	9		4	5		179
Back strains					73													73
crush. bruises	8	5	5		4	3		3	4	1			2		8			43
Tendinitis	40		3					5	17		10		9					84
cuts	31	10	7				2	3	5	3		1					3	65
other disease	3	2	1			3			1	2		1		2			2	17
dislocation, fract	12	3	2		3			6	4			1	3		5		2	41
chem burn	1																	1
other injury		3		3			1		1			1		2				11
Scratch, abrasion	2	1	2					2		22		1						30
multiple injuries						1												1
Total	114	39	86	3	80	18	7	57	38	28	11	8	23	4	17	5	7	545

Type of Accident by Type of Injury- CU 703016

	other strains	Back strains	crush bruises	Tendinitus	cuts	other disease	Dislocation fract	chem burn	other injury	Scratch, abrasion	multiple injuries	Total
fall, same level	43	11	16	2	19		9		1	2		103
vehicle accident	6	3	3				6		2			20
toxics, noxious						12		1				13
struck by	5		12	1	28	1	10		3	12		72
fall, from elevation	40	7	4		3		9					63
Over-exertion	22	27		9					1			59
caught in	3				3						1	7
other vol motion	17	13		3			2					35
Involuntary motion	40	10				1	2					53
repetitive motion		2	2	67					1			72
heat, cold						2			3			5
matter in eye										3		3
strike against	3		6	1	12		3			9		34
rubbed, abraded						1				3		4
	179	73	43	83	65	17	41	1	11	29	1	543

Type of Accident by Body Part- CU 703016

	finger, wrist	other leg	knees	other head	back	Other	O trunk	ankle, toe	Other arm	eye	elbows	hips	shoulder	systems	chest	neck	face and ear	Total
fall, same level	25	4	26	1	13	4	1	1	6	2	1	2	7		8	1	1	103
vehicle accident			2		4	5	1	2	2			1		1	2			20
toxics, noxious	3	1	1			2			1	1		1		1			2	13
struck by	21	11	7	2		2		5	5	14			1		1		3	72
fall, from elevation	5	7	15		9	2	1	15	2			2	1		3	1		63
overexertion	7	2	1		27	1	3	1	3		2	1	7		2	2		59
caught in	2	1	1			1		1	1									7
other vol motion		2	7		14		1	7					2		1	1		35
Involuntary motion		6	17		10	1		19										53
repetitive motion	36		1		2			3	17		7		5	1				72
heat, cold	1	3												1				5
matter in eye										3								3
strike against	14	1	6		1			2	1	7	1						1	34
rubbed, abraded		1						1		1		1						4
	114	39	84	3	80	18	7	57	38	28	11	8	23	4	17	5	7	543

4.12.5 Comparison of themes across classification units—all CUs

Number of employers: (as of June, 2003)

CU 703001 (Chemical Brushing/Weeding/Thinning/Spacing) = 24

CU 703002 (Mechanical Brushing/Weeding/Thinning/Spacing) = 457

CU 703115 (Fire Fighting) = 24

CU 703016 (Tree planting/cone picking) = 244

Summary Table of Frequency

Year	Frequency (# of short and long-term disability claims accepted)	Claim costs	Days lost in year
1998	592	\$2,558,888	19,453
1999	527	\$2,714,068	20,843
2000	580	\$3,095,375	20,062
2001	510	\$2,048,989	17,571
2002	358	\$2,470,348	15,937
Total	2567	\$12,887,669	93,866

1. Frequency

Type of Injury	Number of Claims	Percent of total
Other strains	730	28
Cuts	407	16
Back strains	325	13
Tendinitis, related	309	12
Crush, bruise	252	10
Dislocation, fracture	213	8
Scratch, abrasion	180	7
Other disease	62	2
Other injury	58	2
Chemical burn	13	1
Hearing loss	10	0
Multiple injury	4	0
Unallocated	4	0
TOTAL	2567	100

Type of Accident	Number of claims	Percent of total
Struck by	532	21
Fall: same level	455	18
Fall: from elevation	293	11
Overexertion	270	11
Repetitive motion	265	10
Involuntary motion	174	7
Vehicle accident	162	6
Other voluntary motion	131	5
Struck against	110	4
Toxics, noxious	49	2
Caught in	39	2
Matter in eye	33	1
Rubbed, abraded	23	1
Noise exposure	10	0
Heat, cold	9	0
Other	9	0
Unallocated	4	0
Total	2567	100

Body Part	Number of Claims	Percent of Total
Wrist, fingers	487	19
Knees	391	15
Back	353	14
Ankle, toes	262	10
Eye injuries	182	7
Other leg	173	7
Other arm	151	6
Shoulders	113	4
Other	108	4
Chest	90	4
Elbows	47	2
Neck	44	2
Face and ears	43	2
Hips	43	2
Other head	31	1
Other trunk	30	1
Body systems	14	1
Unallocated	4	0
Scalp, skull	1	0
TOTAL	2567	100

2. Claim costs

Type of Accident	Cost of claim	Percent of total
Struck by	\$2,940,253	23
Vehicle accident	\$2,079,841	16
Fall: same level	\$1,403,614	11
Fall: from elevation	\$1,246,968	10
Overexertion	\$1,129,401	9
Involuntary motion	\$922,644	7
Unallocated	\$787,993	6
Caught in	\$613,268	5
Repetitive motion	\$589,292	5
Toxics, noxious	\$408,561	3
Other voluntary motion	\$261,360	2
Other	\$219,068	2
Struck against	\$160,101	1
Noise exposure	\$74,617	1
Heat, cold	\$21,415	0
Rubbed, abraded	\$16,693	0
Matter in eye	\$12,579	0
Total	\$12,887,669	100

Type of Injury	Cost of claim	Percent of total
Struck by	\$2,940,253	23
Vehicle accident	\$2,079,841	1
Fall: same level	\$1,403,614	11
Fall: from elevation	\$1,246,968	10
Overexertion	\$1,129,401	9
Involuntary motion	\$922,644	7
Unallocated	\$787,993	6
Caught in	\$613,268	5
Repetitive motion	\$589,292	5
Toxics, noxious	\$408,561	3
Other voluntary motion	\$261,360	2
Other	\$219,068	2
Struck against	\$160,101	1
Noise exposure	\$74,617	1
Heat, cold	\$21,415	0
Rubbed, abraded	\$16,693	0
Matter in eye	\$12,579	0
Total	\$12,887,669	100

Body Part	Cost of claim	Percent of total
Ankle, toes	\$1,811,841	14
Knees	\$1,722,288	13
Back	\$1,389,154	11
Wrist, fingers	\$1,233,421	10
Other	\$1,039,088	8
Other arm	\$919,454	7
Shoulders	\$803,610	6
Other leg	\$803,392	6
Unallocated	\$787,993	6
Body systems	\$560,888	4
Eye injuries	\$403,981	3
Chest	\$335,896	3
Other trunk	\$291,933	2
Face and ears	\$233,706	2
Hips	\$213,085	2
Elbows	\$173,531	1
Neck	\$106,933	1
Other head	\$56,007	0
Scalp, skull	\$1,466	0
	\$12,887,669	100

3. Time lost

Type of Accident	Days lost	Percent of total
Struck by	20,696	22
Fall: same level	16,344	17
Fall: from elevation	14,226	15
Vehicle accident	11,758	13
Overexertion	7,173	8
Repetitive motion	7,067	8
Involuntary motion	6,283	7
Other voluntary motion	3,621	4
Struck against	2,171	2
Caught in	1,985	2
Toxics, noxious	993	1
Unallocated	575	1
Other	319	0
Matter in eye	253	0
Heat, cold	211	0
Rubbed, abraded	189	0
Noise exposure	0	0
Total	93,866	100

Type of Injury	Days lost	Percent of total
Other strains	26,560	28
Dislocation,fracture	23,255	25
Cuts	12,023	13
Back strains	11,185	12
Tendinitis, related	8,070	9
Crush, bruise	6,706	7
Other injury	2,464	3
Other disease	1,699	2
Scratch,abrasion	1,122	1
Unallocated	575	1
Chemical burn	165	0
Multiple injury	42	0
Total	93,866	100

Body Part	Days lost	Percent of total
Knees	21,449	23
Wrist,fingers	13,556	14
Back	11,996	13
Other	7,592	8
Other leg	7,322	8
Ankle,toes	6,754	7
Shoulders	4,145	4
Other arm	3,918	4
Chest	3,537	4
Elbows	2,235	2
Other trunk	2,185	2
Neck	1,934	2
Eye injuries	1,893	2
Hips	1,529	2
Face and ears	1,337	1
Body systems	1,210	1
Other head	693	1
Unallocated	575	1
Total	93,866	100

Type of Accident by Gender—All CUs

Type of Accident	Male	Female	Total
struck by	152	17	170
fall, same level	140	23	163
fall, from elevation	87	19	107
overexertion	73	22	95
repetitive motion	57	28	85
Involuntary motion	58	12	70
vehicle accident	41	3	44
other vol motion	33	11	44
strike against	34	9	43
toxics, noxious	15	5	20
caught in	13	2	15
matter in eye	5	2	7
heat, cold	5	1	6
	722	156	880

Type of Accident by Gender—All CUs

Type of Injury	Male	Female	Total
other strains	227	51	278
cuts	117	13	131
Back strains	82	22	104
Tendinitus	67	33	100
crush. bruises	66	14	81
dislocation, fract	69	6	75
Scratch, abrasion	49	7	56
other disease	16	7	23
other injury	20	3	23
chem burn	5		5
Hearing loss	3		3
multiple injuries	1		1
TOTAL	722	156	880

Body Part by Gender—All CUs

Body Part	Male	Female	Total
finger, wrist	137	31	168
knees	115	26	141
back	90	24	114
ankle, toe	78	17	96
other leg	47	9	56
Other arm	44	11	55
eye	50	5	55
Other	34	4	38
shoulder	28	9	37
chest	31	5	37

hips	18	1	19
elbows	11	4	15
face and ear	11	2	13
other head	7	4	11
neck	8	3	11
O trunk	9		9
systems	4	1	5
Total	722	156	880

Type of Accident by Age classes- all CUs

Type of Accident	17yrs-25yrs	26yrs-35yrs	36yrs-45yrs	46yrs-55yrs	56yrs-65yrs	65+yrs	Total
fall, same level	63	54	31	12	2		162
vehicle accident	12	18	4	6	4		44
toxics, noxious	13	5	2				20
struck by	49	68	40	11	2		170
fall, from elevation	36	36	25	8	1	1	107
overexertion	35	40	15	5			95
caught in	3	9	2	1			15
other vol motion	20	14	7	2	1		44
Involuntary motion	15	29	21	4	1		70
repetitive motion	45	24	14	1	1		85
heat, cold	2	3		1			6
matter in eye	2	4	1				7
strike against	15	15	8	2	1		41
rubbed, abraded	1	3	1	1			6
noise exposure			1	1		1	3
Total	311	322	172	55	13	2	875

Type of Injury by Age classes- All CUs

Type of Injury	17yrs-25yrs	26yrs-35yrs	36yrs-45yrs	46yrs-55yrs	56yrs-65yrs	65+ yrs	Total
other strains	89	111	60	14	2	1	277
Back strains	32	42	21	9	1		105
crush, bruises	24	27	19	8	2		80
Tendinitus	54	25	18	2	1		100
cuts	54	46	20	8	2		130
other disease	12	9	1		1		23
dislocation, fract	21	28	13	8	4		74
chem burn	3	1	1				5
other injury	9	8	4	2			23
Scratch, abrasion	14	26	13	3			56
Hearing loss			1	1		1	3

multiple injuries			1				1
	312	323	172	55	13	2	877

Body Part by Age classes- All CUs

	Age classes						Total
	17yrs-25yrs	26yrs-35yrs	36yrs-45yrs	46yrs-55yrs	56yrs-65yrs	higher than 65yrs	
finger, wrist	80	52	24	10	1		167
other leg	16	24	9	5	1	1	56
knees	38	58	36	6	2		140
other head	4	5	1	1			11
back	36	44	23	10	2		115
Other	14	8	10	5	1		38
O trunk	4	4	1				9
ankle, toe	39	38	14	3	1		95
Other arm	23	15	11	3	2		54
eye	16	25	11	3			55
elbows	5	4	6				15
hips	8	3	7	1			19
shoulder	14	16	6	1			37
systems	3	2					5
chest	8	11	10	5	3		37
neck	2	7	2				11
face and ear	2	7	1	2		1	13
Total	312	323	172	55	13	2	877

Type of Accident by Body Part -All CUs

	fall, same level	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary motion
finger, wrist	37		4	43	8	11	4		
other leg	6		1	19	10	2	3	3	6
knees	42	3	1	24	25	3	2	8	22
other head	3	1		7					
back	16	5			17	45		17	13
Other	6	16	3	5	3	3	1		1
O trunk	1	1	1		1	4		1	
ankle, toe	5	3		16	23	1	3	10	27
Other arm	12	2	2	10	2	5	1		
eye	2		3	32					
elbows	2				1	2			
hips	3	2	1	1	5	4		1	1
shoulder	8	3		2	4	11		2	1
systems		2	1						
chest	16	4		4	8	3	1	1	
neck	1	2		4	1	2		1	
face and ear	3		3	3					
	163	44	20	170	108	96	15	44	71

(continued)

	repetitive motion	heat, cold	matter in eye	strike against	rubbed, abraded	noise	
finger, wrist	44	2		15			168
other leg		3		2	1		56
knees	1			8			139
other head							11
back	2			1			116
Other							38
O trunk							9
ankle, toe	4			2	3		97
Other arm	18			3			55
eye			7	10	1		55
elbows	9			1			15
hips					1		19
shoulder	6						37
systems	1	1					5
chest							37
neck							11
face and ear				1		3	13
	85	6	7	43	6	3	881

Type of Injury by Accident Type –All CUs

	fall, same level	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary motion
other strains	64	18		15	59	37	6	23	54
Back strains	14	3			13	45		16	13
crush. bruises	29	7		20	12		4		
Tendinitis	3	1		1	1	9		3	
cuts	31	1		72	7		4		
other disease		1	15	1		1			1
dislocation, fract	16	10		24	16	1		2	3
chem burn			5						
other injury	3	3		9		3			
Scratch, abrasion	3			28					
Hearing loss									
multiple injuries							1		
	163	44	20	170	108	96	15	44	71

(continued)

	repetitive motion	heat, cold	matter in eye	strike against	rubbed, abraded	noise	
other strains				3			279
Back strains	2						106
crush. bruises	2			7			81
Tendinitis	80			1			99
cuts				16			131
other disease		2			2		23
dislocation, fract				3			75
chem burn							5
other injury	1	4					23
Scratch, abrasion			7	13	4		55
Hearing loss						3	3
multiple injuries							1
	85	6	7	43	6	3	881

Injury Type by Body Part – All CUs

	other strains	Back strains	crush. bruises	Tendinitus	cuts	other disease	dislocation, fract	chem burn	other injury	Scratch, abrasion	Hearing loss	multiple injuries	
finger, wrist	26		13	48	52	5	20	1	1	2			168
other leg	18		8		21	2	3		3	1			56
knees	96		12	4	20	1	4			4			141
other head			1						10				11
back		106	7				3						116
Other	24		7			3	2	1				1	38
O trunk	5				2	1			1				9
ankle, toe	64		6	6	8	1	9			3			97
Other arm	8		6	18	14	1	6	1	1				55
eye			1		4	2		2	1	45			55
elbows	1		1	12			1						15
hips	7			1	3	1	2		4	1			19
shoulder	14		3	11	1		8						37
systems						3			2				5
chest	6		16		1		14						37
neck	10						1						11
face and ear					5	3	2				3		13
	279	106	81	100	131	23	75	5	23	56	3	1	883

Claim Counts For Motor Vehicle Accidents Involving ATVs		Selected Silviculture Classification Units				
Counts Adjusted For Uncoded Claims, Claim Years 1998-2002						
Detailed type of accident categories	1998 claim count	1999 claim count	2000 claim count	2001 claim count	2002 claim count	Total
MVA: jack-knifed or overturned-no collision	2	0	0	1	1	4
Other sudden start or stop of vehicle	0	0	0	1	0	1
Vehicle, mobile equip struck stationary object	1	0	1	0	1	3
Fall from moving vehicle - nonhighway	0	0	1	2	0	3
Fell from and struck by vehicle, mobile equip	1	1	0	0	1	3
Overturned - nonhighway accident	5	4	6	2	1	17
Loss of control - nonhighway accident	1	0	0	0	0	1
Other non-highway sudden start or stop	1	1	0	0	0	2
Other non-highway noncollision accident	0	0	1	1	0	4
Other nonhighway accident	1	0	0	0	0	1
Total	12	6	10	7	4	41
(1) the claim counts are by year of injury, and include all claims for injury years 1998 to 2002 that were accepted for short-term disability, long-term disability, or survivor benefits either in the year or the following year. health care only claims are excluded. note that the 2002 figures will be approximately 1% low, as these claims haven't had a full year to be paid yet.						
(2) uncoded claims have been proportionately allocated.the allocated counts have been rounded to whole numbers. column and row totals have been rounded independently, so the columns and rows may not add up exactly to the totals shown.						

Claim Counts For Motor Vehicle Accidents Involving ATVs							
Counts Adjusted For Uncoded Claims, Claim Years 1998-2002							
	Detailed type of accident categories	1998 claim count	1999 claim count	2000 claim count	2001 claim count	2002 claim count	Total
Chemical Spacing/Thinning (CU 703001)	Overtaken - nonhighway accident	1	0	0	0	0	1
	Other non-highway sudden start or stop	0	1	0	0	0	1
	Other nonhighway accident	1	0	0	0	0	1
	Total	2	1	0	0	0	3
Mechanical Spacing/Thinning (CU 703002)	Vehicle, mobile equip struck stationary object	1	0	1	0	0	2
	Fell from and struck by vehicle, mobile equip	0	1	0	0	0	1
	Overtaken - nonhighway accident	1	0	0	1	0	2
	Other non-highway noncollision accident	0	0	0	1	0	2
	Total	2	1	1	2	0	8
Fire Fighting (CU 703005)	Overtaken - nonhighway accident	1	1	0	0	0	2
	Total	1	1	0	0	0	2
Tree Planting/Cone Picking (CU703016)	MVA: jack-knifed or overturned-no collision	2	0	0	1	1	4
	Other sudden start or stop of vehicle	0	0	0	1	0	1
	Vehicle, mobile equip struck stationary object	0	0	0	0	1	1
	Fall from moving vehicle - nonhighway	0	0	1	2	0	3
	Fell from and struck by vehicle, mobile equip	1	0	0	0	1	2
	Overtaken - nonhighway accident	2	2	6	1	1	12
	Loss of control - nonhighway accident	1	0	0	0	0	1

	Other non-highway sudden start or stop	1	0	0	0	0	1
	Other non-highway noncollision accident	0	0	1	0	0	1
	Total	7	2	9	5	4	27

Claim Counts For Motor Vehicle Accidents Involving Highway Vehicles						
Selected Silviculture Classification Units						
Counts Adjusted For Uncoded Claims, Claim Years 1998-2002						
Detailed type of accident categories	1998 claim count	1999 claim count	2000 claim count	2001 claim count	2002 claim count	Total
MVA: vehicles moving in opposite directions	10	3	1	0	0	14
MVA: vehicles moving in intersection	0	0	0	0	2	2
MVA: moving and standing vehicle, in roadway	0	0	0	1	0	1
MVA: other collision between vehicles	2	1	1	1	0	6
Vehicle struck stationary object at roadside	0	0	1	0	0	1
MVA: jack-knifed or overturned-no collision	7	5	20	2	7	41
MVA: ran off highway - no collision	4	0	1	0	3	9
Other sudden start or stop of vehicle	3	0	1	0	0	5
Other noncollision accident	2	0	0	1	0	4
Nonhighway collision between vehicles	1	0	0	2	2	5
Vehicle, mobile equip struck stationary object	0	1	1	0	2	5
Fall from moving vehicle - nonhighway	0	0	1	0	0	1
Overturned - nonhighway accident	3	3	4	1	1	13
Loss of control - nonhighway accident	0	0	1	0	1	2
Other non-highway sudden start or stop	0	0	0	0	1	1
Other non-highway noncollision accident	0	0	0	0	1	1
Pedestrian struck by vehicle non-roadway area	0	0	0	1	1	2
Other pedestrian struck by vehicle	2	0	0	0	0	1
Total	35	12	36	9	21	115

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Claim Counts For Motor Vehicle Accidents Involving Highway Vehicles							
Selected Silviculture Classification Units							
Counts Adjusted For Uncoded Claims, Claim Years 1998-2002							
	Detailed type of accident categories	1998 claim count	1999 claim count	2000 claim count	2001 claim count	2002 claim count	Total
703001	MVA: moving and standing vehicle, in roadway	0	0	0	1	0	1
	MVA: jack-knifed or overturned-no collision	3	0	0	0	2	5
	Other noncollision accident	1	0	0	0	0	1
	Nonhighway collision between vehicles	0	0	0	1	0	1
	Overturned - nonhighway accident	1	0	0	0	0	1
	Total	5	0	0	2	2	9
703002	MVA: vehicles moving in opposite directions	9	3	1	0	0	13
	MVA: vehicles moving in intersection	0	0	0	0	2	2
	MVA: other collision between vehicles	0	0	0	1	0	1
	MVA: jack-knifed or overturned-no collision	0	1	1	1	0	4
	MVA: ran off highway - no collision	1	0	0	0	3	4
	Other sudden start or stop of vehicle	1	0	0	0	0	3
	Other noncollision accident	0	0	0	1	0	1
	Nonhighway collision between vehicles	0	0	0	0	2	2
	Vehicle, mobile equip struck stationary object	0	1	1	0	2	5
	Fall from moving vehicle - nonhighway	0	0	1	0	0	1
	Overturned - nonhighway accident	1	3	0	0	0	5
	Loss of control - nonhighway accident	0	0	0	0	1	1
	Pedestrian struck by vehicle non-roadway area	0	0	0	0	1	1
	Other pedestrian struck by vehicle	1	0	0	0	0	0
	Total	13	8	6	3	11	44

703005	Other non-highway noncollision accident	0	0	0	0	1	1
	Pedestrian struck by vehicle non-roadway area	0	0	0	1	0	1
	Total	0	0	0	1	1	2
703016	MVA: vehicles moving in opposite directions	1	0	0	0	0	1
	MVA: other collision between vehicles	2	1	1	0	0	5
	Vehicle struck stationary object at roadside	0	0	1	0	0	1
	MVA: jack-knifed or overturned-no collision	4	3	19	1	5	32
	MVA: ran off highway - no collision	3	0	1	0	0	5
	Other sudden start or stop of vehicle	2	0	1	0	0	1
	Other noncollision accident	1	0	0	0	0	2
	Nonhighway collision between vehicles	1	0	0	1	0	2
	Vehicle, mobile equip struck stationary object	0	0	0	0	0	0
	Overturned - nonhighway accident	1	0	4	1	1	7
	Loss of control - nonhighway accident	0	0	1	0	0	1
	Other non-highway sudden start or stop	0	0	0	0	1	1
	Other pedestrian struck by vehicle	1	0	0	0	0	1
	Total	16	4	30	3	7	60

4.13 Time of season and injury rates

We attempted to draw conclusions regarding the time of season that injuries were occurring. Are workers more likely to injure themselves at the beginning of their season, late in the season, or is there no relationship between time of season and injury rates? We found that there were many factors that caused these questions to be difficult to answer.

- The most relevant source of information we found was on the Workers' Compensation Board "Employers Report of Injury or Occupational Disease" (Form 7). We were told by the WCB on at least two occasions that often the employers do not fill out the form 7 completely or they fill it out incorrectly. The statistics we received from WCB seemed to support this.
- Answering all questions on the form may also lead to the rejection of a claim, and may be a reason that contractors are reluctant to complete the forms fully. Asking contractor for their perceptions of this risk would be an important question in any follow-up survey.
- Some injuries are acute – like a cut, where others are progressive – like tendinitis from repetitive motion. This complicates reporting and estimating time of season.
- The nature of the industry and the diversity of job functions throughout the year for a typical worker is also a complicating factor. The workers often move from one employer and function to another. Planting starts on the coast in Feb/March and in the interior one or two months later depending on the snow pack and accessibility. Often there is a spring, summer and fall plant and workers may be idle between jobs or may work in other classification units. The firefighting season is also very unpredictable for contractors.
- Our WCB contractor also suggested that many tree planters injure themselves and continue to work in pain. After some time they may decide it is time to establish a WCB claim. This also complicates time of season data.

However, in an attempt to answer this question, we developed a three-page questionnaire targeted for our discussions with key WCB personnel.

Two questions relating time of season were asked:

1. Can we find out how long a person has been on the job/employed prior to the injury occurring?
2. Is it possible to compare early-season and late-season accidents?

Several questions on Workers Compensation "Employers Report of Injury or Occupational Disease" (Form 7) provide some insight on time of season.

Question 1. Date and Time of Injury

Question 8. Do you know of any pain or disability in the area of the workers present injury?
If YES please explain.

Question 11. Please indicate the workers employment status

Question 12. Date worker started employment with you

Question 13. Date worker started this job

Although her scope is limited, Ariel Anne Lyons's study refers to time of season. She has agreed to share her raw data with FISA for further analysis.

One of our WCB contacts suggested that some contractors might already be collecting time of season data.

Despite the difficulty in "pinning down the time of season, we suggest the following:

- An on-line form with required fields may be a solution to this data gap. However, if electronic forms are used, the WCB may want to consider extending the three-day submission deadline because many contractors may have difficulty accessing computers in remote locations.
- A follow-up survey with workers or contractors could include questions on time of season. However, survey questions must be chosen carefully to avoid data distortions that would be possible for the complicating reasons suggested above.
- For more information on this topic, go to:

http://www.worksafebc.com/publications/newsletters/worksafe_magazine/Assets/PDF/WSM_apr_03.pdf

Or:

<http://www.summitreforestation.com/reducing.pdf>

4.14 Distribution of work

4.14.1 Distribution by classification unit

Of the four classification units examined, mechanical spacing and brushing (CU 703002) had the greatest average number of employers during the five-year period 1997-2001 with average of 475 employers. The next greatest average number of employees was in the tree planting/cone picking classification unit with an average of 257 employees. Fire fighting and chemical spacing and brushing had considerably smaller numbers of employers at an average of 38 and 18 for the five year period, respectively.

In the chemical spacing CU, the level of employment (based on number of person years of employment) appears to have significantly reduced between 1997 and 2001 from 132 at its peak in 1998 and 57 at the lowest point in 2001. In other words, it appears that fewer people are working in that industry or they are working shorter season steadily each year.

In the mechanical spacing CU, the employment level appears to have dropped off sharply between 1997 and 1998 but has remained relatively stable from 1998 to 2001.

Contract Forest fire fighter employment was the highest in 2001 than the two previous years, but there was a peak in 1998.

Tree planting employment dropped off sharply between 1997 and 1998 but has remained steady at around 1,700 person years.

Classification Unit	Average number of employers over five years '97-02	Average person years of employment over five years '97-02	Average claim costs over five years '97-02	Average claim costs per person years of employment	Trend in employment levels
Chemical spacing	18	92	\$81,153	\$882	Decreasing each year since 1998
Mechanical spacing	47	945	1.68 million	\$1,777	Steady since 1998, very slight decreasing trend
Forest fire fighting	38	91	\$90,167	\$990	Slightly increasing since 1999. Peak in 1998.
Tree planting	257	1,828	\$1.52 million	\$830	Steady since 1998

4.14.2 Distribution by company size (payroll) per classification unit

The following data is obtained from the payroll information from WCB.

Classification Unit 703001 – Chemical Spacing

Payroll 2001	Number of Companies
> \$500,000	1
\$100,000 - \$500,000	4
\$50,000 - \$100,000	4
< \$50,000	5
\$0.00	6

Classification Unit 703002 – Mechanical Spacing

Payroll 2001	Number of Companies
> \$500,000	1
\$100,000 - \$500,000	79
\$50,000 - \$100,000	63
< \$50,000	179
\$0.00	137

Classification Unit 703005 – Contract Fire Fighting

Payroll 2001	Number of Companies
> \$500,000	2
\$100,000 - \$500,000	7
\$50,000 - \$100,000	7
< \$50,000	12
\$0.00	6

Classification Unit 703016 – Tree Planting and Cone Picking

Payroll	Number of Companies
> \$1,000,000	17
\$500,000 - \$1,000,000	18
\$100,000 - \$500,000	70
\$50,000 - \$100,000	28
< \$50,000	67
\$0.00	42

4.14.3 Distribution of work by location

The following tables show the number of contractors in each of three regions of B.C. for each classification unit. While we cannot assume that a company whose address is one region works only in that region, the payroll listing from WCB provides the best indicator of work location. In some cases, companies located in one region could take on contracts in another region; there are also several contractors based outside of B.C. that operate in B.C. We divided the province into three regions: North (including North coast), Southern Interior, and Coast (including Squamish and Pemberton). The town of Lillooet was included in the Southern Interior count.

Classification unit 703001- Chemical spacing, pruning

	Number of contractors	Percent of total for CU
North	9	43
Southern Interior	7	33
Coast	5	24
Outside of B.C.	0	0
TOTAL	21	100

Classification unit 703002- Mechanical spacing, pruning

	Number of contractors	Percent of total for CU
North	204	45
Southern Interior	130	28
Coast	115	25
Outside of B.C.	10	2
TOTAL	459	100

Classification unit 703005- Fire Fighting

	Number of contractors	Percent of total for CU
North	5	15
Southern Interior	22	65
Coast	3	8
Outside of BC	4	12
TOTAL	34	100

Classification unit 703016- Tree planting

	Number of contractors	Percent of total for CU
North	71	29
Southern Interior	68	28
Coast	97	41
Outside B.C.	6	2
TOTAL	242	100

5 Literature Review: Occupation Health and Safety and Silviculture

5.1 Introduction

This section summarizes current research findings in the fields of health and safety and workplace motivation relevant to the silviculture industry. It summarizes the most current knowledge about the relationship between worker and work environment-related factors (such as nutrition, fatigue, and ergonomics, and management styles) and health and safety outcomes. This section also offers recommendations that arise from research.

The occupational health and safety field is broad and well studied. Many interventions have been implemented to influence workplace behaviours (Anonymous 1998). There is significant literature from many fields, including some articles specific to forestry that lend themselves to supporting investments in health and safety intervention programs. While the literature on health and safety in silviculture is limited, there is significant research-based information from related fields that can be applied to this industry. Because of extensive body of research that discusses the relationship between worker factors (such as nutrition and ergonomics) and work environment (such as tool design and work hours) with reduced injury rates, a great deal can be learned about potential interventions for reducing accident rates and improving the health of field workers from outside the forestry sector.

Despite the substantial body of research and programming in health and safety, our exploration through the literature revealed limited evidence of evaluation about health and safety interventions, particularly in forestry. In other words, much of the literature focuses on links between factors such as worker behaviour and injury rates rather than links between intervention programs and worker behaviours. Research doesn't offer nearly enough about the impacts of training, regulation, and management approaches on worker safety behaviours, particularly in forestry. We don't know enough about which interventions offer the biggest "bang for the buck" in terms of reducing accident rates. This remains a gap in the literature.

One notable exception is a study conducted for the Canadian Centre for Occupational Health and Safety on behalf of the Association of Workers' Compensation Boards of Canada in 1998 (Anonymous 1998). This study evaluated various methods to influence attitudes and behaviours regarding workplace safety. It included a world-wide synthesis of current knowledge on attitude and behaviour toward risk and hazards, factors that influence worker attitude and behaviour toward safety, and methods to influence attitudes and behaviours.

There is ample reason to examine worker-injury linkages in forestry. Accidents in forestry work, including silviculture, are eight times more frequent than other types of work (Larsson and Field 2002). Fatigue, lack of fitness, worker inexperience, nutritional deficits, and temperature-related stresses such as dehydration all contribute to the risk of accidents and injuries (Ashby *et al.* 2001). There are also many musculoskeletal injuries associated with the back, neck, knees, wrists, elbows, and ankles that can occur with repetitive motion, strain, or overuse. This is particularly true when a silviculture worker is not properly trained on appropriate positions and movements for preventing injury. Silviculture workers are also exposed to a variety of insects, disease, and species of wildlife that pose a potential threat to safety. There is evidence to support that many workers and supervisors are not able to

recognize many health and injury risks, which is the first step in the process of changing human behaviour regarding risk and safety. There is also much evidence to suggest that management approaches have a lot to do with safety attitudes and behaviours of workers. More details on this study are described in Section 5.3.

5.2 How the literature review is organized

This section reviews the literature by topical area, beginning with health and safety motivational factors relating to individuals and management, and ending with health and safety factors in the work environment. Because there is substantial literature specific to the tree planting and fire fighting industry, we discuss the research findings of that industry separately.

5.3 Canadian Council on Occupational Health and Safety study on worker attitudes

A 1998 CCOHS study (Anonymous 1998) evaluates health and safety intervention methodologies and discusses the interactions between employees' and managers' attitudes and behaviours towards health and safety. The study showed that interventions that are most successful at generating safe work practices influence both worker and management attitudes and behaviours.

A third target of intervention is societal attitudes about risk and danger that in turn influence workers' attitudes and behaviours. The study provides several examples where broad public "movements" have rendered unsafe work practices socially unacceptable (e.g. second-hand smoke in the workplace).

A key message from this study is that if worker, management, and societal attitudes are all "working in the same direction" (complementary to one another), there is a far greater chance for change to occur than if only one or two factors changing independently. While changing societal attitudes towards safety of silviculture workers may be beyond the scope of FISA and WSCA alone, they may be able to join other organizations in building awareness of worker safety in general in British Columbia to influence this third leg.

The CCOHS study identifies seven major influences on worker safety behaviours. Interventions can be targeted at any or all areas.

1. Non-formal training
2. Formal education
3. Group Norms
4. Organizational Context
5. Family Values, Attitudes, and Stereotypes
6. Campaigns and Media Events
7. Social Values and Attitudes

One of the most useful models in the CCOHS study outlines the cognitive ("thinking") process of worker perception and behaviour regarding risk. Understanding this model helps point the way to possible intervention programs relating to employee behaviours.

Do employees perceive a risk?

If not, there is decreased likelihood of preventative action.

Do workers perceive that the situation is under control?

If yes, there is decreased likelihood of preventative action.

Does the worker perceive that the consequences would be severe enough to induce preventative action?

If no, there is decreased likelihood of preventative action.

Does the worker perceive a possibility that something will go wrong?

If no, there is decreased likelihood of preventative action.

5.4 Psychological factors affecting safety

Interventions to change worker and manager attitudes toward health and safety are grounded in motivation theories that developed in the fields of psychology and sociology in the early 20th century. Motivation has been defined as “the complex of forces, drives, needs, tensions, states or other internal psychological mechanisms that start and maintain activity toward the achievement of personal goals” (Hoy and Miskel 1978).

Motivation theories are widely used in the organizational development field to help explain what leads employees to certain behaviours. The theories help managers know what factors motivate employees to exhibit certain behaviours so that they can create a work environment that leads to desired outcomes (Pardee 1990). The purpose of motivation theory is to explain how behaviour is initiated, sustained, directed, and stopped and what interventions can affect behaviours.

Two categories of theories that can be used to explain motivation in a work environment include non-cognitive theories such as reinforcement or behavioural theory, and cognitive theories such as goal theory (Blackburn and Lawrence 1995). The field of occupational health and safety has relied on both kinds of theories. Cognitive theories emphasize intrinsic (personal) factors, while non-cognitive theories consider the influence of external (stimulus/response) factors. Both categories of theories are useful in examining behaviours of workers in relation to safety. These theories assume that managers are already motivated for safety and are looking for ways to motivate workers. Other theories are devoted to managerial motivational factors.

Non-cognitive theories: Reinforcement (Behavioural) Theory

Sometimes called operant or learning theory, this framework is based on the work of early psychologists Pavlov and Skinner. This theory states that rewards and disincentives are fundamental influences in subordinate performance within an organization. In a work context, managers may apply reinforcement to increase or maintain desirable behaviours while decreasing or eliminating undesirable behaviours. Skinner is credited with development of the science regarding how reinforcers influence behaviour. This framework began to enter organizational literature and teaching texts in the 1970s, and was especially focused on manager-employee relationships. It attempts to explain how managers influence behaviour of employees by structuring rewards and disincentives and forms the basis of many business leadership programs (Henry P. Sims and Lorenzi 1992).

This external influence is provided through organizations in five categories: Material, Symbolic, Social, Task, and Self-Administered. Material incentives constitute a direct or indirect transfer of financial reward to the employee. Symbolic refers to psychological rewards and can be either tangible or intangible. Social rewards are interpersonal. Task rewards include those directly related to the design of job tasks, such as levels of autonomy or scheduling flexibility. Symbolic and social rewards are important for addressing higher-level needs of employees, while material incentives respond to lower-level needs as described by Maslow (Maslow, Stephens et al.).

Examples of the categories are found in the following table.

Examples of organizational rewards and disincentives (adapted from Sims/Lorenzi)

Rewards	Examples
Material	Wages
Symbolic	Plaques, awards
Social	Praise, feedback, recognition, positive verbal and non-verbal communications
Task	Enriched job, preferred task assignments, new job responsibilities
Self-Administered	Self recognition, self-praise, sense of accomplishment
Disincentives	
Material	Dismissal from job, not rehired for future work
Symbolic	Involuntary transfer to another location
Social	Non-verbal disapproval, social isolation, lack of feedback
Task	Close supervision or control
Self-Administered	Sense of failure, guilt, shame, sense of "letting the group down"

There are examples of rewards and disincentive (behaviourist) approaches in the literature on health and safety. Authors generally agree that negative reinforcement regarding safety tends to produce short term gains at a great cost in the long-run. Positive reinforcement such as safety contests have mixed results because of the tendency for under reporting and frustration among those who don't qualify through no fault of their own (Anonymous 1998). In the case of piece-work industries like silviculture, disincentives tend to come in the form of risk of lost work time for the employee. The benefit of relying potential on lost work time as an incentive for safety can only be realized if the employee is aware of the potential.

Knowledge about the potential of cumulative effects of repetitive use, for example, may not exist among newer tree planters.

Cognitive theories: Goal theory and Personal Investment Theory

Cognitive theories assume that people make behaviour decisions based on an evaluation of their ability to respond and by estimating possible gains and losses. Most goal-based research stems from cognitive tradition of motivation that emphasizes the role of conscious intentions as fundamental factors. Goal theory as described by Sims and Lorenzi (1992) is based on the premise that the process of goal-setting is the major motivational force in individuals. While reinforcement theorists believe that perceived consequences are the key motivational factor, goal theorists claim that one's personal goals are the most critical precursor to behaviour (Sims and Lorenzi 1992).

This theory says that an individual's motivation to perform certain work practices is associated with their sense of freedom and expectation to set their own goals. In a safety context, this theory would assert that goals set the stage for employee safety performance and provide a standard by which consequences can be made contingent. It says that a management style that relies on employee initiative in setting and meeting goals is more effective in motivating employees to perform than the reward/punishment model.

Managers who use the goal theory of motivation are more likely to work with employees to establish realistic goals relating to their safety and health.

Most organizational researchers, however, accept the notion that we can understand more about the managerial process if we use both cognitive and non-cognitive perspectives (Henry P. Sims and Lorenzi 1992). Sims and Lorenzi state that most organizational scholars now agree that both goals and consequences provide important contributions to influencing the performance of an employee and should be used in conjunction with each other.

The literature describes a number of initiatives attempted by managers to create safe working conditions and create a culture of safety. One organization used trained observers from both management and the workforce to identify dangerous situations and work together as neutral parties to resolve them. The team reported the results into a "behaviour data bank" that are analysed later to identify trends. While this approach has not been well documented in the literature, companies who have used this method have reported high satisfaction with the results despite the fact that the method is time consuming and expensive. One B.C. silviculture company uses an "ombudsman" approach to improve communications between workers and managers about safety and other issues.

Key messages about worker attitude and behaviour toward safety for managers from the human motivation literature:

- behaviouristic (reward-punishment) approaches are not usually successful with piece-work
- if attitudes don't change along with behaviours, behavioural change is short lived
- attitude change can't come through manipulation or force
- safety contests are largely ineffective at changing behaviour long-term

-the managerial climate significantly influences worker attitudes and behaviours and that managing behaviours of workers is more effective than forcing them (Anonymous 1998).

There is little in the literature about interventions targeted at the attitude of managers. However, it appears that the most successful intervention for changing manager attitude about safety is training and education. Once managers gain detailed knowledge of the risks and costs associated with accidents and injuries, they are considerably more likely to make changes to improve their record (Anonymous 1998).

Another topic discussed in the literature is the benefit of empowering workers regarding health and safety. More has been published about the benefits of empowerment approaches on productivity level rather than in health and safety, but it's reasonable to assume that management approaches that emphasize worker empowerment could also be applied to health and safety.

One example of an empowerment approach is a sawmill that reduced accident rates by 50 percent over one year when small teams of workers were asked to develop their own safety standards and serve as trainers for fellow workers.

5.4.1 Barriers to employer attitude and behaviour in safety and health

1. There is generally a lack of awareness of far-reaching consequences of poor safety records, especially of direct and indirect costs of accidents and lost work time. Costs are often hidden across budgetary items.
2. Safety tends to become “centralized” or delegated to First Aid officers. Sometimes managers assume risk management is covered by delegating the tasks associated with safety. However, lasting results only occur when everyone in the organization are deeply involved in workplace health and safety concerns.
3. There is a lack of knowledge how best to improve safety, even if attitude for change exists. Training is only an appropriate intervention when attitudes are already in place but where health and safety information is lacking.

Despite these barriers, the literature shows several positive trends towards occupational health and safety:

1. The importance of a strong safety culture is now widely accepted within the corporate culture of many companies.
2. Good safety records now have benefits for positive public image for many companies. Increased emphasis on “corporate social responsibility” among companies is having a positive public relations impact, making benefits of a good safety record good for public relations.
3. There is evidence that increasing awareness of the real costs of poor safety among managers will induce positive changes around safety.

5.4.2 The impact of training and education on safety behaviours in managers and workers

The literature offers information on the effects of training and education on safety behaviours. Some consistent key messages arise:

- General safety awareness and motivational sessions targeted at workers are ineffective if not accompanied by other measures, including obvious managerial commitments. Employees must be convinced that management is committed to safety.
- Training is most effective if it can be targeted at specific people who can immediately apply their learning.
- Training can be used as an opportunity to for workers to air concerns and for management and workers to “get on the same wavelength” regarding safety.
- Training must use well-accepted principles of adult education: begin with needs assessment that includes questions to workers about preferred delivery methods and design courses to recognize and expand on what learners already know.
- One shot deals are not enough to induce change. There must be regular and continuous opportunities to reinforce the information.

5.5 Physical factors affecting safety

5.5.1 Fatigue

Fatigue is a common problem in the workplace. The National Institute for Working Life estimates that, worldwide, work-related fatigue costs about 350 billion U.S. dollars every year (Canada Safety Council 2002). It can be defined as “a sense of tiredness, mental or physical, brought on by stress (lack of sleep, physical work, nutrition inadequacies, or mental stresses)” (Sharkey 2002). Extended periods of stress with inadequate recovery periods, known as accumulated fatigue, can negatively affect productivity, immune function, and alertness (Sharkey 2002).

During the work day, fatigue generally peaks before the first break when energy levels are lower than normal (Cummin 1999; Parker 1999; Slappendel *et al.* 1993). However, the negative effects of fatigue not only affect daily work activities, but the commute to and from the work site as well (Canada Safety Council 2002; Caldwell Unpubl. Rep.). Although vehicle-related accidents only accounted for 3.2 percent of reported injuries in New Zealand in 2002, 44 percent of the vehicle near miss incidents reported were related to travel (Ashby *et al.* 2002). It is often associated with poor work performance, delayed onset of sleep, neurobehavioral impairment, subjective sleepiness, and work-related accidents and injuries (Lilley *et al.* 2002; Porcu *et al.* 1998).

Fatigue can be caused by any number of factors, including physically demanding tasks, irregular work schedules, monotonous work, long shifts, vibrations, and drugs (Canada Safety Council 2002). It is also associated with the strenuous nature of silviculture work, compounded by the potential of working at high altitudes, under extreme temperatures, and in humid environments (Sharkey 2002). Days spent on rough, steep, and rocky terrain with numerous snags and other potential hazards will also increase both physical and mental stress, and therefore have substantial effects on fatigue.

Researchers suggest that crew leaders, supervisors, and forepersons should be educated on the signs, symptoms, causes, and consequences of fatigue and accumulated fatigue. Reduced judgment, decision-making, and memory, slower reaction time, lack of concentration, fixation, and a worsening mood are associated with fatigue (Canada Safety Council 2002). “Planter burnout,” a problem commonly seen in tree planters at the end of a planting season, has signs very similar to those seen with accumulated fatigue; decreased motivation, increased inattentiveness and apathy resulting in careless behavior, a higher frequency of illness due to poor immune system function, increased irritability and depression, and a low morale (Ellis 2002; Sharkey 2002).

Sleep deprivation is often the explanation for fatigue at the workplace. It is a product of reduced or fragmented sleep. Consecutive days of sleep-deprived work can have an effect on alertness and performance at work (Lilley *et al.* 2002). Lack of recovery from successive sleep-deprived nights, and an inadequate number of consecutive days off between work days will compound this problem. Inconsistent sleep schedule, inadequate exercise, ineffective techniques for coping with stress, or excessive consumption of alcohol, caffeine, or prescription medication can also lead to sleep deprivation. Inconsistent sleep schedule is particularly a problem with young adults, who often restrict sleep to less than 6.5 hours on week nights and try to make up the lack of sleep on the weekends (Caldwell Jr. 1997).

Lilley *et al.* (2002) found that fatigue was commonly experienced by forestry workers, including those working in silviculture. It was associated with hours of sleep per night and the number of breaks received during the day. Most of the forestry workers surveyed obtained about 7 hours of sleep or less a night. One quarter of survey respondents only received 6 hours or less of sleep per night. Daytime alertness and functioning can be improved when hours of sleep per night increase from less than 8 hours to 9 or 10 hours (Coren 1996).

Results from the Lilley *et al.* (2002) survey indicated that forestry workers underestimated the potential harm of fatigue, suggesting that there needs to be more of a focus on increasing awareness of the causes and consequences of fatigue in health and safety programs. Forestry workers were more willing to acknowledge the negative effects of fatigue on work quality and output, but not its effect on safety. They were also more willing to admit that fatigue was often associated with near miss incidents, but not accidents.

Although silviculture workers (not including fire fighters) may work shorter hours than others in the forest industry, this group seems to have a significant portion of its workers experiencing fatigue (Lilley *et al.* 2002). This may be due to the fact that most silviculture work is done on a piece rate. Since piece rates are closely tied to the expression “time is money,” those operating under this system tend to work for intensive periods, often without regularly scheduled breaks, to achieve predetermined targets of production. The increased severity and frequency of accidents with piece rates could be a result of the working mentality associated with this system (Lilley *et al.* 2002). Although Lilley *et al.* (2002) did not find an association between shift length and frequency of accidents, Dawson and Fletcher (2001) reported that the timing and distribution of hours worked and the total number of hours worked impact work-related fatigue (Dawson and Fletcher 2001). They also noted an increased incidence of fatigue with a 12-hour work schedule compared to shorter shifts.

Where sleep deprivation is a concern, attempts should be made to improve sleep habits. There are several steps that can be taken to reduce levels of fatigue on the job (Canada Safety Council 2002; Caldwell Jr. 1997; Caldwell Unpubl. Report.). Maintenance of proper nutrition can reduce the likeliness of experiencing fatigue. In particular, consumption of complex carbohydrates rather than simple carbohydrates should be increased and fatty foods or junk foods should be avoided. Levels of work-related and leisure time stress should be minimized, particularly before bedtime. To do this, a place and time (at least one hour before sleep) other than the bedroom should be allocated to resolving stressful issues. Self-administered relaxation therapy, where various muscles of the body are systematically tightened for 5 – 10 seconds and then gradually relaxed, is a useful technique when stress is affecting the amount of sleep received. A consistent sleep schedule every day of the week, including weekends, should be established. Soothing routines before sleep, such as reading a book or listening to music, are also helpful techniques. Heavy meals, alcohol, chocolate or caffeine should not be consumed less than 4 hours before bedtime. Activities such as snacking or intensive exercise should also be avoided immediately prior to bedtime.

A problem specific to wild land firefighters is the relationship of fatigue, sleep deprivation and shifting work schedules. Shift work can have direct impacts to the health and safety of firefighters because of its association to the disruption of the circadian rhythm (Caldwell Jr. 1997). Research has shown this disruption to cause reduced energy, poor eating habits, decreased motivation, negative social habits, impaired sleep, degraded performance, and gastro-intestinal problems (Caldwell Jr. 1997; Glazner 1992). Glaszner's (1996) study of urban firefighters in northeastern United States noted that only 54 percent of the fire alarms occurred during the 12:00 – 16:00 shift and the 18:00 – 24:00 shift. However, 68percent of the work-related injuries were sustained by the firefighters during those two periods, indicating that firefighter fatigue resulted in an increased risk of work-related injury.

There are several steps firefighters can take to reduce the impact of shift work on job performance (Caldwell Jr. 1997). If possible, tasks associated with a higher risk of injury should be avoided between 2 – 6 a.m. If it is only necessary to work one night shift amidst several day shifts, attempts should be made to maintain a normal sleep schedule and include a mid-afternoon nap prior to the night shift. Naps as short as 5 minutes can increase alertness and safety. There should be at least one hour in between the end of the nap and the time when work activities must be resumed. Individuals working a night shift should try to stay awake after their shift is over until normal bedtime. If irregular shift work is expected for one week or more, it may be necessary to incorporate some rapid sleep readjustment techniques. Caldwell Jr. (1997) recommends changing stimulation to circadian rhythms by adjusting exposure to bright light.

5.5.2 Nutrition

Nutrition is a commonly issue related to occupational health and safety. Workers relying on nutrient deficient diets for energy have higher incidences of fatigue and temperature-related stresses, decreased cognitive and immune function, and slower recovery from exercise (Ashby *et al.* 2001). In activities requiring a high level of endurance such as those found in silviculture work, the body may reduce fuel for nervous and immune system function to ensure muscle demands for fuel are being met (Roberts Unpubl. Rep.). Fuel deficiencies to the nervous system result in slower reflex responses, poor mental attitude, and inattentiveness, while deficiencies to the immune system negatively affect the body's ability

to repair minor injuries and defend itself from infection. As a result, work performance decreases, driving skills are impaired, and likeliness of injury increases.

The typical North American diet is high in total fat, saturated fat, cholesterol, sodium, and sugar. It is low in complex carbohydrates and fiber. Consumption of fresh fruit, vegetables and whole grains is generally low, while meat, dairy products, other foods high in saturated fats, and processed foods are over-consumed (Burke *et al.* 1995).

This type of diet is very different from that suggested for highly active people. An appropriate diet for active individuals is one with 55-70 percent of the calories obtained from carbohydrates (Sharkey 2001a; Cook 2000; Roberts 2000; Coggan *et al.* 1996), 15 percent from protein, and 15-30 from fats (Sharkey 2001a; Coggan *et al.* 1996). Adequate consumption of carbohydrates (6-10 g/kg/day is recommended for athletes) is vital to the maintenance of glycogen stores (Sharkey 2002; Sharkey 2001a; Roberts 2000). Workers should consider carbohydrate loading before and during the work day. Blood glucose and muscle glycogen levels that are too low can reduce immune function, increase incidence of respiratory tract infections in wildland firefighters, reduce productivity, and impair cognitive and motor function. These impacts can result in confusion, irritability, poor judgment, and accident proneness. Given the intensity and duration of exercise associated with silviculture work, if workers do not replace lost calories it will result in a decrease in body mass and blood glucose levels (Roberts 2000).

Fats from borage oil and fish oil can help to increase oxygenation of the blood during high intensity exercise (Coggan *et al.* 1996). A slight increase in the daily proportion of fats may be consumed if working conditions are very difficult (Cook 2000). For example, a tree planter may want to include slightly more than 20 percent of the daily caloric intake in fat if they know they will be planting on very difficult terrain (e.g. steep slope, very rocky ground, and/or high cover of vegetation etc.) for a longer duration. However, workers relying on a high-fat diet may find a decrease in work performance because the body's stores of carbohydrate as liver and muscle glycogen are compromised. A high-fat diet is also detrimental to immune system response as compared to a high-carbohydrate diet (Sharkey 2001a), and lacks the necessary variety to optimize nutrient intake.

Some protein should be included in the diet (1.2 – 1.8 g/kg/day) to preserve fat-free mass through building and repairing muscle, red blood cells and other tissues (Cook 2000; Coggan *et al.* 1996). Some researchers may recommend that up to 30 percent of the diet should be in high-quality protein for its anabolic potential and supplements like Creatine Kinase. However, Creatine is most often used during maximal intensity excursion (Cook 2000). As a result, Creatine supplementation is only useful to individuals that need a short burst of energy, such as sprinters. Working in the silviculture industry rarely requires the 6-8 second energy source provided by Creatine supplementation.

With the intensive and prolonged exercise associated with silviculture work, adequate nutrient levels should be maintained before, during and after exercise. Carbohydrates should be ingested several days before physically demanding tasks, preferably along with an increased intake of fluids, to improve performance (Vinciguerra 1985). To maintain performance during a workday and throughout the planting season, Roberts (2000; 2003) suggests that tree planters include a bottle of Gatorade or other Carbohydrate/Electrolyte

(C/E) sports drink and small amounts of low fat snacks along with a high carbohydrate lunch to maintain blood sugar levels and prevent muscle wasting and immune system suppression. Other researchers have also suggested including snacks between meals, particularly those that are carbohydrate supplemented such as energy bars and C/E sports drinks, to maintain adequate levels of performance to provide energy and maintain immune system function and mental performance (Sharkey 2000a; Vinciguerra 1985). Before the start of physically demanding tasks, silviculture workers should have a good breakfast and allow some time for digestion. After the work day, a large carbohydrate based meal or snack should be consumed within 1-2 hours of the end of a shift to replenish muscle glycogen stores and speed recovery (Arnett *et al.* 2001). The amount of carbohydrates needed for adequate recovery will increase with body weight.

Along with adequate portions of carbohydrates, proteins, and fats in the diet, silviculture workers should also ensure sufficient consumption of vitamins and minerals. Vitamins act to regulate chemical reactions in the body (Cook 2000). For example, Vitamin E may help reduce the potential for oxidative stress and tissue damage with a high level of activity (Arnett *et al.* 2001). Oxidative stress occurs with the formation of free radicals due to excessive intake of oxygen during physical activity (Sharkey 2000b). Free-radicals can cause tissue damage, slow recovery from fatigue, and contribute to long-term health concerns. Other vitamins that have beneficial effects on the immune system are Vitamin C, which enhances the immune system, Beta-carotene for its ability to stimulate natural killer cells, Vitamin B₆ for its ability to promote white cell proliferation, and Folate, for its ability to increase white blood cell activity (Sharkey 2000b). Minerals are used in the regulation of body processes, such as the role of iron in oxygen transport via hemoglobin red blood cells (Sharkey 2000b). Other important minerals are selenium, for its positive effect as an antibacterial agent, and zinc, for its ability to increase wound healing. In most cases a well-balanced diet will provide workers with sufficient nutrients and energy to complete most physically demanding tasks. However, certain minerals such as zinc, calcium, selenium, iron, and potassium should be carefully monitored, particularly for women and those with restrictive diets (Davis and Brown 2001; Cook 2000; Burke *et al.* 1995; Sharkey 2000a). Although sodium is a mineral lost in sweat, the amount of salt found in regular meals is generally sufficient to maintain sodium levels. That being said, Gatorade or other C/E drinks will also ensure sufficient sodium and potassium replacement. Excess consumption of sodium should be avoided due to its association with reduced temperature regulation, upset stomach and fatigue (Sharkey 2001a). Anti-oxidants can also have a place in the diet of highly active people due to their combative power over the free-radicals (Sharkey 2000a). They can reduce immune system suppression and muscle damage as a result of overuse (Coggan *et al.* 1996). Zinc, Selenium, Magnesium, Manganese, vitamins E and C, beta-carotene, and phytochemicals found in fruits and vegetables are all sources of antioxidants (Sharkey 2000a).

Adequate intake of potassium will help prevent cramps and over-use injuries in joints. Due to the loss of this mineral in sweat, diets of silviculture workers should include adequate levels of potassium (Cook 2000). Iron and Zinc deficiency more common in women and those with a vegetarian or modified vegetarian diet (Davis and Brown 2001). Since iron and zinc deficiencies have been found to effect endurance performance, supplementation of these nutrients should be considered (Roberts 2000). Zinc deficiency can also impede performance due to a reduction in muscle strength. The daily intake of iron and zinc for

women, on average, is lower than the recommended daily allowance (RDA) (Davis and Brown 2001). Men were found to be slightly above RDA. Iron stores in the body can be increased by taking a 50 mg ferrous sulphate supplement. When Iron is deficient vitamin C sources should be included in the diet to help absorb non-heme iron. For example, citrus fruits should be eaten with iron-fortified cereal to ensure proper absorption of iron. Another important nutrient supplement for vegetarian diets where consumption of animal products is completely eliminated (e.g. Vegan diet) is Vitamin B₁₂.

Diet supplementation has become very popular within groups of highly active people as a way of enhancing performance. While some supplements are taken to ensure that the recommended dietary allowance of vitamins and minerals is consumed, others, known as ergogenic aids, are taken due to claims of their ability to increase physical and mental capacity (Public Affairs of the United States Army 2000). Such supplements range from vitamins and minerals to herbals and amino acids. However, many of the supplements on the market today have not been adequately researched for their effectiveness, and may even be associated with severe health hazards. Since manufacturers do not need to follow any standards when developing them, individuals should take the time to research the safety and validity of any supplement before taking it. For a comprehensive table listing performance-related, herb, vitamin, and mineral supplements and their effectiveness, consult Dietary Supplements: is your health at risk? (Public Affairs of the United States Army 2000). As a general rule of thumb, avoid supplements that do not contain a USP (United States Pharmacopeia) label or a label from another organization that develops standards to ensure the quality of medicines, are not made by a nationally known food and drug manufacturer, show no evidence of being supported by research, and that make inaccurate or far-fetched claims (Coleman 2002).

A physician should be consulted before dietary supplements are taken. Roberts (2000) suggests that tree planters get their Ferritin levels evaluated 6 weeks prior to the planting season. If low, recommendations for raising hemoglobin levels to optimal rates should be provided. Unnecessary nutrient supplementation can decrease performance and/or become hazardous to user health. For example, zinc supplementation in excess of 15 mg/day is often associated with negative effects (Davis and Brown 2001). Instead of taking additional nutrient supplements, the better alternative may be to increase consumption of foods high in the particular nutrient that is deficient, or to avoid constituents that inhibit nutrient absorption.

5.5.3 Exercise

Research indicates fitness levels are linked with the risk of injury (Sharkey 2000b; Cady *et al.* 1985). This seems to be especially true for women, who may be two times more likely to suffer injuries than men due to differences in physical fitness, particularly aerobic capacity (Sharkey 2000b).

A regular schedule of exercise outside of work will increase mental and physical alertness required while on the job. For example, the negative effects of fatigue due to inadequate total sleep time, reduced slow wave sleep, amount of REM sleep, and/or delayed onset of sleep may be avoided by keeping a regular exercise schedule (Caldwell Jr. 1997). Regular moderate exercise seems to have a positive effect on immune system response (Sharkey 2000a). There are many examples that illustrate the linkage between fitness level and both

physical endurance and efficiency of energy expenditure. Sharkey (2000b) noted that aerobic fitness is very important for maintaining performance during long shifts of hard work. Regular exercise seems to increase the use of fat as an energy source (Coggan *et al.* 1996). This in turn allows the body to increase carbohydrate stores. The speed at which wildland firefighters can travel to their safety zone is associated with their level of fitness (Sharkey 2001b). Roberts (2002) also noted that the benefits of increasing the amount of carbohydrate consumed can be enhanced if done during exercise.

To reduce the risk of injury associated with the seasonality of silviculture work, authors agree that workers should try to maintain an adequate level of fitness throughout the year. This can be done by incorporating a moderate intensity exercise program into their lives. Miranda *et al.* (2001) found that a moderate amount of trekking decreased knee pain, while a high amount of active trekking had the opposite effect. A common suggestion from health and safety researchers is to incorporate pre-season training programs designed to prepare silviculture workers for the physical demands related to their job. Such programs have been associated with many benefits, such as an increase in maximum aerobic capacity (VO_2 max) and stimulation of red blood cell production (Roberts 2000).

Many individuals employed by the physically demanding, seasonal occupations within the silviculture industry are not able to maintain an adequate level of fitness between seasons. This would explain findings by Cook (2000) that the majority of tree planting injuries occur in the first two weeks of the planting season. Roberts (2002) suggests that fitness levels of tree planters be evaluated prior to the planting season to enable more specific and tailored fitness recommendations. A gradual increase in hours worked at the beginning of the season will reduce the risk of muscle overuse and damage. Lyons (2001) suggested that for the first shift, tree planters work two half days followed by 1.75 days. Furthermore, she suggested that employers implement incentive programs for encouraging tree planters to arrive conditioned and participate in stretching exercises the morning of and periodically throughout each work day. To avoid injury, dynamic stretches should be scheduled before the work day, and static stretches can be encouraged after tree planters have to return to the seedling cache to re-fill their bags for the first time (Cook 2000). Sharkey (2000b) also suggests wildland firefighters begin training, such as jogging, mountain biking, lift weights, hiking hills and power walking with gradually increasing weight 6-8 weeks, prior to taking the “pack test” (a test used in British Columbia to ensure potential wildland firefighters are in adequate physical condition).

Fitness can be maintained throughout the year by sticking to a regular exercise schedule that includes aerobic activity, muscle strengthening, and stretching (Roberts 2002; Sharkey 2000a; Caldwell Jr. 1997). Training programs would include exercising 3-4 days a week at 50 – 85 percent maximum heart rate. Exercising should be conducted several hours before bedtime to avoid negative effects on sleeping patterns (Caldwell Jr. 1997). Aerobic exercise should be conducted for 20-60 minutes and should incorporate rhythmic activities that use the large muscle groups, such as running, hiking, and biking (Roberts 2002). Antioxidant supplements taken during intensive exercise can help to reduce the negative effects associated with oxidative stress (Sharkey 2000b).

5.5.4 Temperature & Hydration

The environmental conditions most silviculture workers are exposed to increase their risk for many temperature-related disorders, including dehydration. This is particularly true for wildland firefighters who must perform arduous and prolonged tasks in hot and dry weather that is amplified by the fire. While fire fighters are exposed to significant risks, all individuals involved in physically demanding work under high temperatures and/or low humidity are susceptible to dehydration and heat stress.

Heat stress is a common problem associated with an increase in radiant heat or the creation of metabolic heat through activity (Sharkey 2001a). To avoid sun burn and attacks from stinging and biting insects, many silviculture workers are forced to wear clothing that covers as much of the body as possible, leading to increased body temperature and reduced heat dissipation (Giguere *et al.* 1993). Individual response to heat stress will differ with gender, body weight, sweat rate, fitness level, and the amount and type of clothing worn (Sharkey 2001a). For example, Sharkey (2001a) noted that women seem to have a lower sweat rate than men when exposed to exercise. This would indicate a more efficient physiological response to metabolic heat production with physical activity.

Two commonly used measures of heat stress are the Wet-Bulb-Globe-Temperature (WBGT) heat stress index and the Required Sweat Rate (SWreq) (Sharkey 2000b; Wasterlund 1998). With the WBGT heat stress index, humidity accounts for 80 percent of the measure, radiant heat and air movement for 20 percent, and air temperature for 10 percent. Arduous physical activity should not be conducted when the index value is greater than 85°F. The WBGT heat stress index is easy to measure and requires minimal interference with work. However, it has been criticized for its poor ability to predict human response to heat stress. The cumulative hours of physical activity or the added heat stress of wearing protective clothing and carrying protective equipment are not included in the WBGT measure. The SWreq compares the sweat rate required to maintain a balanced body temperature with the maximum sweat rate. Although the SWreq seems to be a more accurate measure of heat stress risk than the WBGT heat stress index, it is a more complicated measure that requires more data.

Dehydration is a serious condition that can result in reduced heart and circulatory function, worker ability, and risk of heat stroke if fluids are not replaced (Sharkey 2001a). Thirst is not a reliable method for measuring hydration. The infrequent need to urinate and/or brightly colored urine are warning signs of dehydration (Cook 2000). A urinary color chart is a useful tool for monitoring hydration levels. Other signs include a fast heart rate, weakness, fatigue, dizziness, and rapid weight loss. Failing to react to such signs can result in more serious problems.

Heat cramps, heat exhaustion, heat syncope, and heat stroke are all linked to heat stress (Sharkey 2001a; Curtis 1997). Heat cramps cause involuntary muscle contractions due to a failure to replace fluids or electrolytes. Although relatively minor when compared with heat exhaustion or heat stroke, heat cramps should not be ignored. They can be alleviated by stretching and replacing insufficient fluids and/or electrolytes. Heat syncope is a relatively mild heat illness that occurs when skin blood vessels dilate to try and increase heat loss. The resulting decrease in blood flow to the brain causes symptoms such as faintness, dizziness, headaches, increased pulse rate, restlessness, nausea, vomiting, and potentially loss of

consciousness. Individuals exhibiting signs of heat syncope should lie down or sit in a cool place with their feet elevated. They should be given plenty of fluids and avoid vigorous activity for the remainder of the work day. Heat exhaustion is a serious condition that should be tended to immediately. Signs of heat exhaustion include general weakness, extreme fatigue, nausea, headaches, and wet, clammy skin. An individual exhibiting signs of heat exhaustion needs to rest in a cool environment and replace lost fluids and/or electrolytes. Heat stroke is the most serious of heat disorders and should be treated as a medical emergency. It occurs when there is a failure of the body's heat regulating mechanisms. A victim of heat stroke will no longer be sweating, resulting in the rapid increase of body temperature. They will have a body temperature greater than 41 °C, which may result in mental confusion, loss of consciousness, convulsions, and coma. If dealing with an individual showing signs of heat stroke, the first step is to get help. The victim should then be cooled with ice or cold water, fanned to increase evaporation and treated for shock if necessary. Rapid cooling can also be obtained by partially submerging the victim in cold water.

Persons exposed to heat stress or dehydration should adapt their workload and take other necessary precautions to avoid overexertion and excessive heat exposure (Wasterlund 1998). For example, allocating the more physically demanding tasks to the cooler times of the day, increasing the number of breaks and maintaining hydration are all good practices when working in hot environments (Sharkey 2001a). Hydration should be maintained before, during, and after work. Although hydration demands will depend on the temperature and humidity at the work site, there are general rules of thumb that silviculture workers can follow. Recommendations for tree planters are to drink 500ml of fluid in the morning and 250 – 500 ml after each “bag-up” (i.e. when tree planters must re-fill their bags with seedlings) (Cook 2000). This should add up to about 4L of fluids for each work day, $\frac{3}{4}$ of which should be water, while the rest can be juice or a sports drink. Levels of hydration can also be improved by increasing consumption of water foods such as lettuce, cucumber, tomatoes, oranges, and watermelons. Wildland firefighters should drink substantially more fluids than other silviculture workers, about 1L of fluid per hour (Sharkey 2000a). Sharkey (2001a) recommends drinking 1-2 cups of water, juice or a C/E sports drink and avoiding caffeine before work, taking several fluid breaks throughout the work day, drinking as much as possible during lunch, and continuing fluid consumption after work. The sodium in C/E sports drinks may decrease urinary water loss, although most individuals consume more than enough sodium with meals. Alcohol and use of certain drugs should be minimized when working in hot environments. Although research indicates the importance of adequate hydration, workers should avoid drinking excess fluids. This is because the risk of hyponatremia, a potentially serious disorder that results when too much water is consumed, increases as fluid intake increases (Sharkey 2000a).

Clothing worn should be loose enough to allow for increased air movement and heat dissipation (Sharkey 2001a). A first layer of cotton can increase sweat evaporation. Extra layers should be avoided in hot environments. Due to the relationship between metabolic heat production and body weight, body mass index should be kept below 28. The stress of working in hot and humid environments can also be significantly reduced with improved fitness due to better circulation, higher blood volume, and lower heart rate and body temperature. Sharkey (2001a) found that the level of fitness had a greater impact on body temperature, exertion, heart rate, weight loss, and evaporative water loss than did the

clothing worn. Fit individuals are also able to adjust and acclimatize their bodies to the increased heat much more quickly. Allowing 5 – 10 days for the body to acclimatize will increase blood distribution and the amount and rate of sweat production. It will also help to reduce heart rate and skin and body temperature. However, the increased sweating rate associated with individuals acclimatized to heat makes them more susceptible to severe dehydration, known as hypohydration, than non-acclimated individuals if they do not keep adequately hydrated (Armstrong *et al.* 1997).

5.5.5 Hypothermia

Heat stress in hot, humid environments is not the only temperature-related risk when working outdoors. Hypothermia, a condition that occurs when the body temperature becomes dangerously low (below 95°F); can occur with exposure to cold, wet, or windy conditions (Workers' Compensation Board of B.C. Unpubl. Rep).

Mild signs of hypothermia include shivering, grogginess, and poor judgment. More violent shivering, the inability to think and pay attention, slow shallow breathing, slurred speech, lack of coordination, and a slow, weak pulse are indications that a person is suffering from moderate hypothermia. Severe stages of hypothermia are characterized by the absence of shivering, dilated pupils, unconsciousness, and faint or non-existent breathing and pulse.

Wearing layered clothing and warm head gear with adequate insulation is the best defense against hypothermia. Hands and feet should also be protected against the cold. This can be accomplished by wearing waterproof boots and mittens or gloves. Dehydration and fatigue should be avoided due to their association to hypothermia.

Persons with mild signs of hypothermia should be closely monitored to ensure their condition does not worsen. They should be removed from the cold environment and sent to a physician as soon as possible. Hot fluids can be given to the victim if alert. Shivering should be encouraged. An emergency situation has developed once moderate to severe signs of hypothermia have been observed. In such situations, immediately seek medical attention and administer first aid. Avoid giving moderate to severe hypothermia victim's fluid due to the increased risk of vomiting.

5.5.6 Insect, disease & wildlife threats

Along with the extreme environmental conditions a silviculture worker must withstand, there are also biological risks to contend with when working outdoors. There are several insect, disease and wildlife threats that a person is exposed to when working in the field, some more dangerous than others. Silviculture workers should be able to distinguish between those encounters that are likely to be harmless and those that may be more serious.

Stinging insects such as bees, wasps, and yellow jackets cause only minor discomfort for most people. However, for those with allergies, insect stings can be life threatening. Terry (1995) reported that wildland firefighters require treatment for stings more than any other work-related injury with the exception of sore feet. Allergic reactions often occur when an individual is stung more than once. Severity of reactions will vary between individuals. Symptoms of a severe reaction include dizziness, labored breathing, and the need to lie down. An anaphylactic kit should be readily available for individuals with allergies to insect stings. Co-workers should know where the kit is and how to use it. Highly allergic people

can pass into a coma in as little as 10 minutes. To minimize stings, workers should wear long sleeve shirts that are tucked into their pants, and tuck pant legs into work boots. Avoiding aromatic lotions, perfumes, and deodorants is also recommended. When eating lunch in an area with active wasps, bees, or yellow jackets, placing a small amount of something with sugar in it away from the eating area will help keep the insects away.

There are several diseases that can be contracted when working outdoors that can pose mild to very serious threats to silviculture workers. *Giardia Lamblia*, or Beaver Fever, is a fairly common parasite in the United States and Canada (Johnson 2002). It can be contracted when an individual drinks water that has been contaminated by the parasite through the feces of a host, such as the beaver. Symptoms such as severe diarrhea, nausea, vomiting, and fatigue, generally appear 5 to 25 days after exposure. *Giardia* can be prevented by refraining from drinking water from creeks, rivers, lakes, or ponds unless the water is boiled first or a water filtration or purification device is used.

The West Nile virus has recently spread from eastern United States and Canada to areas of the Pacific Northwest, including British Columbia (National Institute of Allergy and Infectious Diseases – National Institutes of Health 2002). It is transmitted to humans by female mosquito bites. Symptoms of the infection include fever, headaches and body ache, skin rash, and swollen lymph glands. However, if the virus crosses the blood-brain barrier it can cause encephalitis or meningitis, both of which are life-threatening illnesses. Research indicates it can be transmitted by blood transfusion, organ transplants, and from a mother to her child in the womb or through breast milk. There is currently no known cure for the disease. The threat of contracting this virus can be minimized by reducing the chances of being bitten by a mosquito. Applying mosquito repellents and minimizing skin exposure by wearing long-sleeve shirts and hats with protective mosquito netting are effective methods for minimizing mosquito bites. Repellents that contain 20 – 50 percent DEET (N, N-diethyl-meta-toluamide) are the most effective (U.S. Army Center for Health Promotion and Preventative Medicine 2002a).

Ticks are potential carriers to a variety of diseases. If found attached to the body they should be removed immediately. This can be done by grasping the mouthparts of the tick with pointed tweezers and pulling back on the insect slowly but firmly (U.S. Army Center for Health Promotion and Preventative Medicine 2002b). Rocky Mountain Spotted Fever is a serious illness passed on to humans through the bite of a tick carrying the bacteria *Rickettsia rickettsii* (U.S. Army Center for Health Promotion and Preventative Medicine 2002a). However, the tick must be attached for several hours for effective transmission of the disease. The Rocky Mountain wood tick is the main carrier of Rocky Mountain Spotted Fever in the Pacific Northwest. When contracted the disease has a fatality rate of 3 – 5 percent. Higher risks are found in men, the elderly, African-Americans, alcoholics, and individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency. Symptoms appear 2-5 days after the onset of fever, and include a red spotted rash, abdominal pain, diarrhea, and joint pain. Risk of infection can be reduced by maintaining adequate protection from ticks. Use of insect repellants with DEET and wearing pants tucked into boots and long-sleeved shirts tucked in at the waist are recommended methods of tick protection (U.S. Army Center for Health Promotion and Preventative Medicine 2002a; McPhearson 1997).

Lyme disease is rare but very serious disease that can also be contracted from ticks, specifically the western blacklegged tick (U.S. Army Center for Health Promotion and Preventative Medicine 2002c). The chance of becoming infected from tick bites increases between May and July. Symptoms of Lyme disease include a skin rash that starts around the area of the bite and gradually spreads. The initial rash will often have a bull's-eye or donut shape, due to a partial clearing in the center of the lesion. However, up to 40 percent of people who contract Lyme disease do not get the rash. Flu-like symptoms including fatigue, headaches, sore and aching muscles and joints, fever, sore throat, stiff neck and swollen glands are also common. A physician should be consulted once such symptoms arise. If treated quickly with antibiotics, symptoms will disappear shortly and serious complications will likely be avoided. However, symptoms left untreated may disappear even if the disease has not cleared up, potentially leading to more serious complications of the joints, nervous system, and heart. Arthritic attacks lasting a few days to a few weeks are a late symptom of the disease (McPhearson 1997). Lyme disease can be prevented by reducing the chances of tick bites. As mentioned above, use of insect repellants such as DEET and wearing clothing to cover as much of the skin as possible are effective methods of protection.

Hantavirus is a very rare but life-threatening infection that can be transmitted to people working in the vicinity of rodents, particularly deer mice (Workers' Compensation Board of B.C. 1996b). It is most often contracted when an individual disturbs an area presently or previously occupied by deer mice, and breathes in the virus from the rodent's urine, saliva, or droppings. For silviculture workers, disturbance of an area is most common at camp or when a wild burrow is encountered during the work day (Whitney 2000). Initial flu-like symptoms can turn into life-threatening conditions within two or three days. Worker exposure when living in camp can be minimized by implementing an effective rodent control program that includes ongoing inspections, maintenance of adequate camp sanitation, rodent proofing of the camp, and a reduction in rodent populations with traps and poisons.

A silviculture worker will frequently cross paths with many different species of wildlife while at work. Silviculture workers should know how to react when faced with potentially dangerous wildlife encounters.

Many silviculture workers will have some sort of encounter with a bear. The risk of a bear attack during such encounters increases when bears are habituated to human food, defending a fresh kill, or when females are defending their cubs (B.C. Ministry of Water, Land and Air Protection 1996). Important facts to know about bears are their acute senses of smell and hearing, speed (they can reach speeds of 35 – 40 mph), strong swimming abilities, and extreme strength (University of Oregon Unpubl. Rep.; B.C. Ministry of Water, Land and Air Protection Bear and Cougar Factsheets). Although both black and grizzly bears can climb trees, black bears are more adept at doing so (B.C. Ministry of Water, Land and Air Protection 1996).

Bear encounters can be reduced by staying alert and look for signs of recent activity, such as fresh droppings, abundant berries, tracks, evidence of digging, or claw/bite marks on trees (B.C. Ministry of Water, Land, and Air Protection 1996; University of Oregon Unpubl. Rep.; B.C. Ministry of Water, Land, and Air Protection Bear and Cougar Factsheets). Making noise with loud talking or bells will alert bears of your presence and keep them away. Food should not be left around camp as it can quickly attract a bear. In the event of a bear

encounter, avoid eye contact and talk quietly. Slowly back away, all the time facing the bear and moving arms up and down. Bear spray should be used once if the bear is 30 feet away, again if they move closer, and should be sprayed until the can is empty when a bear is within 10 ft. If possible, climb a tree at least 15 ft in height. Mild aggression can be used if a black bear does not leave. This can include yelling or running at it. Avoid such aggression with a grizzly bear encounter. The most appropriate course of action in the event of a grizzly bear attack is to play dead by lying face down and protecting the neck. If viciously attacked, however, it is best to fight. Black bear attacks are best defended by fighting.

Cougar encounters are very rare in British Columbia and elsewhere (University of Oregon Unpubl. Rep.). Attacks to children under the age of 16 are most common (B.C. Ministry of Water, Land, and Air Protection Bear and Cougar Factsheets). They are very rarely seen due to their solitary and stealthy nature (University of Oregon Unpubl. Rep.). Cougars typically attack from behind, resulting in very little warning to their victim. Methods to avoid cougar encounters are similar to those mentioned above for avoiding bear encounters.

A cougar encounter more than 50 ft away rarely results in an attack and often indicates simple curiosity (University of Oregon Unpubl. Rep.; B.C. Parks Unpubl. Rep.). The best strategy with such an encounter is to move away, avoid direct eye contact, and grab any weapon available, even if it is a rock. In the event of a closer encounter, try to be as intimidating as possible. Staring, hiding to mimic the behavior of a predator ready to attack, yelling and trying to look as big as possible are all recommended tactics. In the event of an attack it is important to fight and protect the head and neck. Blows to the face and skull of a cougar are generally most effective.

5.5.7 Musculoskeletal injuries

The Workers' Compensation Board of British Columbia (2001) define musculoskeletal injury (MSI) as "an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels, or related soft tissue including a sprain, strain, and inflammation that may be caused or aggravated by work (Occupational Health and Safety Regulation, Part 4, Section 4.46). MSI can develop when muscles, tendons, or ligaments become inflamed (Cook 2000) due to overuse or repetitive motions. Fatigue, lack of physical fitness, nutrition deficits, dehydration, working in cold, wet conditions, and other job-related stresses contribute to the risk of MSI. In the silviculture industry, MSI to the back, neck, wrist, knee, elbow, and shoulder seem to be the most common

There are several methods for controlling the risk of musculoskeletal injuries (Workers' Compensation Board of B.C. 2001). Engineering controls are those related to the arrangement, design, or alteration of the physical working environment. An example of an effective engineering control for tree planters would be replacing an ill-fitting tree planting bag or wildland firefighting pack with one more suitable to the dimensions of the worker. Administrative controls can also be used to improve the ergonomics of the working environment. They can improve the work organization and performance through an alteration of the use and scheduling of resources and staff. Limiting shift length to 8 hours is an example of an administrative control. Personal protective equipment and clothing should be worn when the other controls are not practical. For example, gloves should be worn by those using chainsaws for mechanical brushing operations.

Workers should be trained on appropriate movement techniques when conducting awkward, repetitive, or strenuous motions. This is particularly true for low back pain, which affects 60-85 percent of all working people (Anon. 2000). Back injuries can be caused when one or more of the following improper lifting techniques are used: lifting with the back bent and legs straight (stoop technique), holding the load too far from the body, twisting while lifting, losing balance during a lift, lifting the load in cluttered areas, or poor coordination when two or more people are required to lift the load (United States Army Center for Health Promotion and Preventive Medicine Unpubl. Pamphlet). To prevent back injury a squat technique as compared to stoop technique should be used when any heavy or repetitive lifting is required to avoid strain to the lower back (Hagen and Harms-Ringdahl 1994). If chronic non-specific lower back pain is an issue, van Tulder and Pennick (2002) recommend exercise therapy, behavioral therapy, and multidisciplinary treatment options as the most effective treatments.

Due to the relatively high occurrence of wrist and back injuries in occupations related to silviculture, exercises and stretches that can help to reduce these injuries should be incorporated into a fitness program. Workers will often change from a squat to a stoop technique when the quadriceps muscles are tired, suggesting that exercise programs should ensure adequate strengthening of this muscle (Hagen and Harms Ringdahl 1994). Wall slides for strengthening the back, hip and leg muscles, leg raises while face-down for strengthening the back and hip muscles, leg raises while face-up for strengthening the stomach and hip muscles, partial sit-ups for strengthening the stomach muscles, back leg swing for strengthening the hip and back muscles and other exercises that focus on strengthening these muscle groups can help reduce the risk of back injury (American Academy of Orthopaedic Surgeons 2000). Wrists and forearms can be strengthened by grasping weights in each hand and rolling them up, or towards the body (Roberts 2003). Spelling the alphabet in the air using each of your fingers separately and on each hand is also a useful wrist and hand exercise (Lyons 2001). Other effective wrist exercises include squeezing a racquetball or stress ball in each hand or bouncing a hacky sack on the back of the hand (Roberts 2003).

The next three sections incorporate further descriptions of MSI and other health and safety issues as they relate to specific occupations within the silviculture industry.

5.5.8 Tree planting injuries

Tree planting is seasonal work that begins with the snow melt and usually ends in August in the interior of British Columbia and in October for coastal B.C. (Ellis 2002). A typical workday for a tree planter is 11-12 hours long, including travel time to and from the work site. When the worksite is accessible by road, a 5-day work week with one day off in between shifts is typical, although one period of two consecutive days off or eight non-consecutive days off are required each month (Ellis 2002; Lyons 2001). For work sites accessible only by boat or airplane, work shifts are often extended to nine to 10 days with two to four days off between shifts. The average age of B.C. tree planters is between 18 and 30, and many of them are students. They will expend anywhere from 6.9 to 7.8 kilo calories per minute and can lose 1.7 percent of their body weight over a 14 day period, 25 percent of which is fat free muscle mass. The physical demands of the job require tree planters to work at a VO_2max of 46 percent after an 8 hour period (Trites *et. al.* 1993). To put this into perspective, Astrand and Rodahl (1986) recommended a VO_2max of 40 percent to avoid fatigue at the end of a work day. Average annual turnover is about 50 percent due to the

physical demands of the job and possibly to perceived health and safety risks as well (Ellis 2002; Trites *et al.* 1993). Tree planter burnout is a common problem at the end of a planting season (Trites *et al.* 1993). It is associated with sickness, debilitation, and below average performance. One in five tree planters are injured on the job, and cost the Workers' Compensation Board of B.C. approximately 2 million dollars per year. Lyons (2001) noted that, of the tree planters she surveyed who reported an injury; only 41.8 percent consulted a doctor. In addition, 12 percent of those surveyed who reported an injury needed to take more than 10 days off of work.

Ergonomic injuries are among the most common injuries associated with tree-planting. It is not unusual for the daily activities of a tree planter to include planting 1600 seedlings, lifting a cumulative weight of over 1000 kg, and hiking over 16 km with a heavy bag (Workers' Compensation Board of B.C. 1996a). In just one hour a tree planter will likely bend and drive their shovel into the ground more than 200 times. A substantial number of injuries reported from tree planters are a result of the repetition, force, and awkward postures associated with the work (Ellis 2002). Risk of injury is much higher at the beginning of the planting season. A recent survey of tree planters reported 46 percent of tree planting injuries occurred within the first two weeks of work due to improper conditioning (Lyons 2001). Although there seems to be a gradual adaptation to the strenuous work as the season progresses (Trites *et al.* 1993), 38 percent of tree planting injuries occurred in the last two weeks of the season, possibly due to burnout and a loss of muscle mass (Lyons 2001).

The Workers' Compensation Board of British Columbia (1996a) reported that the most common injuries for tree planters in B.C. were associated with the wrist, and back. Shoulders and knees were the 3rd and 4th most common sites of injury. Injuries such as tendonitis and carpal tunnel syndrome in the wrist, and lateral epicondylitis of the elbow often result from the repetitive motion and force required when using the shovel (Ellis 2002; Lyons 2001). The risk of wrist injuries increases when working on hard or rocky ground (Cook 2000). Carrying a heaving planting bag and bending to plant the seedling and close the hole with the hands places strain on the back and shoulders. Shoulder injuries have been related to an inability to re-distribute muscle activation pattern in the shoulder region or upper extremity (Jensen *et al.* 2000). Muscle strengthening in these areas may reduce the likelihood of fatigue and improve load sharing. The risk of back injury increases when tree planters dig planting holes with a partially flexed back. Knee and ankle injuries are often caused by strain, stumbling or tripping (Anon. 2002).

Roberts (2000) also warned that overuse and strain due to tree planting may have implications for longer-term musculoskeletal disorders such as osteoarthritis. Knee osteoarthritis has been linked to heredity, obesity, injury and physical loading (Manninen *et al.* 2002). Manninen *et al.* (2002) noted that forestry is one of the five top trades for risk of osteoarthritis. Activities such as climbing, kneeling and squatting were found to increase the risk. Interestingly, physical exercise during leisure time was negatively associated with the risk of knee osteoarthritis. Women seem to be more susceptible to the injury.

Tree planting injuries can be the result of a number of factors. Roberts (2002) found that with the examination of individual results, hemoglobin levels were sub-optimal for an endurance athletic population. She also found that the overall fitness level of the tree planters was less than non-trained athletes. These findings suggest that tree planters may be

affected by inadequate nutrition and a lower than adequate fitness level. The relationship between injury rate and both nutrition and level of fitness has been well documented (Cady *et al.* 1985; Ashby *et al.* 2001). Hypoglycemia, a condition where blood sugar levels are unacceptably low, is a common problem for tree planters. It affects motor response most severely but also impacts attentiveness (Roberts 2000). Hypoglycemia can be minimized when carbohydrate consumption makes up 60-70 percent of the total caloric intake (Roberts 2000).

Tree planters should be aware of the signs and symptoms associated with injuries common to their profession. Numbness, tightness, swelling, redness, and pain the wrists, back, shoulders, or knees should alert the tree planter that a problem exists. If a tree planter experiences any of these warning signs, they should immediately stop working and seek medical attention. Taking painkillers without consultation with a doctor, taping wrist injuries, and continuing to work are common mistakes made when warning signs are felt.

There are several steps a tree planter can take to decrease the chances of a work-related injury (Ellis 2002; Workers' Compensation Board of British Columbia 1996a). First of all, administrative controls should be implemented to ensure tree planters are receiving adequate rest and recovery. Lilley *et al.* (2002) recommend two 30 minute breaks each day. Work shifts 7 days or longer have been associated with increased risk of injury and should be discouraged (Lyons 2001; Robinson *et al.* 1993). The piece rate system may increase stress in tree planters because it encourages working excessive hours without sufficient breaks (Lilley *et al.* 2002; Robinson *et al.* 1993). As a result, employers currently using the piece rate system may want to consider switching to another payment scheme, such as an hourly or daily wage (Ellis 2002).

Tree planters should be encouraged to participate in fitness training before the beginning of each planting season. Training programs should include cardiovascular, muscle strengthening, and stretching exercises. Stretching and weight training should focus on problem joints such as the wrist and lower back.

Since posture and movement associated with the planting shovel are often the cause of reported injuries, tree planters should take care in choosing a shovel with the appropriate height and weight for their body type. The staff shovel is recommended by the Workers' Compensation Board of B.C. (1996a). Other shovel types include the D-, L-, and T-handle shovels (Giguere *et al.* 1993), but the D-handle and staff shovels are the only ones of widespread use in B.C. (Lyons 2001). Use of the D-shovel has been discouraged because it tends to require more wrist movement than the staff shovel. However, if used improperly the staff shovel can cause more damage than the D-handle shovel, particularly to the shoulder (Ellis 2002; Cook 2000). The shovel should have sufficient absorptive material where it will likely be gripped to protect the median nerve and reduce potential of carpal tunnel syndrome (Lyons 2001). Tree planters should take care when selecting footwear since they are used both for protection and as a tool (Giguere *et al.* 1993). The idea boot would have reinforcement where it will most often contact the planting shovel, adequate grip on the sole to prevent slipping, an air cell in the sole and adequate sturdiness to last multiple seasons (Giguere *et al.* 1993). Planting bags should be available in a variety of sizes to suit all body types (Lyons 2001). The planting bag should also fit in such a way that the majority of the weight falls on the hips instead of the shoulders. The recommended carrying weight of

the planting bag is between 10 and 15 kg (Bell 1993). This can be linked to findings by Miranda *et al.* (2001) that work-related physical loading is strongly correlated with musculoskeletal pain.

Tree planters should minimize repetitive, stressful and straining movements whenever possible. Planting on soft ground if possible, using the boot to scrape the organic layer away from the planting spot and when closing the hole, bending with the knees instead of the back, keeping wrists straight, avoiding a tight grip on the shovel, changing hands regularly if possible, and using the foot and leg when driving the shovel into the ground are all examples of good planting techniques (Workers' Compensation Board of British Columbia 1996a).

5.5.9 Health and safety concerns of wildland firefighters

There has been extensive research on health and safety issues for wildland firefighters due to the exceptionally high physical demands and risks associated with this field. They need to be able to perform under the various hardships related to their occupation. Exposure to environmental toxins, smoke inhalation, burns and other injuries are potential risks wildland firefighters face on a daily basis (Sharkey 2000b). They are required to hike rugged terrain in extreme environmental conditions, and do this while wearing additional protective clothing and carrying a heavy load of firefighting gear, water, and tools. Lower back injuries due to repetitive motions and heavy lifting throughout the work day are also prevalent. Unfortunately, there has also been a gradual decrease in the work capacity of existing and prospective wildland firefighters, reflective of the decrease in overall health and fitness of the North American population (Sharkey 2000b).

Over a 7 day shift, total energy expenditure can be anywhere from 3000 to 6300 kilo calories each day (Sharkey 2000a), clearly indicating that the tasks of a wildland fire fighter are arduous. To ensure an adequate level of fitness prior to the work season, potential wildland firefighters are required to perform a series of tests. The Pack test is used in B.C. as a means of ensuring an adequate level of muscular fitness. It is the preferred test in B.C. because scores are not influenced by gender, ethnicity, age, height, or weight. Those who pass the test have a proven ability “perform prolonged and arduous work, under adverse conditions, with a reserve to carry out emergency responses” (Sharkey 2001b).

Wildland firefighters expend a large amount of energy due to the physically demanding tasks they are required to perform. This increase in energy expenditure can occur in conjunction with an alteration of dietary habits that often occurs while off duty for an extended period of time (Sharkey 2000a). As a result, rapid weight loss and inadequate nutrition are common problems. Data suggests that in a 5 – 7 day stretch, women may reduce their average weight by 0.6 kg and men by 1.2kg (Sharkey 2000a). Men can lose 1.7 kg of fat free mass over the same period. Although men seem to be more susceptible to loss of weight and fat free mass, research suggests women may be more affected by oxidative stress during wildfire suppression activities.

Of the silviculture-related occupations, smoke inhalation is a health risk unique to wildland firefighters (Mott *et al.* 2002; Sharkey 2000a; Sharkey 2000b). Chemicals in smoke, particularly exposure to carbon monoxide, aldehydes, benzene, acrolein, and other particulate matter small enough to reach the lungs, have been linked to both fatigue and injury (Sharkey 2000b). Sharkey (2000b) noted that 30 – 50 percent of the medical visits by

wildland firefighters were due to upper respiratory problems such as coughs, colds, and sore throats. Along with fatigue, stress, and inadequate nutrition, smoke inhalation was given as a possible reason for the high incidence of upper respiratory problems. Prolonged exposure to smoke can produce many of the same serious health problems associated with smoking, but these can often be avoided when the lungs are allowed to recover between firefighting seasons. However, health problems associated with smoke inhalation are more frequent and severe when smoking is combined with wildland firefighting. Past research has shown that firefighters who smoked had increased blood vessel constriction, resulting in reduced blood flow to the muscles (Sharkey 2000a). They were more likely to suffer injuries when undergoing fitness training. Heavy lifting and standing resulted in a higher incidence of lower back pain in smokers than in non-smokers. Furthermore, smoking has been associated with an increased risk of musculoskeletal injuries and disorders, vehicle and industrial accidents, burns, fire fatalities, and even suicide. That being said, the linkage between smoking and injury may not be evident for smokers that exercise on a regular basis.

Wildland firefighters need to be able to react quickly under potentially dangerous situations. Firefighters in superior health are able to make quicker escapes during emergency evacuations (Sharkey 2000b). For example, level of aerobic fitness has been positively associated with speed of escapes from fire. In addition, wildland firefighters should abandon their packs during evacuations to enable a faster escape.

5.5.10 Other hazards

Other silviculture work can also be associated with an increased risk of injury when compared to many other occupations. For example, chainsaw safety is an issue due to their use in pruning, spacing, and brushing operations. Hand-arm vibration syndrome (HAVS), vibration white finger, or Raynaud's disease is a potentially serious problem that can lead to the loss of fingers (Cornell Human Factors and Ergonomics Research Group – Department of Design and Environmental Analysis at Cornell University 2000). It can occur with excessive exposure to vibration from the chainsaw causes physical damage to the hands and arms (Occupational Health Clinic for Ontario Workers 1998). Symptoms include a bluish discoloration of the fingers and hands, whitening of the fingertips after exposure to cold and wet conditions, numbness, reduced sense of touch and feelings of pain, and decreased grip strength. Symptoms can appear a few months to several years after the first exposure to chainsaw vibration. If any of the above symptoms are experienced, circulation should be immediately restored to the whitened fingers by putting the hands in warm water or swinging the arms. Warm, dry clothes including gloves should be worn and a physician should be consulted as soon as possible. Smoking is also not advised for those experiencing symptoms of HAVS. The best way to prevent the HAVS from progressing is to minimize further exposure to the vibration. Using padding to absorb the vibration or redesigning the chainsaw are possible ways of avoiding exposure (Cornell Human Factors and Ergonomics Research Group – Department of Design and Environmental Analysis at Cornell University 2000; Occupational Health Clinic for Ontario Workers 1998). Silviculture workers who are required to use chainsaws should be examined regularly for symptoms of HAVS (Miller 1997). Chainsaw safety should also consider the risk of lacerations, cuts, and exposure to gas fumes (Nugent 1985).

There are also many other injuries that can be associated with pruning, thinning, or brushing operations. Kirk and Parker (1996) found that manual pruning tools required strenuous and

repetitive motions in both the wrist and elbow. While they noted that chainsaw pruning can be an alternative to manual pruning, they also recognized the obvious dangers associated with the use of chainsaws, including lacerations, noise, vibration, and exhaust fumes.

Use of pesticides has been a controversial issue in British Columbia for many years. Currently there are five herbicides registered in British Columbia, glyphosate (Vision®), 2, 4-D amine, 2, 4-D ester, triclopyr (Release®), and hexazinone (Velpar, Pronone) (B.C. Ministry of Forests 2002). Jauhainen *et al.* (1991) found that forest workers conducting brush saw spraying had low exposure to glyphosate through the breathing zone. However, due to the possibility of exposure during pesticide dilution and administration, and during repairing and servicing of the sprayer in the field, they recommended that protective equipment commonly used for pesticide work be used to minimize potential health risks. *Bacillus thuringiensis*, carbaryl (Sivin®), MSMA (Monosodium methanearsenate), and NPV (Nuclear Polyhedrosis Virus), are the most commonly used pesticides registered in British Columbia for use against insect outbreaks in the forest (Bob Hodgkinson pers. comm.). Most of the forest pesticides registered for use in B.C.'s forests pose a low risk to the safety of silviculture workers. There are also several fungicides, herbicides, and pesticides that are registered for use in B.C. seedling nurseries (Dave Trotter pers. comm.). Although concern has been expressed regarding tree planter exposure to pesticides applied at the nurseries, risk of injury due to exposure is generally low. The highest risk associated with pesticide use is during their direct application. As a result, pesticide applicators must be certified and are required to through a variety of precautions to ensure safe application. There has been extensive research on the potential hazards associated with pesticide use. However, due to the enormity of the subject only a very brief summary has been given here. It is recommended that a future review of the literature be conducted that is exclusive to the topic of health and safety with pesticide use.

Silviculture workers are often required to travel relatively long distances when going to and from work. Prevention strategies for vehicular accidents should be considered when designing healthy and safety programs for silviculture workers. Traditional driver training seems to be effective when established for those driving company vehicles (Haworth *et al.* 2000). However, further research suggests other methods such as group discussions and safety incentive programs may be more effective. As a result Haworth *et al.* (2000) suggested that a combination of approaches be used to reduce the risk of vehicle accidents, including those relating to the selection of vehicles, driver training and education and accident free driving incentives.

Interestingly, research to date suggests that traditional driver-training programs for individuals driving personal vehicles are not successful at reducing the risk of driving accidents (Christie, R. 1996; Watson 1994) and have been associated with an increase in the accident rate of inexperienced drivers (Mayhew and Simpson 1996). With more experienced drivers, it is difficult to undo driving techniques that have been learned in the past (Christie 1996). In light of these findings, most researchers recommend a different approach to driver training that targets other issues such as over-confidence, the belief held by many inexperienced drivers that they are skillful and at a low risk of getting in a vehicle accident, and other attitudes or motivations that affect driving safety (Mayhew and Simpson 1996). However, the effectiveness of such training programs has not been adequately researched (Christie 2001).

Conducting silviculture work in remote areas often requires workers to use All Terrain Vehicles (ATV) to get to their site. Many serious injuries related to ATV accidents can be prevented when approved safety helmets are worn (Larsson and Field 2002). Overloading an ATV with excess weight can also increase the chances of an accident. Most ATVs are not equipped to handle more than one person. As a result, transporting two or more people is not recommended (Occupational Safety and Health Service - Department of Labour 1997). ATV drivers should receive suitable training on safety procedures for their operation.

Cannabis use by individuals in the silviculture industry is another potentially serious threat to worker health and safety. It can increase the risk of accidents and injuries through its effect on worker fatigue (Occupational Safety and Health Service - Department of Labour 1999). Musson (1999) found that 27 percent of the New Zealand silviculture workforce surveyed indicated they used cannabis while working, with the youngest workers admitting the heaviest use. Unfortunately, many silviculture workers believe they can still perform adequately while using the drug at work as long as they have experience in doing so (Occupational Safety and Health Service - Department of Labour 1999). Survey results contradicted this with the finding that injury rates were not affected by either experience or age. Heavy users of the drug were linked to the highest accident rates (Occupational Safety and Health Service - Department of Labour 1999; Musson 1999).

5.5.11 Bennett's Hierarchy

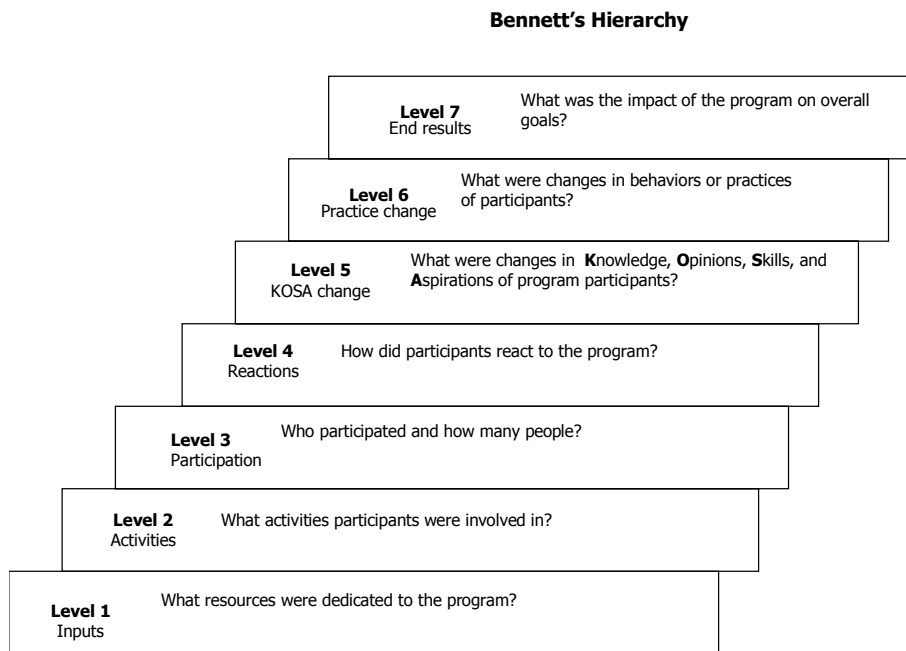
We include Bennett's Hierarchy in our literature review because we believe it could offer FISA/WSCA a useful tool for strategic planning. It is often used as a tool by organizations whose mission is to change behaviours of a specific audience and affect a desired long-term outcome (see figure below).

The model shows hierarchical relationships between knowledge, attitudes, and behaviours for intervention programs designed to induce some kind of change in an audience. (In the case of FISA, of course, the desired change is improved safety and health behaviours, and ultimately the audience is silviculture workers). It was developed by Claude Bennett of the U.S. Department of Agriculture in the mid 1970s for program planners of the Cooperative Extension Service. This simple tool was originally designed to help planners identify the changes that they were attempting to induce through the extension of agricultural research to farmers. In most cases, the Extension Service planners measure changes in knowledge, skills, attitudes or opinions, and aspirations (KOSAs) of their audience, and sometimes changes in behaviours, that occur as a result of their interventions. Understanding the links between KOSAs, behaviour changes, and long-term objectives through this model is useful for any organization involved in planning and evaluating intervention programs.

The hierarchy describes a series of staircase levels, beginning at the bottom step with "inputs" (allocation of resources to a program) and progressing to the top step, the "long-term objectives." Evidence of program impact at each ascending step is progressively more substantial albeit more difficult, costly, and time-consuming to measure. According to Bennett, higher-level programming provides stronger evidence of impact than "lower level" programming and he encouraged organizations to aim for the highest levels possible.

For example, at the lowest level on the hierarchy, an organization measures and reports on the amount of dollars allocated to a project as an indicator of program success (level 1: *Inputs*, as shown in Figure 1). While this data is easy to obtain, it does not say much about “what difference” the program made. Higher in the hierarchy, however, organizations measure changes in knowledge, opinions, skills and aspirations of the target audience as a result of their program (level 5, “*KOSA*” changes). This kind of evidence shows that the program led to more substantive change than lower points on the Hierarchy.

The highest level of Bennett’s Hierarchy shows process toward a long-term objective such as reduced injury rates (level 7: *End Results*). FISA/WSCA may wish to use this model to determine what kinds of impacts they are aiming to affect – KOSAs or behavioural changes, or both. The tool can provide a common vocabulary for board members and program planners.



Bennett’s Hierarchy

5.6 Conclusions and recommendations from the literature

Research indicates that one important barrier is the fact that workplace health and safety is seen by many as the domain of specialists (CCOHS report), a phenomenon known as “centralization of safety.”

Forestry workers, including those working in silviculture, are at a much higher risk of work-related illness and injury than most other occupations. Overall, research into the health and safety of silviculture work suggests there are many factors associated with this increased risk. Sleep deprivation, nutrients deficiencies, temperature-related disorders, dehydration and biological threats are all factors that can increase the risk of accidents, illness, and injury. The following points summarize health and safety recommendations found in the literature for both silviculture workers and employers. Most of these recommendations seem common sense. They represent recommendation found in the literature.

Silviculture workers:

1. Obtain an adequate amount of sleep and consistent sleep schedule. Individuals should obtain about 7 to 10 hours of sleep per night. In addition, safety training and education should focus on increasing awareness of the causes and consequences of fatigue.
2. 55-70 percent of the total calories consumed should be obtained from carbohydrates. Carbohydrate consumption immediately after a work day is particularly important for speeding recovery. Ensure adequate consumption of vitamins and minerals such as vitamin E, vitamin C, vitamin B₆, beta-carotene, folate, iron, selenium, calcium, potassium and zinc.
3. Avoid excessive use of drugs or alcohol.
4. Drink plenty of fluids before, during, and after the work day. Hydration demands will depend on physical demands of the job and on the temperature and humidity at the work site. A general rule of thumb for tree planters is to drink about 4L of fluid each work day. The amount of fluids needed by wildland firefighters is much higher at about 1L per hour.
5. Maintain a consistent exercise schedule throughout the year at 3-4 days a week and 50-85 percent maximum heart rate. It should include aerobic training, muscle strengthening and stretching. Regular exercise should not be limited to the field season.
6. Avoid insect and disease threats by keeping a clean camp, wearing insect repellent with DEET, and wearing clothing that covers the arms and legs.
7. Tree planters should choose shovels of appropriate height and weight for their body. Planting bags should fit so that the majority of the weight falls on the hips, not the shoulders.
8. All silviculture workers, especially wildland firefighters, should avoid smoking. Firefighters are particularly susceptible to the ill effects of smoking because they are also inhaling large amounts of smoke from the wildfires they are fighting.

Employers

1. Ensure silviculture workers, particularly crew leaders, supervisors, and forepersons, receive adequate education and training to increase awareness of the signs associated with cumulative fatigue, heat stress, dehydration, hypothermia, illness due to nutrient depletion and insect- or disease-related illness. They should also know how to react when such signs or symptoms are observed.
2. Provide adequate education and training to ensure silviculture workers know the best procedures for preventing musculoskeletal injury, insect/pathogen threats,

wildlife encounters, and vehicle accidents from occurring while at work or while traveling to or from work.

3. If the piece rate system is being used, employers should consider paying their employees an hourly or daily wage instead.
4. Implement a mandatory pre-season training program designed to prepare silviculture workers for the physical demands related to their job. Programs should target those areas prone to musculoskeletal injury such as the wrist and back.
5. Ensure adequate camp sanitation.
6. Meals supplied at camp should contain sufficient calories and nutrients to maintain optimal health of employees.
7. Ensure chainsaws supplied for brushing, pruning, or thinning operations provide minimal exposure to vibration through the use of padding, gloves or other protective equipment. Adequate training around chainsaw safety for prevention of lacerations, cuts, and exposure to gas fumes is also important.
8. Consider implementing group discussions around health and safety or safety incentive programs, which may be more effective than traditional training programs.

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6 Best Practices in Health and Safety Programs in Canada

This section highlights innovative health and safety intervention programs across Canada. The organizations discussed in this section have been selected on the basis of one or more unique and innovative elements of their programs or philosophical/theoretical base rather than their whole organization. This is only a quick overview summary of some of the programs we found to have elements that could be applicable and adaptable by FISA/WSCA for the B.C. silviculture audience. We found that no one organization has a perfectly adaptable model, but much can be learned from looking at specific components across several organizations. We have not included B.C. or U.S.-based organizations in this section, as those are discussed in other sections of the report.

Without exception, every organization that we contacted welcomed the opportunity to speak more with FISA/WSCA about specifics, including invitations for field visits and exchanges. Most organizations asked for information on the results of this needs analysis and expressed an interest in being kept abreast of developments in B.C. Some organizations we contacted, such as the Saskatchewan FISA, have not developed programming for silviculture but would like to. FISA/WSCA has the opportunity to be a national leader in this area.

By far, the most comprehensive intervention program for silviculture workers that we found was with the Ontario Forest Safe Workplace Association. This organization has conducted a needs assessment, formed a strategic planning committee, and has developed numerous initiatives targeted at the tree planting community. Although only two years old, this program has some of the best resources and ideas that we found anywhere specific to this audience.

One notable common thread through all programs, with rare exceptions, is a lack of evaluation of these programs that links the intervention to long-term impacts. Many of these programs are relatively new (within the past five years) and the opportunity for summative (conclusive) evaluations is limited. Still, without data regarding impacts, continuation of these programs is based on assumptions of impacts rather than solid data.

6.1 Best practices at a glance

Health and Safety Programs	Unique Highlights/Features	Contacts
1. Ontario Forestry Safe Workplace Association (OFWSA)	Multi-media package specific for silviculture worker safety, including -on-line shopping for publications in English and French -sample hot weather plan -young workers safety video - waterproof exercise cue cards with punched holes	John Murray, Manager 705-474-7233, ext. 249 or John Levesque Writer/Program Developer 705-474-7233 ext. 223

		http://www.ofswa.on.ca/silviculture
2. Ontario Service Safety Alliance (OSSA) and the Institute for Work and Health (Ontario)	<p>OSSA is the health and safety association for the service industry in Ontario. Programs are based on the “Business Change Model” (focus on organizational culture) also called the Continuum of Client Service Delivery concept.</p> <p>Searchable web-based library of health and safety resources for employers at http://www.ossa.com/t.tools/t9.downloads/t9.downloads.cfm</p> <p>The Institute of Work and Health conducts research and technology transfer programs in the field of workplace health and safety and is strong partners with OSSA. OSSA partners with the institute to conduct research projects on workplace health and safety.</p>	<p>John Baker, CEO 416-250-9111</p> <p>Website for OSSA: http://www.ossa.com/</p> <p>Website for the Institute for Work and Health: http://www.iwh.on.ca</p>
3. Centre for Human Factors and Ergonomics-New Zealand	<p>Research centre with a mandate for extension and education to forestry workers and companies.</p> <p>Conducted recent survey of New Zealand Forestry Workers on Health and Well Being</p>	<p>Website: http://www.forestresearch.co.nz</p>
4. Partners in Injury Reduction Program (Alberta)	<p>Safety certification program for lower WCB rates in Alberta. Includes “certification of recognition” and independent safety audits, and linkages with the Alberta Forest Products Association.</p>	<p>James Wilson, WCB manager for the Partners in Injury Reduction Program. http://www.wcb.ab.ca Lloyd Harmon, Director of Health, Safety, and Loss Management, Alberta Forest Products Association, 780-452-2841 lharman@albertaforestproducts.ca</p>
5. Safety Groups (Ontario)	<p>A program of Workplace Safety and Insurance Board (WSIB): provides rebates on WSIB premiums for reduced claims to members of group. Need at least 40 firms to form a “group” and requires a “sponsor.” Based on concept of “peer pressure” and mutual support.</p>	<p>Website: http://www.safetygroups.ca</p>
6. Forest	<p>Worksite consultations with employers.</p>	<p>Tommy Harper, Manager</p>

Safety Association of Nova Scotia	CORE program (certification). Internal safety audit guidebook (included in this report)	902-895-1107 THarper@fss.ns.ca
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6.2 Ontario Forestry Safe Workplace Association (OFSWA)

Funded by the Ontario Worker Safety Insurance Board (WSIB), OFSWA is one of 16 occupational health and safety organizations in Ontario. The organization was founded in 1915 but only recently added silviculture to its mandate. In 2001, silviculture workers were transferred into the sawmill rate group of WSIB, bringing them under the mandate of OFSWA. Silviculture is a relative newcomer to the association and programming for silviculture is new, but with two years experience it could still be a significant resource to FISA.

Of the programs reviewed for this study, OFWSA appears to have developed the most comprehensive health and safety package targeted at silviculture workers in Canada. Called “*Health and Safety Resources for Tree Planters*,” the package consists of six information booklets and brochures, a training video and safety meeting presentation guides. The package is based on a needs assessment that included a focus group of contractors to discuss needs and issues. In addition to the focus group process, OFWSA also adapted information from Scott Chisholm’s Tree-planter.com website and information from programs in Sweden to plan its programs, as well as consultation with industry experts.

The program focuses primarily on the tree planting industry, but most of the information is appropriate for any silviculture worker audience.

OFSWA has produced a wide array of web-based and print resources, as listed below.

OFSWA Materials and Delivery Methods

Materials	Description	Web-based?
a. Newsletter- the Log	Approximately three issues/year. Features silviculture company profiles, articles relevant to silviculture	Yes
b. Booklets/brochures	-Strain and Spain prevention -Wilderness First Aid Tips -Dealing with Bears -Safe Travel on Logging Roads -Health Tips for Women -Safe and Health Work Habits -Exercise cue card	No. Printed copies are \$1.00 each
c. Videos “Survival of the Fittest” addresses ergonomic factors in tree planting and the importance of pre-work physical conditioning, proper nutrition, and hydration while working, as well as pre and post work stretching exercises. The video can be previewed at :	-“Survival of the Fittest” -“Speak Up!” a video for Young Worker safety	Previews are web-based

http://www.ofswa.on.ca/silviculture		
d. “Meeting Topic” guides	<p>Presentation guide, video, information booklet, exercise cue card, and overhead transparencies available for sale ranging from \$25 to \$50 per topic for members.</p> <p>Topics include: -Dealing with Black Bears -Hazardous Materials- Your Right to Know -Safe Travel on Logging Roads -Strain and Spain Injury Prevention</p> <p>Weatherproof cue card has a punched hole with grommet for easy attachment to worker’s gear</p>	No
e. Sample hot weather plan	<p>To help firms that haven’t already established a plan of their own, OFSWA has posted a sample hot weather plan (link) with information on preventing and treating the various forms of heat stress. Goal is increased awareness of the health risks of heat stress.</p>	Yes
f. Safe Workplace Ontario (SWO) resource manual	<p>Specifies SWO standards in all areas of a silviculture firm’s operations to help it establish a comprehensive health and safety program</p>	No
g. -On-line Products and Services Catalogue at http://www.ofswa.on.ca .	<p>Click on “Products and Services.” Includes a search function.</p>	Yes

Other OFSWA initiatives:

-Tree planter certification program. During the first year, OFSWA attempted a pre-employment tree planter certification program that provided certification to workers who passed certain fitness tests. The concept was that contractors could ask new employees to become certified as a condition of employment. The program was discontinued last year.

One of the challenges of the program was lack of buy-in from contractors for the program. There is interest in the organization to re-establish the program.

- Silviculture company featured in OFSWA newsletter: The Log
- Articles on health and safety in silviculture industry in newsletter: The Log
- Web-based “Near Miss Reporting”—opportunity for workers and contractors to share stories of near misses on the website. Currently listed 13 near miss stories on the website.

Initiatives in development:

- Employer/supervisor training package for silviculture – web-based to reach the younger, computer literate audience
- Video training package on strain and sprain injury prevention in silviculture

OFSWA has recently launched an evaluation plan to establish methods and processes that will assist the board and its members determine the effectiveness of classroom training. The Training Evaluation and Effectiveness Form (TEEF) is one tool used to measure training impacts weeks and months after the training is completed. It is a check-off form that asks supervisors to record workplace behaviour as well as increased skills and knowledge that occur as a result of the training. It also records participants’ perceptions about the effectiveness of the training.

Manager John Murray expressed an interest in maintaining contact and sharing information with FISA/WSCA as programs in British Columbia develop and has provided a complimentary tree planter package to FISA.

6.3 Centre for Human Factors and Ergonomics (COHFE), New Zealand

Although it is a research centre, the COHFE has a significant mandate for extension and education to the forestry sector in New Zealand. It has a 16-year history of research and education in worker safety, and health and performance in the forest industry with the aim of reducing frequency and severity of injuries among workers as well improve human performance in this sector. Their website (www.forestresearch.co.nz) highlights their services:

- Work system analysis and evaluation
- Physical environment assessment (e.g. thermal, lighting)
- Workplace assessment, design/redesign and evaluation
- Equipment assessment, design/redesign and evaluation
- Personal Protective Equipment (PPE) assessment, design/redesign and evaluation
- Consumer product assessment, design and evaluation
- Task analysis/job safety analysis
- Physical/mental workload analysis
- Injury database management/Injury epidemiology
- Safety management
- Built environment
- Inclusive design for people with disabilities
- Survey design and analysis

COHFE routinely collects health and safety data on the silviculture industry, including information on near-misses for the past eight years in a program called “Forest Industry Accident Reporting Scheme” (ARS). Data is analysed each quarter and provided back to the industry through statistical summaries and a newsletter.

COHFE has produced a number of recent reports of relevance to silviculture, including:

- Musculoskeletal Disorders in Silviculture and Logging 1995-1999
- Near Miss Report, 1995-1999
- Understanding and Preventing Slip, Trip, and Fall Injuries in the New Zealand Logging Industry
- Survey of Health and Wellbeing of Workers in the New Zealand Forestry Industry, conducted in 1999/2000.

The organization has recently completed a year-long study into ATV loss of control incidents. By interviewing users from around the country, they have identified a large number of factors including such design features that can seriously impact rider safety.

6.4 Ontario Service Safety Association (OSSA)

OSSA is one of Ontario’s 16 health and safety associations and serves more than four million workers. It is one of three health and safety organizations that offer programs relevant to the forest sector (along with the Farm Safety Association and Ontario Forestry Safe Workplace Association). In Ontario, the provincial Occupational Health and Safety Act requires companies with over 20 employees to have a joint health and safety committee and for two members of the committee to become safety certified (one person representing workers and one representing management). OSSA is an approved provider of the safety certification training, which takes trainees between two and four days to complete.

The certification training has two phases:

Phase 1: “Basic” Certification training. This is available in video format or traditional classroom delivery.

Phase 2: “Hazard-specific” training, using self-paced modules, where employers identify the hazards and then train staff to deal with the specific hazards. This component includes an “employer’s kit in CD format that includes an instruction guide, hazard and WSIB forms, as well as Hazard Training Modules that are self-paced problem solving and assessment training tools for specific hazards. Each module contains a pre and post test, case studies and other training materials.

OSSA also has a web-based library of health and safety resources, searchable by title or topic. Some of the publications relevant to silviculture include: Working in the Heat and Cold, Preventing Muscular-Skeletal Injuries, Preventing Slips, Trips, and Falls, and Using Chainsaws.

OSSA has strong linkages with the **Institute of Work and Health**, a non-profit organization whose mission is to research and promote new ways to prevent workplace disability (<http://www.iwh.on.ca>). IWH scientists conduct research in the field of workplace health, prevention, and rehabilitation strategies for injured workers and conduct education initiatives including distribution of their newsletter, “At Work” that features plain-English articles about topics such as “Getting a Grip on Repetitive Strain Injuries” (February 2001).

The institute also has an on-line “ask the expert” website where employer questions about workplace health and safety are addressed (<http://www.iwh.on.ca/pages/contactinfo/mediaroom/experts.htm>). The institute has fact sheets on common workplace disorders such as repetitive strain injury that can be downloaded from the website.

OSSA is one of the few health and safety organizations conducting formal evaluations of the impacts of their interventions. Information on recent evaluations may be available through John Baker, CEO.

OSSA conducts its strategic planning using a “Business Change Model” approach. This model is common in the business and organizational development and learning literature and describes how to create cultural change within an organization that will lead to behavioural changes. In setting goals, OSSA sets benchmarks related to perceptions of risk and other attitudes related to accidents (psychological), rather than focusing solely on the physiological barriers to safety such as poor tool design and fatigue factors.

In the words of John Baker, CEO, *“you can engineer yourself to death but if you don’t change attitudes about safety, all you are doing is building higher and higher walls. Typically, health and safety people tend to be ‘barrier’ people. But we need to look at what motivates people and how they perceive risk if we want to make long-term differences in injury rates.”*

John Baker acknowledged that this Business Change Model approach is leading-edge in the industry.

6.5 Alberta Partners in Injury Reduction Program (PIR)

Many interviewees in our study cited the Alberta PIR program as an example of an innovative incentive program for reducing injury rates. A partnership between the Alberta Human Resources and Employment agency, WCB, and 15 safety associations, the program has enrolled over 6,500 companies in Alberta and offers reduced WCB rates for safety certified companies. The program was piloted in 1989 and has undergone several revisions and name changes, but has continued to grow for 14 years. Participation in the program is voluntary, and companies can earn up to 20 percent reductions in their insurance premiums for achieving a “certificate of recognition” (COR), undergoing independent and internal safety audits, and implementing a workplace health and safety management program. Registration is renewed annually.

The Alberta Forest Products Association is the certifying partner for the forest sector. Lloyd Harman, Director of Health, Safety and Loss Management for the Alberta Forest Products Association, estimates that the majority of silviculture contractors in the province are

enrolled in the program. In British Columbia, the program is not in place in forestry, but is being piloted with the road construction industry, according to Scott Chisholm, a PIR auditor.

In addition to the more obvious reduced-cost benefits, the program works at the core of organizational change and emphasizes “systems thinking.” It raises the knowledge of contractors regarding costs, statistics, and trends, raises the profile for health and safety within companies, and creates organizational cultural change and a greater potential for long-term impacts than other programs such as safety contests that may only induce short-lived changes. It provides more safety accountability than what is required now (which is currently limited to WCB involvement in B.C.). Relationships built with certifying auditors have the potential of ‘bringing companies into the safety fold’ and connecting them with information, resources, training programs, consulting services, and networking through the certifying partner that they would not have otherwise. These benefits could be particularly useful to the silviculture industry that is generally characterized by a dispersed and independent contractor environment.

An additional benefit to the program may be increased knowledge among the health and safety professional community about safety issues overall through the work of the auditors who visit on site with contractors and through better documentation of injury details. Scott Chisholm, a PIR auditor, for example, has worked with over 90 different companies to help them achieve certification and has collected valuable qualitative information about safety issues facing the silviculture industry. Many of his observations have been reflected in this study and are invaluable in understanding the nature of this industry and the health and safety issues, and what challenge face the industry in attempting to solve them.

While the program seems widely accepted in Alberta, it’s difficult to substantiate the cause-effect relationship between participation in the PIR program and lower workplace injury rates without collecting pre and post participation data. It’s possible that already-safety conscious companies are more likely to enroll in the program than those who are not, making it difficult to assess the impacts of participation in PIR on injury rates without the kind of data collection that was beyond the scope of this project. A meaningful way to assess effectiveness of the program would be to collect injury rates for companies before participating in the program to see if the program made a difference to individual companies.

In some cases, claims can increase in the short term for companies that are certified. One has to ask if short-term reduced claims are realistic indicators of program success; perhaps organizational change in support of health and safety is a more realistic indicators of success. Increased claims in the short run could, in fact, mean increased focus on safety. Longitudinal data that looks at longer-term impacts on accident costs, frequency, and severity for certificate programs like PIR remains an important task for this industry.

6.6 Safety Groups

The Workplace Safety Insurance Board (WSIB) of Ontario has launched an innovative program to reduce workplace injuries based on a group reward system. It is based on the premise that groups with a shared purpose can learn from each others’ experiences in implementing prevention programs. Any group of businesses can join together and apply for

reduced WSIB rates; rebates are rewarded to members of the group if several criteria relating to health and safety are followed by group members.

Each “Safety Group” has a sponsor, usually a trade or safety association. The greater the number of firms that make achievements on safety (in the categories of leadership, organization, recognition, assessment, and controls), the greater the rebate. However, rebates are not guaranteed. Firms that enroll must show that they are introducing new health and safety elements into their company operations.

Since 2000, the Ontario Forestry Safe Workplace Association has been a sponsor for a Safety Group in the forest sector and provides support to the group and report progress to the WSIB. The original 43 firms who signed on with OFSWA in 2000 were rebated \$1.4 million from WSIB. OFSWA staff members organize meetings and workshops, recruit new members, and guide the process. The OFSWA considers the Safety Group one of its key intervention delivery mechanisms. Frequent OFSWA newsletter articles highlight the work of the Safety Group. Likewise, the OFSWA newsletter is used as a communication tool for Safety Group members.

A brochure on the Safety Group concept is at <http://www.safetygroups.ca>.

6.7 Forestry Safety Society of Nova Scotia (FSSNS)

FSSNS is a non-profit society funded through a Nova Scotia Worker’s Compensation Board levy. The society provides health and safety interventions for Christmas tree farmers, logging, silviculture, sawmills, box/shook mills, and pulpwood/log trucking. The staff and contract trainers conduct training programs targeted at all members, many of which are applicable to silviculture. Seventy-five percent of their budget is spent on training. There are 112 silviculture employers in Nova Scotia, about 68 percent of which receive discounts on WCB insurance premiums for favourable safety records.

FSSNS conducts worksite consultations on request from companies in their “worksite specific” program. It also has a voluntary program called CORE that provides a general two-day training on health and safety for employers. Tommy Harper, Manager of FSSNS said that many companies that hire silviculture contractors now require contractors to have completed the CORE program.

Included with this report are the following materials from FSSNS:

- Forestry Education Safety Training – Student Work Book
- Internal audit guidebook
- Forestry Safety Manual

Tommy has provided a package of information on FSSNS, including student binder for safety course.

7 Relevant training in the U.S. and elsewhere

This section summarizes occupational health and safety training programs of five organizations in the U.S. that offer courses and training materials relevant to the silviculture and fire fighter industry in B.C. Many of the programs are offered through distance learning and other innovative learning environments (such as a web portals and CD-ROMs) rather than conventional classroom training; in fact it seems that most training, with the exception of training offered through the National Wildfire Suppression Association, is available in alternative formats. Dispersed learning is appropriate for the silviculture industry in B.C. so we have a great deal to learn from the experiences of these organizations. Most organizations contacted were interested in linking with B.C. organizations to share information and resources. The organizations listed here have been selected because of the unique adult education delivery methods they use, as much as the content they teach.

7.1 Relevant training at a glance

Organization	Highlights/features	Contacts
1. U.S. Department of Agriculture Forest Service Technology and Development Centers (Missoula Technology Development Center)	CD-Rom on Safety and Health Training Program for Employees Many health and safety publications, all on CD and web Large assortment of safety videos for distribution.	Cail Hegman is the publications specialist at 406-329-3978. Chuck Whitlock is health and safety specialist at 406-329-3924. http://www.fs.fed.us/t-d/php/tdc_products.php , use user ID is “t-d” and the password is “t-d”
2. National Interagency Fire Center (NIFC)	“Six Minutes to Safety” topics updated on website daily Safenet, an anonymous website site for employees to report unsafe work situations. One Stop Shopping resource centre for fire safety instructors Safety and Health Information Portal System (SHIPS)	Ed Hollenshead, Fire Operations Safety Officer, 208-387-5102 (http://www.nifc.gov)
3. “Safety Net”-U.S. Department of Interior	downloadable reference material	http://safetynet.smis.doi.gov

4. Occupational Health and Safety Administration (OSHA)-OSHA Training Institute Region “X” (Pacific Northwest)	Dispersed classes held in cities around the Pacific Northwest On-line training institute	http://www.regionxoti.org http://depts..washington.edu.ehce CE@u.washington.edu .
5. National Wildfire Suppression Association (NWSA)	The only organization that provides training and information services to private fire fighting industry	Stan Kunzman training coordinator 541-389-3526, http://www.nwsa.net

7.2 U.S. Department of Agriculture Forest Service Technology and Development Centers

The USDA Forest Service has two Technology Development Centers-- in Missoula, Montana and San Dimas, California. Originally devoted exclusively to equipment engineering technology development and testing for the wildfire sector, these centres have expanded their mandates to include programs relevant to land and human resource management, including health and safety education and training. The centres have in-house expertise in engineering, recreation, forestry, and social science and aim to provide agency decision makers and managers with science-based knowledge on these topics. The centers conduct research and distribute technology transfer materials on request by Forest Service regional and national offices and have been described as “the Forest Service’s in-house consulting firm.”

The centre in Missoula, called the Missoula Technology Development Center (MTDC), has many downloadable electronic publications and videos on topics such as “Personal Safety in Remote Locations” that are available to anyone. Their publication collection on Wildland Fire Safety is available on CD and has been included with this report. Downloadable publications are accessible at <http://www.fs.fed.us/t-d/pubs>, user ID is “t-d” and password is also “t-d.” Single copies of the videos are provided at no cost on request from related groups within and outside the organization.

The MTDC also distributes a self-paced safety training product developed by the Department of the Interior in the form of a CD-ROM and accompanying handbook. The course gives employees basic safety training in six modules:

1. Introduction to Safe Behaviour Process
2. Executive Orientation
3. Authorities, Roles, and Responsibilities
4. Resources, References, and Standards
5. Department of Interior Safety and Occupational Health Overview

6. Safety and Health Field Training Menu. This menu is divided into seven sections on rights and responsibilities, chemical hazards, physical hazards, biological hazards, personal protection, general safety, and field operations and support activities.

For this study, MTDC provided complimentary copies of the following videos :

- “Backing Up on Forest Roads: Take Your Time”
- Personal Safety in Remote Locations,”
- “Driving Mountain Roads: Slowing Down.”

MTDC has also published a series of “Health and Safety Reports” for firefighters, several of which are also relevant for silviculture workers. On line on topics include:

- Energy and Nutrition
- Work, rest and Fatigue
- Fitness and Work Capacity

7.3 National Interagency Fire Center (NIFC)

Located in Boise, Idaho, this centre is a central headquarters for “incident” training in the U.S. and is a partnership between eight federal and state-level agencies, including the Bureau of Land Management, National Park Service, USDA Forest Service, Bureau of Indian Affairs, federal Fish and Wildlife Service, National Atmospheric and Oceanic Administration (NOAA), Office of Aircraft Services, and National Association of State Foresters.

Health and Safety initiatives include:

- On-line safety sessions called “Six Minutes to Safety” that offer information on high-risk situations and are updated daily. Website: http://www.nifc.gov/sixminutes/dsp_sixminutes.php. All Six Minute discussions are archived by topic and are available for downloading. The handouts can be used for tailgate safety meetings or posters at tree planting camp. Relevant topics include:

- Heat disorders
- Hydration
- Fatigue/stress
- Hazard Assessment
- Thunderstorm safety
- Falling snags
- ATV safety
- ATV transportation
- ATV – How to ride and operate properly
- Potentially violent personal encounters

- Publications available on line on topics relevant to silviculture – such as driving, Lyme disease, heat and stress, and fatigue. Publications are distributed by the NIFC partner organization, the National Wildfire Coordinating Group at 208-387-5119.
- Safenet, an anonymous website site for employees to report unsafe work situations. The website is <http://safenet.nifc.gov/safenet.nsf>. According to Ed Hollenshead, Fire Operations Safety Officer for the USDA Forest Service at the NIFC, 300 Safenet entries were filed by employees last year and already about 300 have been completed during the first half of this year. Ed stated that most of the Safenet safety entries are about communication issues.
- One Stop Shopping resource centre for fire safety instructors called “WFSTAR” (Wildland Fire Safety Training Annual Refresher). An example is a handout on “How to Properly Refuse Risk” – a guide for employees about the procedure to follow if they feel a work assignment is unsafe and wish to refuse the assignment. Also included are web resources associated with “lessons learned from the “30 Mile Fire” (2001 fire in Northern Washington that killed four firefighters). Website is http://www.nifc.gov/safety_study/annual-refresh/index.htm.
- Training Packages (includes courses specific to fire fighting such as a 40-hour driver’s training course, 3-4 hours fireline safety refresher course, 4-5 hour human factors on the fireline course, and 18 hour fatality fire case studies course). Training courses are offered at the centre in Boise to member agencies.
- A new Safety and Health Information Portal System (SHIPS) is being tested and implemented this summer by the U.S. Forest Service. It is an electronic portal for health and safety statistics that will allow for more efficient reporting of accidents among the 40,000 employees of the U.S. Forest Service. It is based on commercial software by a company called Compliance Suite that is located at <http://www.rmssystems.com/smsSummary.asp> Although it is an American company, the software is adaptable for Canadian provinces. A press release about the US Forest Service launch of the software is included with this report.

7.4 “Safety Net”—U.S. Department of Interior

Safety Net is a web-based “shared, one-stop information source for the safety and health community of the U.S. Department of the Interior (DOI)” that includes the National Park Service and the Bureau of Land Management. Safety Net provides downloadable reference material called “Safety and Health Topics” such as heat stress and fitness and work capacity. DOI has an extensive array of training programs, but are available only to DOI employees. The website is <http://www.safetynet.smis.doi.gov/training>.

7.5 Occupational Health and Safety Administration (OSHA)- Training Institute

OSHA is an agency of the U.S. Department of Labor headquartered in Washington D.C. In addition to health and safety training sessions around the country through the OSHA Training Institute, OSHA hosts a nation-wide resource program for books and videos for OSHA employees and affiliates on loan. The OSHA training facility that is closest to B.C. is at the University of Washington’s Department of Environmental and Occupational Health

Sciences Continuing Education Program. Classes are held in Seattle, Spokane, Anchorage, Boise, and Portland.

Contact information for the Pacific Northwest is:

OSHA Training Institute—Region “X”

206- 685-3872

email: CE@u.washington.edu.

One upcoming course of interest is “Creating a Safety Culture in your Workplace” on September 16, 2003 in Seattle. Speakers and topics will include examples from the forestry sector. For more information, see <http://www.hi.wa.gov/wisha/gov/gov-conf> or phone 206-543-1069.

In partnership with OSHA, the University of Washington also hosts the “Region X OSHA Training Institute Education Centre On-line Institute.” The web-based training centre offers training in:

- Hazardous materials/Dangerous Goods
- Occupational Health and Safety
- Transportation Safety
- Environmental Compliance
- Emergency Response and Management
- Human Resources

7.6 National Wildfire Suppression Association (NWSA)

NWSA is member-based non-profit society that provides basic fire fighter training and information support to independent contractors associated with wildfires primarily in the western U.S. Headquartered in Oregon, its aim is to ensure training and quality standards of private companies as well as training for certified instructors of basic wildfire courses for private fire fighting crews. Through a memorandum of understanding with the interagency National Wildfire Coordinating Group, NWSA agrees to meet or exceed the standards for training used by government crews. Stan Kunzman, training coordinator, estimates that roughly 60 percent of the personnel on major wild fires in Washington and Oregon are employees of private companies who provide air tanker, helicopter, fire line, catering and other services. He estimates between 50 and 60 contractors and associations are members of NWSA. Membership cost is \$250/year for organizations, and \$100 for individuals. The organization offers insurance for certified instructors and a code of ethics for the industry.

Training courses include basic requirements to quality crews for work on forest fires, including what are called the FF, FF2, S-290, S-215 and P-151 courses. The courses address a position paper put out by the National Wildfire Coordinating Group in 1994 that outlined the training, qualifications, and certification requirements of private crews. While NWSA does not use training methods other than conventional classroom and field trips, the organization does have a unique model of certifying instructors who are dispersed throughout the west, so training is still considerably more accessible than a centralized training centre that requires significant travel.

Formed about 15 years ago, the organization has seen a tremendous growth in the number of private crews involved in fire fighting. Kunzman estimates that five years ago there were only about 60 crews, and now there are roughly 280. Government budget cut-backs, the Bush Administration's policy trend of out-sourcing government functions to private contractors, and several big fire years have led to the significant growth in the number of crews. NSWA provides a quarterly newsletter, regular briefings to its members as new equipment comes out, and a roster of certified trainers, and is growing. Kunzman sees what he calls a "drain on experience" within the sector and believes that recent fatalities are related to lack of leadership experience in a fire situation.

"Many of the larger companies have their own people who keep up on things, but the smaller companies don't. If it were not for a group like NWSA, these contractors would work completely independently without access to information and resources."

He is not aware of a similar organization that supports private fire fighting contractors in Canada, and said that they would like to maintain contacts with organizations in British Columbia. Challenges of sharing training and trainers with Canada would include differing training standards and fire behaviour rating systems between the two countries.

7.7 Training in Tasmania

The most heavily forested state in Australia, Tasmania has the Tasmanian Forest Industries Training Board that provides training mainly to the logging and sawmilling industries. Website is <http://www.workcover.tas.gov.au/node/forestryandl.htm>. According to the website, the contact information is Mr. Derek Bendall, Executive Officer, at forestitb@bigpond.com in Launceston, Tasmania.

8 Interviews with key informants in the silviculture industry

The aim of these interviews were to:

- identify the current health and safety gaps as perceived by key informants in the silviculture industry
- document suggested interventions to close perceived gaps as perceived by key informants in the silviculture industry

8.1 Methods

The original intent for this deliverable was to conduct a focus group interview with key informants in the silviculture industry. Given the short timeline of the project and the difficulty of bringing together individuals during a busy work season, however, we conducted individual phone interviews rather than a focus group. While qualitative data collected for this deliverable are based on a limited number of interviews with selected individuals, the information provides an in-depth look at issues that would otherwise be “skimmed over” in a survey.

Questions used in the interviews are found in Appendix D. In most interviews, many additional questions were asked as interviewees shared information. Interviews took between 20-90 minutes each.

Four kinds of individuals were interviewed:

1. Silviculture contractors, typically those who were leaders in the industry and had “big picture” views of the industry.
2. First Nations contractors, including one female silviculture company owner
3. Workers or worker representatives
4. Others knowledgeable about the industry

One interviewee, Scott Chisholm of Advanced Safety Management, Ltd, representing a forest-sector safety consulting firm and who serves as an auditor with the Alberta-based Partnerships in Injury Reduction, submitted a written summary of his observations of the problems and barriers to safety in the silviculture industry (found in Appendix G).

Specifically, interviewees included: (in most cases, names are not included in this report by agreement with interviewees):

1. Leaders of the Canadian Reforestation Environmental and Workers Society (2 individuals)
2. Tree planting employees (2 individuals)
3. Silviculture contractors (11 individuals, including two First Nations contractors)
4. First Aid attendant for tree planting company with master’s degree in Occupational Health and Safety (1 individual)
5. Former New Forest Opportunities Staff member (1 individual)
6. Forest industry safety consultant (Scott Chisholm, Advanced Safety Mgt. Ltd.)
7. BC Ministry of Forests staff (1 individual)
8. WCB contacts (4 individuals)
 - Dave Springall

- Dave Rowe
 - Kevin Thipthorpe
 - Gerry Paquette
9. City of Kelowna
- Pat Cantner
 - Ken Emmons

8.2 Results

Responses from interviewees fell naturally into the following headings:

- Is there a problem with accident rates in the silviculture industry?
- General comments about the industry that relate to safety
- Greatest barriers to safety within the industry
- Other suggestions for change
- Advice to FISA/WSCA about interventions

8.2.1 “Is there a problem with accident rates in the silviculture industry?”

With the exception of one interviewee (contractor), all interviewees perceived that the current rate of accidents was unacceptable and that some intervention was needed. One interviewee said that it’s impossible to generalize about the industry and that each component of the industry should be treated separately according to the characteristics, gaps and opportunities of each. Not all interviewees agreed on the most critical problems, but almost all felt that safety could be improved. Workers were especially concerned about improving the work conditions and several made the link between working conditions and safety issues.

One interviewee (a contractor) stated that there are high expectations for productivity and low cost in this industry, and that “maybe the rates are actually reasonable, considering this.”

8.2.2 General comments about the industry

Scott Chisholm of Advanced Safety Management, Ltd. identified seven significant safety and training barriers that are inherent to the industry (a full copy of his report is found in Appendix G).

- Short and seasonal work season with scattered locations
- Young workers
- The physically demanding and repetitive nature of the work
- Inadequate pre-season physical preparation
- Remote work sites
- Production-based nature of the payment of workers
- High intensity of the field season with limited time and money
- Long “off season” periods with workers dispersed across the country
- High turn-over of workers
- Lack of high-quality trainers
- Poor learning environment with many distractions such as work site set-up needs

Several other interviewees spoke of the dispersed nature of this industry, pointing out that only in the past few years has there been any move toward standardization. Several contractors agreed that there has been significant improvement in standards and professionalism in the silviculture industry over the past few years. One contractor said,

There has been a big change in the industry for the past five years or so. At that time there started a push from clients to focus on requiring health and safety programs. Especially now with forest certification. There is more awareness about safety and health issues now.

Despite this, one interviewee called the industry “still the wild west” and stated that safety still isn’t as important as production.

“We are sliding by on the illusion that there are regulations for safety – we have the bottom line now but we still lack standardization. It’s still very much individualized. We need more homogenization.”

One interviewee spoke of three kinds of contractors: companies that are 1) “high functioning” with a lot of health and safety measures and experienced crews, 2) those who hire mostly less experienced workers, and 3) those who are run “by the seat of their pants with fewer safety measures in place.” He said that reaching contractors in the three levels would require unique approaches.

8.2.3 Greatest barriers to safety within the industry

While workers and contractors responses varied significantly on barriers to safety, there was agreement on a one key point: **vehicle accidents** are major concern. At the same time, the nature of the vehicle accident concern varied among interviewees. Several contractors spoke of speeding and fatigue, particularly at the end of the day, a key causes of accidents. Workers pointed to the use of inappropriate vehicles for mountain roads, unskilled drivers, low pay that leads them to work long hours and rush back for the evening meal at camp, and lack of proper vehicle maintenance.

“Vehicle accidents are a contractor’s worst nightmare. This industry needs to have class 4 driver’s licenses for all drivers carrying crew members.”

Several interviewees said that vehicle accidents off-hours (such as driving to and from camp on gravel roads) are a very serious concern. Others spoke of lack of seat belts, and lack of enforcement using them, overloaded vehicles and the lack of “bush driving courses.”

“We need radios in all trucks, government inspected vehicles.”

“Vans are death traps and shouldn’t be allowed.”

One contractor mentioned ATV accidents as a major concern.

“If the truth be known, as an industry I think we are using ATVs for jobs for which they are not designed – steep side slopes, too fast. I have heard about some sites that are inaccessible where all crew members have one. They should only be driven by experienced drivers.”

Repetitive use-related injuries were mentioned more frequently by workers than contractors as key issues, but not all workers considered interventions for repetitive use injuries among the most critical issues. One interviewee thought that vehicle accidents were much more critical an issue to look at.

Workers spoke of observing “countless” acute repetitive motion injuries to the shoulders, wrists, elbows, particularly in the tree planting industry, and most said that typically little is done to prepare them for the potential of these injuries, with some exceptions.

“For the most part, workers are on our own to make sure we are in shape and able to do the work. I heard about workers getting together on one crew to do yoga to make sure they didn’t get hurt. (Laughing)... I can’t imagine a supervisor leading us in anything like that.”

Contractors spoke of the system of hiring that doesn’t allow them to carefully screen the pre-conditioning of the workers, and that often workers arrive only a couple of days before the season. Some contractors blame the repetitive use injury problem on the nature of the industry.

“In this industry we are mining our bodies. There are no benefits, no after season plans for health like hockey players or other athletes. Yet we have a very physically demanding profession. We just don’t think long term in this industry – I have heard many long-term tree planters repeatedly say that this would be their last year planting.”

Safety associated with **helicopter use** was considered a serious potential issue by one interviewee. There is a perceived increase use of helicopters for transporting crews to more remote, steep, and brushy areas on the coast that are more difficult to access in case of medical emergencies. Helievacuation is not covered in first aid training, and the stakes of emergencies in remote areas are higher.

Many comments came from both contractors and workers relating to **nutrition, hydration, and fatigue**. Most interviewees spoke of the need for information on these topics particularly for less experienced workers. One interviewee recommended targeting workers, who are motivated to learn because “it’s their bodies.” Another recommended a multi-pronged approach targeted at different layers in the organization – licensees, contractors, supervisors, and workers.

“Give workers no-nonsense, to-the-point information. Workers and foremen end up running the show when it comes to health on the job. In good companies there is a good feedback mechanism between workers and contractors—target all levels if you are going to make a real difference.”

“Make sure that you target licensees to increase their knowledge about safety. It’s their requirements that have the potential to make the biggest difference in safety. Sometimes licensees don’t know how to read a safety plan written by a contractor. They just sign off on them without really knowing what’s in them.”

Some interviewees pointed to the lack of standardization for safety and health procedures in this industry as a problem.

“Contractors should give us handouts – such as drinking every 15 minutes or so, and to do stretching. The problem is that there is no standardization, it’s all up to individual contractors and there is a lot of variability.”

Other interviewees felt that providing **easy-to-access information for contractors** was key to changing the accident rates and improving health of workers. One contractor who was relatively new as a contractor spoke of the need for “one-stop-shopping” for information on health and safety.

“I don’t really know where to go for this. It’s one thing to get regulation information from WCB but I would like more accessibility for other things besides what WCB has. And I am still waiting for WCB to get back with me.”

Others pointed to the lack of knowledge about what accidents actually cost contractors.

“Some contractors don’t do the math. The costs tend to get hidden and you don’t see the long term impacts of the WCB claims.”

One worker felt that different contractors send messages about safety through their management decisions.

“If contractors don’t take it seriously, then neither do we. You can do all the education to workers that you want, but until the contractor takes it seriously, nothing will really change. I don’t understand why we don’t get paid to attend the one-day health and safety meetings at the beginning of the season. It’s a message to us how much they (don’t) really value it.”

The same interviewee spoke of the competitive nature of the work, and how she felt that safety was mentioned but not taken seriously. ***“This supervisor told us to wash our hands, but then provided no water for it.”***

Several workers spoke about the safety hazards associated with their work rotation. ***“The 4 days on, 1 day off schedule is really hard because one day off isn’t really enough to recover, mentally or physically.”***

Opinions on the **role of drug and alcohol use** on safety varied by interviewee. One interviewee thought it affected safety no more than any other job, while others agreed that substance abuse is a safety issue.

Many interviewees spoke of issues that were **inherent in the silviculture industry** for which only systemic changes to the industry might affect safety records. Factors that were mentioned:

- Transient population of workers (“*You bring them up to speed and they are gone.*”)
- Payment by piece work (*incentive to work long hours*)
- Intermittent work (*people get out of shape between contracts*)
- Culture of the workplace of machismo (*like an extreme sport*)
- Attitude of contractors that if people get hurt they can be replaced (*highly competitive work force*)
- Contractor/supervisor burn out – more administration required than previously so less time to focus on first aid and health issues, and not modeling good health practices themselves.

One contractor spoke of his incentive for health and safety saying, “we are doing health and safety because we think it’s right, not because we can see that it “pays.”

“We haven’t yet really seen how safety pays, since 1999 when we started with these programs.”

They also stated that many workers are motivated first by keeping their daily pay up where they want it, at the sacrifice of personal health and safety measures.

“As a contractor and owner, we can invest in procedures and equipment but we don’t get support from employees – if it obstructs their production, the motivation is down. There’s a lot of pressure from all sides right now.”

Several key informants spoke about the need for cultural and systemic change in the industry.

“It hasn’t been the culture for the supervisor to step in on safety matters – they see that workers can be responsible for themselves since working on a piece basis—the contractor thinks it is not their domain. Especially in the north where many contractors hire foremen who hire their own workers (pyramid). They hire university students or those from back east. This puts even more pressure on foremen for production. Called “supervisor production incentive.” It’s one more layer to avoid dealing with safety. No one is accountable.”

Some contractors spoke of the changes that have already occurred in attitude toward safety.

“The attitude of the crew is same as the contractors: they have come a long way. If the forest company takes it seriously, so does the contractor, and then the same with the crew. From beginning I took safety seriously. Everyone has first aid training.”

8.3 Suggestions for change

(note: “C” refers to a comment made by a contractor, whereas a “W” refers to a comment made by a worker).

W -Bush-driving training

W -Better enforcement of existing regulations (e.g. seat belt use)

W-Increasing license requirements to Class 4 for all drivers

W-Better pay for workers to encourage shorter work hours

W- Standardisation of health and safety practices through active oversight and enforcement

W- Standardisation of work & camp conditions through active oversight and enforcement

W- Standardised protocol (appropriate to silviculture-piecework) and procedures to mitigate worker exposure to toxins

W- Whistleblower protection regulation for both workers and contractors

W and C- Advanced off-road driving training workshops and certification

C- First aid training that is offered now isn't relevant to our industry. Need two levels: the issues around tendinitis (which is about 99 percent of what we deal with now), and the issues around remote access when there is only one first aid person. We need a hybrid course that combines the ABCs with information relevant to our industry.

W- We need minimum wage regulations to ensure adequate earnings to afford extended medical and dental insurance coverage.

C- Helicopter safety: yes, a big issue on the coast, esp. because of the slash. Also if they get fogged in there is no way to walk out. Need a portable kit.

C- Come up with a different way of getting the job done. Use a package—10 months of work with different activities to keep a crew going. Negotiate a price per worker day, but clients won't give a cost-plus price, only a total contract price. Give people consistent work. Include training as part of the job. Pay people to train.

C- Do a hands on training at least one time per year where everyone practices loading safety equipment off the truck and tries loading someone onto a stretcher.

C- Regular health and safety committee meetings

C- At every block, point out specific safety hazards. The foreman should do the reconnaissance of dangers.

C- Professional drivers' training is badly needed.

C- Check in with crew members on a regular basis. How you doing, how's the body, fatigue etc.

C-Pre-screening. Interview at the universities, look for attitude, athletic, good recommendations. Tried to avoid hiring over the phone, although had to sometimes, with sometimes bad results.

W- Begin the season with safety and health training sessions

C-Look for x-c skiers, down hill racers, rowers, even piano players, those whose bodies are exposed to repetitive strain, and those who know their bodies.

C- It's a matter of:

- hazard reduction assessment and mitigation – daily basis

- better reporting of incidents

- training

- modifying equipment

- ownership commitment to safety and health

- pre-season conditioning. Hard to enforce, since many time you don't hire until right before the season. But you can encourage by reminding people they will make more \$\$ if they are in shape – appealing to self-interest.

W-Don't make the first aid person the health and safety person.

W- Contractors may be the ones needing the wake up call.

Scott Chisholm of Advanced Safety Management Ltd. suggests that solutions to silviculture safety issues must involve changes at management, supervisory, and worker levels. Managers must communicate and demonstrate to workers that they are serious about health and safety. Senior management should receive information about health and safety through group courses, on-site consultations, and on-line courses and literature targeted directly at their industry. Supervisors should receive training immediately preceding the season in addition to training offered at other times and it should be focused specifically on health and safety systems. From the worker standpoint, hazards such as repetitive strain injury and other ergonomic issues should be identified and a plan for mitigating risks should be instigated. Haul road vehicle travel should be monitored and controlled. (For a complete copy of Scott Chisholm's written discussion, refer to Appendix G).

8.4 Advice to FISA from interviewees

The following are recommendations from contractors and workers to FISA.

C- Somehow need to record near misses are not recorded. Vehicle accidents that don't result in personal injury are not recorded. A big number of vehicle accidents are on personal vehicles that aren't suited for active haul roads.

W- Find out what the workforce wants and is saying. This study seems to be set up to get the contractor's perspective, but my advice is to get worker's perspectives. For workers, safety is about themselves, but for contractors safety is about reducing costs. There is a need to balance this.

C- Enforcement needs to be improved. Smaller contractors aren't in compliance. Make it mandatory to have an orientation day for workers, often this doesn't happen. I like the idea of a safety certificate program. Make workers accountable and fill out form like a check list for safety learning re: procedures.

C- Interventions should focus first on supervisors and workers, and somewhat to contractors (managers). Licensees would not need training if there is certification. Right now licensees need to know how to assess/evaluate an acceptable health and safety program of contractors – right now they look at the materials but don't know if it's acceptable or not.

C- Encourage certification

C- Give people access to training and support materials. Help industry keep from re-inventing the wheel all the time.

C-Delivery can be a problem because of dispersed population, so central training site would not be practical. There is a strong case for using the internet with this audience.

W- I am skeptical: there is a tendency to think of training as the answer – but does the training really address the real issues in each crew? I think companies should do their own hazard assessment and reduction. Avoid the top down approach.

C- This is a cultural thing that we are trying to change. Use a multiple faceted approach.

W- Give us information on exercise, awareness (how to avoid tendinitis), information on good footwear, eyewear and when to wear it – so people have choices.

W- FISA could be the neutral ground necessary to negotiate. Contractors often feel threatened – caught in middle- in fear of losing contract and preferred bidding status. Direct awards have been lost because workers questioned use of certain products.

C- Strike a committee of silviculture workers to guide and create appropriate regulations specific to silviculture (for example, don't use ones designed for loggers) and enforce them using an oversight committee made up of workers themselves. Create a industry-wide centralized reporting framework, with regional representation through camp ombudspeople or health and safety reps. Would like to see different models for this.

W- Make workers employees, not work on piece basis. Improving working conditions and creating protocol for reporting and strong oversight of status for silviculture industry workers will help improve the safety record a lot.

C- Take safety seriously from the top (licensee). Walk the walk, don't just talk the talk. Implement it.

C- Bush driving training: FISA could develop this course. The whole forest sector could use this.

C- Work with manufacturer to get an ATV model made just for this industry.

C- Need to increase awareness, and improved planting techniques (a list of “don’ts”) to help avert soft tissue problems. Message is to get in shape for the season with specific exercises.

C- Lobby to get rid of hard hat requirements. We need a special helmet like a bike helmet that is cooler and lighter.

C- Interventions need to happen at all levels. Materials on health and safety exist but they are not getting to the contractors, less so to supervisors, and even less to workers.

C- Make people more aware of safety. Have relevant meetings, not just to fill the legal requirements. Talk about the process stuff: like how to time meetings.

C- Use programs that use the idea of learning from peers: People look up to experienced people. So make those people responsible for safety and it will change the culture.

9 Occupational Health and Safety Education/Outreach Activities in B.C.

9.1 Introduction

This summary provides information on occupational health and safety (OSH) education, training and outreach programs, including a description of their delivery methods. The information used to write the summary was obtained from telephone interviews and web-based searches. The following table summarizes the interviews and web sites.

Interviewees
Andrew Carpenter, Weyerhaeuser Ltd., South Island Timberlands
Liz Redic, Workers' Compensation Board, Certification Program
Rick Cox, Supervisor, Occupational Health and Safety with the B.C. Safety Council
Ken Emmons, Consultant and Safety Officer for Kelowna's School District 23
Sandeep Mangat, Senior Health & Safety Coordinator, Farm and Ranch Safety Association
Pat Cantner, City of Kelowna Safety Officer
Linda Kinney, General Manager with Safety and Health in Arts Production and Entertainment
Doug Ellis, Certified Arborist with the Malaspina University College, Forest Extension Program
Scott Chisholm, Advanced Safety Management, Ltd.

Web sites
Forest Industry Safety Association http://www.forestsafe.ca/index-fr.html
Malaspina University College, Forest Extension Program http://www.mala.bc.ca/www/ForestEx/
Summit Reforestation and Forest Management Ltd. http://www.summitreforestation.com
Farm and Ranch Safety Association http://www.farsha.bc.ca
Forest Continuing Studies Network http://www.fcsn.bc.ca
Forest Research Extension Partnership http://www.forrex.org
Workers' Compensation Board of B.C. http://www.worksafebc.com
Canada Safety Council http://www.safety-council.org
WCB of B.C.'s WorkSafe Magazine, Sept.-Oct. 2002 issue http://www.worksafebc.com/publications/newsletters/worksafe_magazine/Assets/PDF/wsm_sep_t_oct_2002.pdf
Workers' Compensation Board of Alberta's Partners in Injury Reduction Program http://www.wcb.ab.ca/pdfs/pir_broch.pdf
Safety and Health in Arts Production and Entertainment http://www.shape.bc.ca
B.C. Safety Council http://www.safetycouncil.bc.ca
Tsuga Forestry Service Inc.

<http://www.tsuga.ca>

Advanced Safety Management Ltd.

<http://www.tree-planter.com> and <http://www.theCORexperts.com>

In addition to the Forest Industry Safety Association, there are other organizations in British Columbia that have health and safety as their primary focus: the Workers' Compensation Board (WCB) of B.C., Safety and Health in Arts Production and Entertainment (SHAPE), Farm and Ranch Safety Association (FARSHA), and B.C. Safety Council. An on-line training facility is offered at <http://www.tree-planter.com> and is called the Silviculture eLearning Centre (see Appendix G for details on the Silviculture eLearning Centre).

9.2 Workers' Compensation Board of British Columbia

WCB uses many delivery methods for education and outreach of health and safety issues. They have a substantial library service that houses publications and videos that are loaned free of charge (other than mailing fees). Ergonomics, forest industry, back safety, driving and vehicle safety, personal protective equipment, and slips and falls are just a few of the video categories pertaining to silviculture. For a complete list of the categories and video titles within each category, visit http://www.worksafebc.com/about_us/resources/library_services/assets/pdf/videos_titles.pdf. The WCB web site provides access to a variety of on-line publications and other resources. The "Forestry" and "Ergonomics" links on WCB's online "Health and Safety Centre" (<http://www.healthandsafetycentre.org/s/Home.asp>) contain useful information relevant to silviculture. WCB also coordinates delivery of its WorkSafe courses. They cover several health and safety issues including hazard recognition and control, joint health and safety committee training, occupational health and safety in small business, preventing and investigating musculoskeletal injury (MSI), preventing workplace violence, and supervisor safety management. Courses for each subject area are one day long and can be offered by any one of the consulting companies or institutions that are part of the WorkSafe Education Network (http://www.worksafebc.com/news/worksafe_courses/assets/pdf/Partners.pdf). The WorkSafe magazine is published 6 times per year by WCB and is intended to increase worker and employer awareness of current issues in occupational health and safety.

9.3 Farm and Ranch Safety Association

The Farm and Ranch Safety Association (FARSHA) was established in 1993 to reduce the number of accidents and injuries in the farm and ranch industries through safety promotion and education programs. FARSHA publishes its own materials and passes on information produced by other organizations in the health and safety field. Their target audience is the 20,000 farms in B.C. registered with the WCB board. Although they will respond to information requests that come from farms that are not registered, they are not proactive with these groups. FARSHA has adopted several information delivery methods such as presentations, workshops, crew talks, and training sessions. Topics for the training sessions include conducting workplace inspections, conducting incident investigations, hazard recognition, ATV safety training, preventing back injuries, and preventing musculoskeletal injuries (MSI). Evaluation forms are given out after each training session. FARSHA also loans or gives out most of their other resource material upon request and free of charge (other than mailing costs). They include videos, kits, training programs, presentation packages, booklets, pamphlets, reference guides, fact sheets, posters and decals. A catalogue of the resources available from FARSHA can be accessed through their web site at

<http://www.farsha.bc.ca/resources.htm>. The following section lists some videos, presentation packages, booklets/pamphlets/information sheets/guides that also pertain to silviculture work.

Videos:

1. Protective Clothing and Equipment in Pesticide Use
2. Pesticide Safety
3. Protect Yourself from Pesticides
4. Safety and the Young Worker
5. Keeping your Cool
6. Slips, Trips, and Falls
7. Hazard Recognition and Control
8. Effective Crew Talks
9. Cost of Accidents
10. Due Diligence
11. Musculoskeletal Disorder Prevention: An Overview

Presentation Packages:

1. Refusal of Unsafe Work
2. Musculoskeletal Disorder Prevention: An Overview
3. Preventing Back Injuries
4. Communication

Booklets/Pamphlets/Information Sheets/Guides:

1. Worksafe: Keeping Young Workers Safe
2. The Small Business guide to Health and Safety
3. Heat Stress in Industry
4. Chainsaw Safety
5. Emergency Preparedness in the Workplace
6. Safety Quiz – Pesticides
7. Safety Quiz – Chainsaw Safety
8. Heat Exposures and Heat-Related Emergencies

9.4 B.C. Safety Council

The B.C. Safety Council has been active in both the public and private sector since its inception in 1945. Their mission is to “assist BC's citizens prevent injuries arising from work, travel, home or leisure activities...through safety education and training.” They offer courses in a variety of areas, such as legal responsibilities and due diligence, effective joint health and safety committee training program (6 different modules), conducting worksite safety inspections, conducting worksite accident investigations, WHMIS training and instructor training, fall protection awareness, fall protection operations, supervising fall protection, respiratory protection awareness, task hazard analysis (risk assessment), supervisor safety management, and driver training programs that include hazard avoidance and defensive driving.

According to Rick Cox, Supervisor of Occupational Health and Safety with the B.C. Safety Council, the most popular courses are the ones dealing with legal responsibility and due diligence, safety committee training, worksite safety inspections, and worksite accident

investigations. He also felt that the legal responsibilities and due diligence course is the most effective one they offer. Cox noticed that managers showed continued interest and support for health and safety education and outreach once they became aware of their own responsibilities for ensuring a safe work environment. However, the council has no evaluation mechanisms in place to validate these perceptions.

The B.C. Safety Council has had few requests from the silviculture industry, and as a result has done very little training for this industry. Their work with this industry has been limited to answering a couple of requests for risk assessments from tree planting contractors. As a result of the recommendations from these assessments, the B.C. Safety Council delivered courses to the same groups on MSI prevention. They also offer training on other areas, such as bear and cougar awareness, ATV safety, Hantavirus, and tick, snake and black widow spider bites that could be useful for silviculture workers and employers. The Canada Safety Council, a national equivalent to the B.C. Safety Council, also offers ATV safety training through its 5-7 ½ hour long ATV Rider Course.

9.5 Safety and Health in Arts Production and Entertainment

Safety and Health in Arts Production and Entertainment (SHAPE) was established in 1998 as the safety and health organization for those working in arts and motion picture industry in British Columbia. They deliver health and safety information to their target audience through publications, guidelines, videos, information sheets, newsletters, and workshops. Currently posted on their website is a comprehensive client survey for evaluating the effectiveness of SHAPE and their information delivery methods. Results are still being compiled and should be available to the various safety associations within B.C. by late summer, 2003.

9.6 Disability Prevention Program

Ken Emmons, a consultant and safety officer for School District 23 in Kelowna, markets a package called the Disability Prevention Program. The unique program focuses on what to do once an injury has occurred rather than how to prevent injuries from happening to keep costs down (modified work tasks). The program has been used by School District 23 in Kelowna, which claimed savings of approximately \$18 000 in November, 2002, after its implementation. Saving continued in January, 2003 at \$7 000 and in April, 2003 at \$3 200.

The Disability Prevention Program is a train-the-trainer program that teaches those who will teach it within their own organizations. The program includes a study guide, in service training for principles, and teacher guidelines. It has never been applied to silviculture work. Cost of the package is \$2,500 for individual contractors and \$7,500 for associations. Support is provided via e-mail by Emmons for one year after the program is purchased. Buyers can photocopy and duplicate the materials freely.

9.7 Other Organizations

There are many other organizations and contractors throughout the province not specifically focused on occupational health and safety, but that provide some training and education on the subject. There are also many academic institutions that provide courses, diplomas, and degrees related to occupational health and safety. The following table lists health and safety programs offered by academic institutions and other organizations within British Columbia. The table does not list the organizations that offer only WHMIS training or WorkSafe

courses. Although relevant to silviculture, the number of organizations that offer these courses is too large to include them all in the table.

Institution/Contractor/Organization	Health and Safety-Related Programs/Products Offered
B.C. Ministry of Water, Land, and Air Protection http://wlapwww.gov.bc.ca/wld/pub/pub.htm	Bear and Cougar Safety Guides
Blue Star Training http://www.solarwinds.com/npaec/blst.htm#BLST	Industrial ATV Operators Course
British Columbia Institute of Technology (BCIT) http://www.health.bcit.ca/ochs/	Occupational Health and Safety Program
Camosun College http://www.camosun.bc.ca	Joint Health and Safety Committee Training
Care Institute of Safety and Health http://www.care-institute.com	Back Awareness
College of the Rockies http://www.cotr.bc.ca	<ul style="list-style-type: none"> • S100 Fire Suppression (Ministry of Forests) • Basic Chainsaw Operations and Safety
Forestry Continuing Studies Network http://www.fcsn.bc.ca	<ul style="list-style-type: none"> • Danger Tree Assessment Course (Sponsored by the Ministry of Forests) <ul style="list-style-type: none"> ➢ Wildland Fire Safety ➢ Forest Harvesting and Silviculture • S100 Fire Suppression (Sponsored by the Ministry of Forests) • Pesticide Application Certification Training Program
Justice Institute of British Columbia http://www.jibc.bc.ca	Occupational Health and Safety Program ¹
Langara College http://www.langara.bc.ca/cs	Occupational Health and Safety Committee Training
Northern Lights College http://www.nlc.bc.ca	<ul style="list-style-type: none"> • CSC ATV Rider Course • CSC ATV Instructor Course • PITS Chainsaw Safety • S100 Fire Suppression (Ministry of Forests) • Safety Program Development • Principles of Health & Safety Management
Northwest Community College – Terrace http://www.nwcc.bc.ca	S100 Fire Suppression (Ministry of Forests)
Selkirk College http://www.selkirk.bc.ca	Fall Protection
University of British Columbia (UBC) http://www.soeh.ubc.ca	School of Occupational and Environmental Health Program
Malaspina University College Forestry Extension http://www.mala.bc.ca	S-100 Fire Suppression and Safety Spill response training Forest worker training Aboriculture training
Advanced Safety Management Ltd. http://www.tree-planter.com	On-line training for tree planters and other silviculture workers. Silviculture eLearning Centre.

¹ Two courses are currently available through this program. The rest are under development.

9.7.1 Education, Outreach and Training by Forest Companies and Contractors

Education and training to silviculture consulting company employees has also been initiated by the forest companies that contract their services or by the consultants themselves. After Andrew Carpenter, a forester with Weyerhaeuser Ltd., South Island Timberlands, took the course "Leadership in Health and Safety" offered by the Alberta Forest Products Association (AFPA) while employed with the company in Alberta in 1999, he decided it would be useful for the planting contractors he worked with to receive similar training. Carpenter noted an opportunity to improve decision making related to health and safety by leaders within his contract workforce. He decided, with support from the silviculture companies, to host a 3-day training session for their 'front-line' leaders. This training was modeled after the course offered by the Alberta Forest Products Association and was customized to address the specific health and safety issues of silviculture work within his division.

At the end of the course participants were administered an exam that included questions structured as job-specific scenarios that required participants to synthesize and demonstrate the knowledge they had gained during the training session. All the front-line forepersons of the consultants working with Carpenter were required to take the training. The primary goal of the session was to give these key leaders a better understanding of the principles of health and safety leadership and to know how to conduct hazard assessments. Carpenter wanted the supervisors to be able to conduct their own assessments and also know what to do if the assessment revealed a health and safety issue that needed to be addressed (i.e. adequately identify and appropriately address the hazardous condition). Interest from some of Carpenter's peers within his Weyerhaeuser division resulted in the training sessions being delivered to a few brushing and weeding contractors doing work for the company as well.

Carpenter believes that he now spends less of his time dealing with contractor health and safety issues that are negative, and more time monitoring safety performance and focusing on issues around planting quality. In addition, Carpenter has seen an improved relationship between harvesting operations and silviculture operations, and improved integration of safety into work planning by contractors. Furthermore, Carpenter has noticed that contractors have significantly increased the frequency and quality of reporting and responding to incidents. Contractor developed incident reports are now circulated within the silviculture operation to other contractors working with Carpenter so that they can be used as learning tools.

Summit Reforestation & Forest Management Ltd. is an example of a planting contractor that has initiated internal health and safety training for its employees. It is currently certified with the Alberta Forest Products Association Partners In Reduction (PIR) Program and claim a commitment to regular inspections, monitoring, reporting, and training. It has incorporated Occupational First Aid Level III, Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods, Firearms Acquisition Certificate (FAC)/ Firearms Possession and Acquisition License (PAL), and Danger Tree Assessment certification into their training programs. Tsuga Forestry Services Inc., a reforestation and firefighting contractor for western Canada that is based out of Edmonton, Alberta, was the first tree planting company to receive PIR certificate of recognition.

9.7.2 Continuing Education/Extension Organizations

Continuing education/extension organizations within B.C. could be potential collaborators with FISA/WSCA for education and outreach of occupational health and safety to the silviculture industry in the future. The Forestry Continuing Studies Network (FCSN) delivers education and training to those involved in the forest industry in British Columbia and the Pacific Northwest. They are particularly relevant for those who want to sponsor a course by providing access to a large database that lists potential trainers and/or curriculum developers identified by specific area of expertise. They can also provide assistance with the organization and administration of a particular activity, such as budgeting and financial management, scheduling advice, suggesting resource people, facility and equipment arrangements, advertising, registration services and contact point for information on activities, distribution of pre-reading materials, registration packages, session evaluation, training needs assessment, and on-site support. For those who would like to participate in a training activity, FCSN offers information and advice on suitable training. They also have a comprehensive list on their web site (www.fcsn.bc.ca) of seminars, workshops, field trips, and conferences that are being offered.

The Forest Research Extension Partnership (FORREX) is a non-profit society dedicated to “sustainable resource management by providing access to the best available research, experiential and indigenous knowledge.” They can provide extension services such as technical expertise and problem solving, synthesis of complex information, technical writing, and research partnership building. FORREX also offers information management services through their web-based Natural Resources Information Network (NRIN), on-line Journal of Ecosystems and Management (JEM), LINK newsletter, and access to information and links to other initiatives through the FORREX web site (www.forrex.org). Their services can also be used for conducting needs assessments and program evaluations.

Malaspina College houses a forestry extension program that offers a variety of courses and programs aimed at the Natural Resources sector. For example, they have been responsible for organizing and administering the Coastal Silviculture Committee’s summer and winter workshops since 2001. Services are available for workshops, training sessions, meetings, learning needs assessments, and conferences including speaker/instructor arrangements, program development, advertising, facilities, catering, audio-visual arrangements as well as event proceedings. Doug Ellis, Director of the extension program, teaches safety-related courses such as the Danger Tree Assessment, and participates in several studies through research and report writing. Services of the Malaspina forestry extension program are provided at full cost recovery and mainly to those operating in the Vancouver Forest Region.

The on-line training facility offered by the Advanced Safety Management Ltd. called the Silviculture eLearning Center (www.tree-planter.com) detailed elsewhere in this report (including Appendix G) is designed to be flexible and adaptable for the remote, dispersed nature of the silviculture industry. Originally funded to provide five health and safety courses for forestry company employees, the site is continuing to develop and offer more courses at increased capacity.

10 Conclusions

The conclusions in our analysis rely on information from several sources—the scientific literature, statistics on injury and accidents in silviculture in B.C., examples from other jurisdictions, and interviews with those familiar with the industry in B.C. This synthesis was important for gaining a full understanding of this industry. Any one of those sources alone would have painted only a partial picture of the safety situation and opportunities for B.C.

The statistics available from WCB, while valuable, were limited to very basic data about the nature of accidents, and particularly about the claimant. There are many more factors that could affect accident and injury rates than those collected by WCB.

If we have learned anything from this analysis, it is a reiteration to the old adage “safety is everyone’s responsibility.” From workers to foremen, to supervisors to contractors to foresters, every layer within a silviculture company – and even to the contracting licensee-- has what we would call “points for intervention.” Programs aimed at reducing accidents and injuries must look at the unique attributes and needs of each layer within the system. We found through our interviews that workers see the barriers to safety quite differently than contractors –seeing the same kinds of accidents linked to very different causes.

Understanding how risk and hazards are perceived by every player within a silviculture organization is important for designing effective interventions. To quote from a Canadian Council of Occupational Health and Safety report: “Good lasting results only happen when everybody in the organization, from managers to all workers, are deeply involved in workplace health and safety concerns.”

We found considerable scientific literature on the physical factors associated with accidents and injuries. There is no research (that we could find) that discusses the relative strengths of the relationships, or which factor would best respond to intervention. We found numerous articles on work motivation and behaviour, and our interviews seemed to support the notion that good management practices overall within a company can be linked with good safety practices among workers. Workers who feel a sense of pride in the organization and their work we believe are more likely to respond to increased safety measures. The words “institutionalization’ and “enculturation” of health and safety were used by several key informants.

In the words of John Baker, CEO of the Ontario Service Safety Association: ***“you can engineer yourself to death but if you don’t change attitudes about safety, all you are doing is building higher and higher walls. Typically, health and safety people tend to be ‘barrier’ people. But we need to look at what motivates people and how they perceive risk if we want to make long-term differences in injury rates.”***

More than one interviewee recommended treating each segment of the industry as its own separate industry and planning interventions according to the characteristics, needs, gaps, and opportunities of each. We were warned by several interviewees that it’s inaccurate to generalize about this industry.

Vehicle accidents were mentioned as key issues throughout this study, and the statistics show that vehicle-related injuries are indeed concerning. Training in off-road vehicle use that is

specialized for the silviculture industry that includes information on dirt roads, radio communications, and vehicle loading is recommended. In preparing for such a course, we recommend looking into more detail about vehicles accidents – look into what really happened, what were all the factors. Use the case studies in the course.

Research shows that increasing driver knowledge and skill does not always lead to change in driving behaviour or reduced crash risk so we would not recommend driver's training as a stand-alone intervention for reducing vehicle accidents. We recommend a multi-pronged approach of increased driving law enforcement and increased supervision of novice drivers. We recommend including greater emphasis on understanding how beliefs and motivations shape driver behaviours. R. Christie's work in Australia on driver training and perceptions included in our literature review may help in the curriculum design.

As FISA/WSCA begin the strategic planning process for interventions, we recommend that time be spent focusing on programs to affect both “process” and “outcome” indicators of assessing safety. We recommend to not just rely on reduced injury rates (outcome indicators) to measure success, but look at changed attitudes, increased knowledge, skills of managers, supervisors, and workers. Perhaps working with a wellness model (increasing what we do want) rather than a deficit model approach (e.g. reducing what we don't want) would be a helpful approach.

We recommend that FISA/WSCA consider using strategic planning tool called the Logic Model to plan the next steps for intervention. This tool is commonly used in health and social service agencies to design their interventions and identify goals and desired outcomes and is well documented in the program planning and planning literature. It helps organizations identify the cause-effect linkages between interventions and short and long-term desired outcomes. There are many resources on the web that explain more about Logic Models and how to use them.

Because the remote and seasonal nature of this industry, it suffers from many barriers to effective training delivery. Creative delivery mechanisms should be supported and further explored. Training companies such as Advanced Safety Management Ltd. that created an on-line training facility to overcome training barriers inherent in the silviculture industry can help design appropriate delivery methods . (For four years, the AMS has provided remote training access for over 3,000 users each year at <http://www.tree-planter.com>. In addition, a “Silviculture eLearning Center” (SeLC) has been launched to enhance the training and delivery capability of the facility).

Our exploration of other organizations involved in health and safety issues in silviculture showed us that there are not many initiatives focused on this industry to date, with the exception of Ontario Forest Safe Workplace Association. British Columbia has the opportunity to be a national and world leader in reducing silviculture injury rates, and improving overall wellness for this industry. This needs assessment is a very important first step.

11 Recommendations

- Conduct a case study of the lowest injury rate companies to learn the common denominators- do this for both companies with over \$1,000,000 in payroll, and smaller companies with less than \$100,000 in payroll.

- Launch an advisory committee with representatives from WCB, ICBC, workers, supervisors, educators, and contractors to review the results of this report, recommend strategies, and monitor progress.

- Institute near miss reporting like Ontario.

- To close the gap on limited data about the nature of accidents, we recommend suggesting to WCB to begin using electronic accident and claim forms. To avert the problem of employers not completely filling them out, WCB could make each box of the form mandatory. Because of differing interpretations in how forms were completed, WCB should better define the terms on the forms.

- Partner with research institutes such as Institute for Work and Health to conduct research projects on the research gaps (www.iwh.on.ca) and evaluation of interventions. Partner with training and consulting organizations such as Advanced Safety Management Ltd. (www.theCORexperts) that are offering creative training delivery methods to address the training barriers unique to this industry.

- Work with contractors to enhance what the Canadian Council of Occupational Health and Safety (CCOSH) calls “key management strategies”
 - increased management commitment to safety
 - credibility of the organization to safety (workers must be convinced that management is committed through what they observe)
 - empowerment management style is linked with good safety results (and is also consistent with other management trends)
 - management changes must go hand in hand with training and education. Giving training and education are only part the solution
 - Invite workers to be active stakeholders in safety programs

Other helpful comments from CCOSH regarding training and education:

- general awareness sessions don't work if in isolation of other things
- motivational sessions are not worth it if not backed up by obvious managerial commitments
- training should be targeted at specific people with specific action paths
- use training as opportunity to air concerns and for managers and workers to “get on the same wavelength” regarding safety
- must use good principles of adult education: begin with specific needs assessment, appropriate delivery methods for the audience, and recognition of special needs of adult learners
- continuous learning cycle must happen. Persistence. One shot deals are not enough

-There is significant lack of data on methods of reducing repetitive use injuries, and of factors that are linked with that type of injury. Adequate funding for research is needed for longer-term studies, especially long-term impacts of injuries.

-Existing FISA courses could be modified to address safety issues of silviculture. Use results of this study to modify the existing courses.

-Create templates of health and safety plans, near incident report forms, and safe vehicle operations, practices and procedures. Distribute these to contractors, especially the smaller and new companies and encourage them to use them.

-To build awareness of safety issues among contractors, develop a brochure based on the statistics and distribute to contractors.

11.1 Research gaps

Studies that examine the linkages between factors not collected by WCB are needed: number of consecutive work days and accident rates, and the role of fatigue in vehicle accidents.

Research is also needed for the following:

-Optimum recovery strategies – the role of in-season stretching, the role of icing, and other personal methods of recovery (meaning resting overnight so you can do the same thing the next day)

-Alternative stress reduction methods

-Optimal diet

-Optimal pre-season physical training program

Other References

(See section 5 for complete literature listing)

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Appendix A
List of contacts contacted for this study
(except names of contractors contacted for the confidential interviews)

Contractors, Reforestation Society leaders, and tree planters (employees)	Confidential interviews
Forest Industry safety representatives	-Vicky Gauthier, Weyerhaeuser -Andrew Carpenter, Weyerhaeuser -Scott Chisholm, Advanced Safety Mgt. Ltd. -Maureen Shaw, IAPA -John Murray, OFSWA -John Bonin, Saskatchewan FISA -Tommy Harper, Nova Scotia Forestry Safety Society -John Levesque, OFSWA
B.C. Ministry of Forests	-Steve Backop -Frank Barber
WCB contacts	-Dave Springall -Kevin Thipthorpe -Dave Rowe -Gerry Paquette
FARSHA (Farm and Ranch Safety and Health Association)	-Sandeep Mangat
City of Kelowna	-Pat Cantner -Ken Emmons
Researchers and practitioners	-Suzanne Kinney -Delia Roberts -Daniel Crumbach -Jackie Ellis (First Aid Attendant, tree planting, Health and Safety Officer, Malaspina University College)
U.S. Contacts	-Stan Kunzman, NWSA -Chuck Whitlock, USFS -Bert Lindler, Missoula Technology Dev. Center -Cail Hegman, Missoula Technology Dev. Center -Ed Hollenshead, Boise National Interagency Fire Center

Appendix B Relevant websites

<http://www.tree-planter.com> (On-line training and resources)

<http://www.theCORexperts.com> (Advanced Safety Management Ltd).

<http://www.awt.on.ca/member.html> (Association of Woodland Trainers)

<http://www.cifffc.ca/> (Canadian Interagency Forest Fire Centre)

<http://safetynet.smis.doi.gov/> (US Dept. of Interior SafetyNet Program. A shared one-stop information source for the Safety and Health Community of the Dept. of the Interior that includes Bureau of Land Management and National Park Service)

<http://www.fs.fed.us/fire/safety/index.html> (USDA Forest Service, Fire and Aviation, Wildland Safety Program)

<http://www.fss.ns.ca/about.htm> (Forestry Safety Association of Nova Scotia)

http://www.worksafebc.com/Publications/newsletters/worksafe_magazine/Assets/PDF/wsm_sep_oct_2001.pdf (BC WCB Worksafe newsletter)

<http://www.wst.tas.gov.au/attach/wstforestsaf-1.pdf> (Tasmania Forestry Code)

<http://www.masha.on.ca/links.htm#SWA> (list of health and safety associations in Ontario funded by the Workers Safety Insurance Board)

<http://www.cdc.gov/niosh/homepage.html> (National Institute for Occupational Safety and Health- US).

<http://www.ofswa.on.ca/home.html> (Ontario Forestry Safe Workplace Association)

<http://www.ccohs.ca/oshanswers/psychosocial/> (Canadian Centre for Occupational Health and Safety)

<http://www.canadian-forests.com/silv-contractors.htm> Website on forests and forestry in Canada with focus on silviculture. Quick access to all the internet sites of the federal and provincial governments, the forest industries, service and supply companies, associations and NGOs, consultants, education and research, forestry news, employment opportunities, etc.

<http://www.fs.fed.us/eng/techdev/mtdc.htm> (Missoula Technology Development Center)

<http://chppm-www.apgea.army.mil/aboutus.asp> (US Army Center for Health Promotion and Preventative Medicine)

<http://www.nsc.org/> (National Safety Council, U.S.)

<http://www.fs.fed.us/t-d/> USDA Technology Development Center (user ID is t-d.
Password is t-d).

http://www.nifc.gov/safety_study/index.htm (National Interagency Fire Center, Boise
Idaho, US) Safety webpage.

Appendix C Interview Questions

- Can you first tell me a bit about your company – how many employees, what kind of contract work that you do? How long have you been in the business?
- What is the make up of your crew(s) – ages, gender, education, level of experience, native, non-native?
- How much of a problem is lost work time for you—When your crew members have accidents. Would you say that it is a big problem, a moderate problem, or not much of a problem for you?
- What would you say are your biggest barriers to safety for you as a contractor? How much is related to lack of information and experience with safety of your crews? Of lack of different ways to get information to your crews? Of lack of knowing what the real costs to you are? Lack of incentives on the part of the workers?
- What kinds of safety strategies are you involved with your crews? (e.g. tale gate sessions, formal training, getting new equipment, incident debriefings, company health and safety practices and procedures), Do you think that this is pretty typical among others in the industry? If you do more than others, what motivates you to do more—ie. Does it really “pay?”
- What are your most common safety issues? Describe the number one safety issue that your company faces. How would you describe your workers’ behaviours towards safety, when you spend time training, tale gate sessions, etc. what appears to be their attitude toward taking the time to talk and deal with safety?
- How do you motivate your crews to have good safety practices in the field. What are the consequences to them of not playing it safe, other than getting hurt and losing money by not being on the job?
- Do you encourage your crews to use good-health practices off the job (like diet, fitness, sleep) – what strategies do you use to motivate them to do this? How do they respond to your requests for this?
- Where do you get information on safety and health issues as it relates to your crews and your industry? Do you feel like this is a gap for you –would be able to use more information if it was easily accessible to you? On what topics? In what form? Do you ever read safety journals or materials? Websites? Where do you go for information on health and safety? Where would you go, if it was there?
- What would you think of a program like they have in Alberta where you can reduce your WCB rates by becoming safety certified? Is that a good idea for BC?

-What advice would you give an umbrella organization whose business is trying overall to reduce accident rates and improve overall health and safety of workers in (this industry), about how to go about this?

Appendix D Glossary

Definitions for Accidents, Injuries and Body Parts:

Ankle, toe – means ankles, feet or toes

Chemical burn – includes dermatitis

Eye injuries – includes cases where an eye injury is combined with another facial injury

Fall: same level –falling on the same level

Fall: from elevation –accidents where the injured person fell from one level to another

Finger, wrist –fingers, hands or wrists

Involuntary motion – injuries are those that result from slips and other loss-of balance events with no fall to the ground

Other – parts of the body that do not fit into the other categories

Other arm – parts of the arm other than the shoulder, elbows, wrists, hands and fingers

Other disease – diseases not covered by other categories

O head – parts of the head other than the eyes, face, ears and neck

Other injury - injuries not covered by the other categories

O leg – parts of the leg other than the hip, knee, ankles, toes and feet

Other strains – includes strains, sprains and musculoskeletal

O trunk – parts of the body trunk that do not fit into the other categories

Other voluntary motion – injuries are those that result from a single voluntary motion like reaching, bending, walking and twisting

Overexertion – injuries are those resulting from the application of force to some object

Strike against – when a body part strikes an object

Struck by – when a worker is struck by an object

Systems – the body part used for occupational diseases where an entire bodily system (respiratory, digestive, etc.) is affected, not just a specific body part (such as salmonella, giardia, or hepatitis)

Appendix E Regional comparisons

Note: “Region” describes the regional district of the employer where the accident occurred.

A. Number of claims for CU 703001—Chemical spacing/pruning

Age classes by region

	17yrs- 25yrs	26yrs- 35yrs	36yrs- 45yrs	46yrs- 55yrs	
Bulkley		4			4
C Okanagan		1	1		2
Columbia			1		1
Comox		2	1		3
Fr Georg	6	6	3		15
Vancouver				1	1
	6	13	6	1	26

Event by region

	fall, same levl	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary motion	strike against	
Bulkley	1	2		1							4
C Okanagan					1				1		2
Columbia	1										1
Comox			1	1		1					3
Fr Georg	4	2	2	3	1		1	1		1	15
Vancouver					1						1
	6	4	3	5	3	1	1	1	1	1	26

Injury by region

	other strains	Back strains	crush bruises	cuts	other disease	dislocation fract	chem burn	Scratch, abrasion	
Bulkley	2		2						4
C Okanagan	2								2
Columbia	1								1
Comox	1					1	1		3
Fr Georg	4	1	3	2	1	2	1	1	15
Vancouver	1								1
	11	1	5	2	1	3	2	1	26

B. Number of claims for CU 703002—Mechanical spacing/pruning

Age classes by region

	17yrs- 25yrs	26yrs- 35yrs	36yrs- 45yrs	46yrs-55yrs	56yrs- 65yrs	
Bulkley	5	8	10	3		26
C Okanagan		2	6	1		9
Columbia	5	4	4			13
Comox	4	3	6	2	1	16
Fr Georg	10	7	4			21
Alberni		6	2		1	9
C Koot	1	2	2	1		6
Capital			2			2
Cariboo	6	11	6	3	4	30
Cowichan	1	4	5			10
E Koot	1	2	2	1		6

Fr cheam	1	1	2	2		6
Kitimat	2	10	6	2		20
Koot boundary	2	3	2			7
Mt. Wadd	3	3	1			7
N. Okanagan		3	2			5
Nanaimo	7	9	10	2		28
Ocean f			1			1
Okanagan S	2	1				3
Peace River	4	4	2	4		14
Powell River			3			3
Skena		1	2			3
Squamish	1		1	2		4
Sunshine	1	4	3	1		9
Thompson	8	5	2	1		16

Uncoded		2	2	1		5
Vancouver	6	3	3	1	1	14
	70	98	91	27	7	293

Event by region

	fall, same levl	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary motion	repetitive motion	heat, cold	matter in eye	strike against	rubbed, abraded	fall, same levl	
Bulkley	4	2		10	3	3	1		1	2						26
C Okanagan	1			5	1			2								9
Columbia	1		1	4	2	2		1				1	1			13
Comox	4			3	3	1		1	1	3						16
Fr Georg	2	3		8	1	3	1		1			2				21
Alberni	2			4	1	2										9

C Koot	2			2					1	1						6
Capital				1	1											2
Cariboo	4	5		11	2	3	2	1		1			1			30
Cowichan	4			2		2				1			1			10
E Koot	3				2	1										6
Fr cheam				3	2	1										6
Kitimat	3	3		9	2				2	1						20
Koot boundary	2			5												7
Mt. Wadd	3			2		1			1							7
N. Okanagan				1		1	1	1					1			5
Nanaimo	5			9	5	1		1	5	1					1	28
Ocean f				1												1
Okanagan S				1	1									1		3
Peace River	1	5		2	1	1			1	1	1		1			14

Powell River					2				1							3
Skena	2									1						3
Squamish	2			1		1										4
Sunshine	1	1		1	3	2						1				9
Thompson	2		1	3	4	3							2	1		16
Uncoded						3			1						1	5
Vancouver	4			4		3	1		1				1			14
	52	19	2	92	36	34	6	7	16	12	1	4	8	2	2	293

Injury by region

	other strains	Back strains	crush bruises	Tendonitis	cuts	other disease	dislocation, fract	chem burn	other injury	Scratch, abrasion	Hearing loss	
Bulkley	6	5	1	3	7		3		1			26
C Okanagan	5		1		3							9

Columbia	3	1	1	1	4			1		2		13
Comox	6		2	3	2		3					16
Fr Georg	5	1	3		5		1			6		21
Alberni	2	2	2				1			2		9
C Koot	2		1	1					1	1		6
Capital			1		1							2
Cariboo	9	2	6	2	5	1	3			2		30
Cowichan	4	2		1	1		1			1		10
E Koot	1	3	1		1							6
Fr cheam		1			4		1					6
Kitimat	8	1	3	1	2		1		2	2		20
Koot boundary					6					1		7
Mt. Wadd	4		1				2					7
N. Okanagan	1	2			1				1			5

Nanaimo	6	3	1	1	8		6			2	1	28
Ocean f					1							1
Okanagan S	1					1	1					3
Peace River	2		1	1	2		3		5			14
Powell River	1	1			1							3
Skena				1	2							3
Squamish		1					2			1		4
Sunshine	2	2	1		1		2			1		9
Thompso n	4	1	3		3	1			1	3		16
Uncoded	3	1									1	5
Vancouve r	3	1	3		4		1		1	1		14
	78	30	32	15	64	3	31	1	12	25	2	293

C. Number of claims for CU 703005—Fire Fighting

Age classes by region

	17yrs-	26yrs-	36yrs-	higher	
--	--------	--------	--------	--------	--

	25yrs	35yrs	45yrs	than 65yrs	
Bulkley	1		1	1	3
Columbia	2				2
C Koot	4	4			8
Thompson		3	1		4
Uncoded				1	1
	7	7	2	2	18

Event by region

	fall, same level	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary motion	repetitive motion	noise exposure	
Bulkley					1		1			1		3
C Okanagan									1			1
Columbia			1		1							2
C Koot	1		1		4	1		1				8
Thompson	1	1		1		1						4
Uncoded											1	1
	2	1	2	1	6	2	1	1	1	1	1	19

Injury by region

	other strains	Back strains	crush. bruises	Tendonitis	other disease	chem burn	Hearing loss	
Bulkley	1		1	1				3

C Okanagan	1							1
Columbia	1				1			2
C Koot	5	2				1		8
Thompson	3				1			4
Uncoded							1	1
	11	2	1	1	2	1	1	19

D. Number of claims for CU 703016—Tree planting/cone picking

Age classes by region

	17yrs- 25yrs	26yrs- 35yrs	36yrs- 45yrs	46yrs- 55yrs	56yrs- 65yrs	
Bulkley	10	7	1			18
C Okanagan	7	7	7			21
Columbia	1	1	1	2		5
Comox		9	8	2		19

Fr Georg	104	32	1	1		138
Alberni		1			1	2
C Koot	7	20	11	5	1	44
Capital	5	6	2	1		14
Cariboo	11	12	3	1		27
E Koot	1	3	1			5
Kitimat	3	5	2			10
Koot boundary	8	11	2	1		22
Mt. Wadd	2	8	2			12
N. Okanagan	1	4	2	1		8
Nanaimo	1	1	1	2		5
Ocean f			1	2		3
Okanagan S	2	8	2			12
Peace River	1	2				3

Skena			1			1
Squamish	3	3				6
Sunshine		1				1
Thompson	3	1				4
Vancouver	57	60	23	8	4	152
C fr val	1	1	1	1		4
Dewdney			1			1
	228	204	73	27	6	538

Event by region

	fall, same level	vehicle accident	toxics, noxious	struck by	fall, from elevation	overexertion	caught in	other vol motion	Involuntary	repetitive motion	heat, cold	matter in eye	strike against	rubbed, abraded	
Bulkley	2	1		1	2	1	1		2	5			3		18
C Okanagan	6		1	4	1	2	1	2	3	2					22

Columbia	3								2						5
Comox	7			1	1	2		1	4	1			1	1	19
Fr Georg	20	7	6	11	16	17	2	9	8	25	3		13	1	138
Alberni						1			1						2
C Koot	6	1	1	10	3	7		4	4	5		1	2		44
Capital	4			3	2	2		1		1		1			14
Cariboo	4	1		7	2	4			3	4	1		2		28
E Koot				1	2	1				1					5
Kitimat	2			2	1			1	1	1			2		10
Koot boundary	2		2	1	4	4	1	1	3	4					22
Mt. Wadd	2			4	2	2		1					1		12
N. Okanagan	1			4		2			1						8
Nanaimo	1			1	1	2									5
Ocean f	2			1											3

Okanagan S	3		1	1				1	4	1		1	1		
Peace River								1		2					3
Skena	1														1
Squamish	3	1			2										6
Sunshine									1						
Thompson	1			1		1			1						4
Vancouver	32	9	2	14	23	10	2	13	15	20	1		9	2	152
C fr val				4											4
Dewdney	1														1
	103	20	13	72	62	58	7	35	53	72	5	3	34	4	541

Injury by region

	other strains	Back strains	crush. bruises	Tendonitis	cuts	other disease	dislocation, fracture	chem burn	other injury	Scratch, abrasion	multiple injuries	
Bulkley	3	2	2	5	2	1	1			1	1	18
C Okanagan	11	1		4	4	1			1			22
Columbia	4	1										5
Comox	8	5	1	1	1		1			2		19
Fr Georg	44	17	7	28	17	5	8	1	3	9		139
Alberni	1					1						2
C Koot	11	8	5	6	9	1	3			1		44
Capital	5			1	4		1			3		14
Cariboo	7	4	3	5	3	1	3		1	1		28
E Koot	1			1			3					5

Kitimat	3		2	1	1		1			2		10
Koot boundary	8	4		5	1	2	1		1			22
Mt. Wadd	2	3	1		3		2			1		12
N. Okanagan	2	1	1		1					3		8
Nanaimo	2			2	1							5
Ocean f					2		1					3
Okanagan S	4	3		1		1	3			1		13
Peace River	1			2								3
Skena	1											1
Squamish	4		2									6
Sunshine	1											1
Thompson	1	1			2							4
Vancouver	54	23	17	22	11	4	11		5	6		153
C fr val			1		2		1					4

Dewdney			1									1
	178	73	43	84	65	17	40	1	11	30	1	543

Note:

- C fr val = the Central fraser Valley
- Koot bou = Kootneay Boundary
- Fr-cheam is the Fraser Cheam
- N okanag is the North Okanagan
- Bulkley is the Bulkley-Nechako
- Fr george is the Fraser-Fort George
- Dewdnes is the Dewdey-Alouette
- Vancouver is the greater Vancouver Regional D

Appendix F
Enhanced Forestry in the Pacific Region

Based on Data Collected by New Forest Opportunities Ltd.

1998 to 2002

Prepared by: Jim Starr and Bruce Perry

July 11, 2003

The reports that follow have been produced from data collected by New Forest Opportunities Ltd. from 1998/99 through 2001/02. It is hoped that the information presented will be of significance to the silviculture contracting industry in its undertaking to develop a strategic health and safety program.

Due to time and financial factors the writers were limited to information pertaining to enhanced forestry costs and productivity as well as accident and safety statistics. Unfortunately EF worker demographic data and data pertaining to training and the sporadic nature of EF projects is not readily available. An extensive database does exist however and can be retrieved from the provincial government archives.

New Forest Opportunities Ltd. dedicated significant energy and budget to the tasks of training Enhanced Forestry workers and improving the state of health and safety in the Pacific Region. The outcome of this work is described in part by the 1998 to 2000 Enhanced Forestry Safety Report that follows. During the existence of NFO a dialogue involving the recipients of FRBC funding, EF contractors, workers and the IWA regarding health and safety was actively promoted. Again the pertinent documents reside in the provincial government archives however a number of issues (the writers' recollections) regarding factors affecting the risk of accidents in EF activities resonated with all parties.

Intermittent work:

Typically an EF project lasts +/-30 workdays followed by a layoff of days to weeks. Workers lose their level of conditioning during layoff periods and when they return they are prone to falling or tripping while working themselves back into shape.

Supporting stats. Average project length, Average length of layoff

Age of Enhanced Forestry Workers:

As the opportunity for EF work decreases, only the most experienced senior workers are in demand by contractors. The demand for new entrants is low and as a result the age of the average EF worker is increasing. Although these individuals are highly skilled it takes longer to for an older worker to get into work shape after a layoff and conditioning following a project is lost more quickly.

Supporting stats: EF worker demographics, Project and layoff lengths, average days of worker engagement annually.

1 Demands of Incentive Based Work

Individuals whose earnings are dependent upon the volume of work they produce in a workday are inclined to take risks to increase productivity and therefore their personal earnings. As the amount of EF work available decreases anxiety over earning potential increases and the “go for it” inclination of EF workers is magnified in an effort to maximise personal earnings in an uncertain work climate.

Supporting Statistics: Average workerday productivity, EF expenditures

2 Physical and Emotional Health of Enhanced Forestry Work Force

EF work is a highly demanding physical activity. A nutritious diet, proper rest, fluid intake and an optimal work pace are key components to high level performance and safe productivity. As EF worker earning opportunity decreases high calorie (high cost) food may be overlooked. Fatigue -identified as a contributing factor in many accidents, may result from inadequate diet, low conditioning levels, long commutes and emotional stress.

Supervision:

A typical EF crew of 10 workers is managed by 1 supervisor, this individual is expected to co-ordinate the crews activities, do in block layout, monitor quality and production, maintain equipment, liase with client field staff, train less experienced workers as well as monitor and promote health and safety. The rigours of standards certification and an increased emphasis of record keeping add to the supervisory workload. Supervisory costs run at +/- \$30 per workerday i.e.7% to 10% of gross contract revenue.

As contractor competition increases due to the reduced volume of EF contracts being tendered pressure to reduce costs also increases. Consequently supervisors are expected to do more with less. Concerns were often expressed that training and safety were programs that may be compromised in this economic climate.

Supervisory credentials were also a topic that received attention. EF supervisors are not required to have any specific qualifications nor have there been opportunities (other then on the job) to acquire such skills.

Note: Reliable statistics regarding the level and quality of supervision were not maintained by New Forest as contractors were not required to pay supervisors through the NFO payroll system.

Training:

New Forest had a sizeable budget dedicated to training. This money was used to:

- Train workers in specific activities.
- Reimburse contractors for on the job training of workers inexperienced in an activity.
- Upgrade skills and provide safety training to experienced EF workers
- Provide professional development for supervisors and contractors with a focus to the enhancement of project management and health and safety practices.

NFO health and safety statistics showed favourable trends suggesting that training has a positive impact.

3 Fiscal Year 2002

New Forest Opportunities employed 554 EF workers on 149 projects that required 18175 worker days to complete. The average project required 122 worker days or 12.2 workdays with a 10 person crew.

The average worker was employed for 33 days during FY 2002 doing Enhanced forestry work in the Pacific Region.

Note: Information of this nature is available for Fiscal Years 99 through 02 and is currently stored in Provincial Government archives

Acknowledgements

Thank you to Forest Industry Safety Association and Western Silviculture Contractors Association for their support and patience in completing this report.

Shawn Morford, FORREX
Doug Ellis, Malaspina University College
Jennifer Turner, FORREX

Appendix G
Recommendations from Advanced Safety Management Ltd.

Advanced Safety Management Ltd.
(in partnership with Tree-planter.com)

July 2003

Silviculture Industry Needs Assessment



Advanced Safety Management Ltd.

Alberta Operations
Edmonton, Alberta
Toll Free 1-866-231-0641

Head Office
Vernon, B.C.
Toll Free 1-866-276-5551

www.theCORexperts.com

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Who We Are

Advanced Safety Management Ltd. (ASM) is a safety consulting firm that specialized in helping resource industry contractors establish and implement effective health and safety systems that exceed the minimum requirements of the Alberta-based Partnerships in Injury Reduction (PIR) program. Over the last four years we have worked with over 90 different companies to help them earn certification in this program and achieve a Certificate of Recognition (COR).

Our roots are in the silviculture industry where we have extensive planting experience and have run a mid-sized silviculture services company for 5 years. During the operation of this silviculture company, we realized the importance of health and safety in the workplace, and in turn were one of the first silviculture companies in Alberta to obtain a COR. Since then we have continued to be extremely involved in the silviculture industry by building safety programs, group and on-site training, auditing and developing Tree-planter.com – an online safety training school for treeplanters as well as a community-style resource for treeplanters.

The discussion of the issues that follow is based on our experience as silviculture workers, contractors and safety consultants. We are kept abreast of current issues, developments and trends due to our active participation in the silviculture industry through our business activities. This enables us to maintain a close working relationship with some of Canada’s largest silviculture contractors and hundreds (if not thousands) of individual treeplanters. Our single most significant business activity for the gathering of intelligence on this industry is through the health and safety audits that we conduct each summer. Through these audits we get to see first hand what the issues are, and what problems arise from industry’s attempts to correct them.

Issues and General Solutions

The silviculture industry has been plagued by extremely high injury rates. Some of the factors that have contributed to this problem are:

- The short and seasonal work season with scattered locations
- Young workers
- The physically demanding and repetitive nature of the work
- Inadequate pre-season physical preparation
- Remote wilderness work sites
- The production-based nature of the payment of workers, and
- The high intensity of the field season with limited resources (time and money)

The solutions for improving the safety performance of this industry are not simple. We believe that the problems must be approached from several different angles. The following are some of our ideas starting with the most “Big picture” suggestions and working toward the specifics.

Issues and General Solutions (continued)

Management Focused Suggestions

Company owners and management drive health and safety systems. Without the complete “Buy-in” from management, health and safety in the workplace is not likely to improve. Managers and owners must take a very serious leadership role by demonstrating that there is both a reason and need for health and safety. Without this leadership, the company might as well leave the safety system on the shelf. This will not be an easy task, as the vast majority of the individuals in question have seen constant, heightened requirements in regard to paper work. They see safety as another headache. The first step to improving this industry is through teaching senior management about health and safety, who it affects, and what sort of tangible impacts it can have within their businesses. They have to be taught to see the “big picture”.

We suggest that the following information be made available to silviculture company owners and senior managers. This information could be made available in the format of group courses, on-site consultations, online courses and/or literature that is targeted directly toward their industry.

Suggested Topics

- How Health and Safety Affects Your Business
- Understanding Effective Health and Safety Systems
- Building an Effective Health and Safety System
- Implementing an Effective Health and Safety System

The first topic, How Health and Safety Affects Your Business, is the most important. Even the industry’s most advanced companies do not fully understand the value of an effective health and safety system. Our company has targeted this course for development over the 2003-04 off-season because once developed, we believe that silviculture companies will have the information they need to understand why their health and safety system is as important as their existing productions and quality systems. This course will have to be carefully developed to ensure that senior managers can see the direct and indirect dollar values associated with accidents, injuries and occupational illnesses. Without this course, or without otherwise providing this information, this initiative to improve the safety performance of the industry will be seriously limited.

The remaining three topics are designed to give senior managers the tools they need to take their new found enthusiasm for safety systems and make them a reality within their company – without experiencing the difficulties so often encountered in taking a good idea and making it happen.

Issues and General Solutions (continued)

Supervisory Staff Focused Suggestions

Supervisory staff are responsible for the day to day implementation and monitoring of the health and safety system and their leadership is critical to maintaining the company's health and safety system. In order for supervisory staff to implement and monitor a health and safety system properly, effectively and efficiently, they need targeted and timely training. It is not enough to train these people once or during the middle of the off-season. Due to the highly seasonal nature of the work, supervisory staff need reoccurring training right before the commencement of the planting season. We suggest that in addition to the certified training that they are already required to have (e.g. First Aid, Chainsaw Operation, ATV Operation etc), these people need additional training that is geared toward fulfilling their health and safety responsibilities within their employer's safety system. We suggest training that consists of the following:

Implementing an Effective Health and Safety System

- Conducting Employee Training
- Inspections and Monitoring
- Incident and Accident Investigation Techniques
- Corrective Action Determination and Tracking
- Hazard and Control Communications
- Conducting Effective Health and Safety Meetings
- Record Keeping
- Emergency Response Preparedness
- Claims Management (Well suited for management as well)

Worker-Focused Suggestions

Through the development of a proper and effective health and safety system, silviculture companies will be able to much more easily identify the specific hazards associated with the work that they do. Additionally, they will be much better prepared to make ongoing improvements to their safety systems through the analysis of incidents, accidents, records and stats, and inspections. Given our extensive experience in this industry (especially through auditing) we can offer the following suggestions which are the hazards that are at the top of our list – and that are most in need of effective controls at the worker level.

- Haul Road Vehicle Travel (both company and personal vehicles)
- Repetitive Strain Injuries and Ergonomic Injuries
 - Safe Work Procedures
 - Pre-Season Physical Preparation
 - Diet and Nutrition
 - Improved Tool Design

There are many other hazards that are in need of controls, however, these are our top issues.

Logistic Challenges of Training

There are several key challenges to recognize and overcome that are unique to the silviculture industry.

Seasonal Work with Long Off-Seasons

Many silviculture workers and supervisory staff work two or three months per year in this industry with long breaks between seasons. These long breaks necessitate reoccurring training. There would be major benefits to having all levels of the company trained early in the year (March), and again at season commencement (May). This approach could help prepare personnel for the upcoming season, and reinforce specific issues just prior to commencement.

High Turn-Over of Personnel

Workers

- Many silviculture workers will work in the silviculture industry for a period of one to three or four seasons. Every year there are thousands of new and inexperienced silviculture workers.

Supervisory Staff

- Although supervisory staff often have several years of planting experience, being a member of the supervisory staff is seldom a long-term career choice – two to three years is typical.
- There are hundreds of new supervisory staff each year and for most, this will be their first job where they are responsible for the safety of other workers.

Widespread Dispersal of Workforce

Pre-Season

Silviculture workers and supervisory staff are typically scattered across Canada (and some are traveling in other parts of the world) during the off-season. It is not feasible to conduct training with these workers in a typical classroom fashion.

In-Season

Most silviculture companies have projects that span one or more provinces. Contracts are rarely in the company's hometown so workers and supervisory staff do not usually have access to company training facilities or company trainers.

Logistic Challenges of Training (continued)

Intensive Season Commencement

Lack of Time

The start of the treeplanting season typically consists of workers and supervisory staff arriving at the first contract right before the first trees are to be planted. Upon arrival, there is very little time to be wasted, as camps often need to be assembled, reefers unloaded, blocks stocked and work initiated immediately. There is virtually no time for supervisory staff or workers to be trained.

Information Overload and Poor Learning Environment

Companies that attempt to train their workers as they arrive for their first project are faced with a challenging learning environment. It is not realistic to expect people to be able to learn during the excitement of season commencement. Workers will find themselves in a new and exciting environment full of distractions – hardly an appropriate time for a lengthy lecture filled with important information that must be absorbed and applied quickly.

Lack of Qualified Trainers

It is difficult for companies to conduct quality and standardized employee training because companies simply do not have enough suitably qualified trainers. It is unreasonable to expect young foremen or supervisors to have the knowledge, skills and safety “buy-in” to conduct quality training – especially considering the many other demands for their time.

Summary

- Managers require information and training to better understand the tangible benefits of effective health and safety systems
- Managers require training in the development and implementation of effective health and safety systems
- Supervisory staff require more in the implementation of effective health and safety systems
- Silviculture workers require training to better understand the numerous hazards of their work and the necessary control measures
- Training needs to be accessible prior to season start-up and reinforced at season commencement

Creating Solutions

Advanced Safety Management Ltd. has teamed up with Tree-planter.com and Bushpro Supplies Inc. to make fundamental improvements to the health and safety record of the silviculture industry.

Together we are working on several fronts to create solutions.

- **Tree-planter.com** is building upon their experience with the online training of treeplanters by creating a new online school titled the Silviculture eLearning Centre (SeLC). This new facility is designed to provide a flexible eLearning platform to handle the diverse training needs of the silviculture industry.
- **Advanced Safety Management Ltd.** is authoring a variety of courses designed to fulfill the needs of the silviculture industry.
 - This literature forms the foundation of the health and safety programs that ASM builds for silviculture contractors, and
 - These courses are well suited for online delivery to all Canadian treeplanters via the SeLC
- **Bushpro Supplies Inc.**, the manufacturer of treeplanting equipment for Canadian treeplanters, is currently:
 - Refining ergonomic treeplanting shovel handles
 - Developing safe work procedures for the various uses and modifications of their products for distribution via the SeLC

The SeLC is well suited to meet the needs of the silviculture industry and can overcome all of the problem areas identified within this report.

The SeLC is looking for your ideas, suggestions, comments and support. Our three primary cooperating agencies are willing to work hard to see this idea through to fruition – but we're going to need some industry cooperation. If you'd like our condensed proposal please request a copy from our corporate website's ***Information Request*** Section.

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Conclusion

We are keen to see advances in the health and safety practices of silviculture firms across Canada. We welcome any opportunity to participate in the enhancement of this industry that we have been so passionate about since we first became treeplanters some thirteen years ago. Please let us hear your comments and suggestions.

Sincerely,

Scott Chisholm
President
Advanced Safety Management Ltd.
1-866-276-5551

Forest Industry Safety Association
1488 4th Avenue, Suite #602
Prince George, BC V2L 4Y2
www.forestsafe.ca

telephone: (250) 562 3215
toll-free: 1 877 324 1212
fax: (250) 562 9237
e-mail: fisa@forestsafe.ca

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