Food and Agriculture Organization of the United Nations

Occupational safety and health in forest harvesting and silviculture

A compendium for practitioners and instructors

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Preface

This working paper on occupational safety and health in forestry is intended for an audience of producer organizations, trade unions, vocational training institutes, extensionists, instructors and relevant public bodies. It is also meant to serve as an introduction to the subject for foresters who have had little or no exposure to the subject.

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Acronyms and abbreviations

BLS	Bureau of Labour Statistics
CCOHS	Canadian Centre for Occupational Health and Safety
EHS Today	Environmental Health and Safety Today, a US occupational safety and health magazine
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
ILO	International Labour Organization
NWFP	Non-wood forest products
OSH	Occupational safety and health
PPE	Personal Protective Equipment
SDG	Sustainable Development Goal
SPEQS	Safety, Productivity, Environment, Quality and Social
WHO	World Health Organization

PHOTO 1
Workplace with safety issues

Executive summary

This working paper on occupational safety and health in forestry is intended for an audience of producer organizations, trade unions, vocational training institutes, extensionists, instructors and relevant public bodies. It is also meant to serve as an introduction to the subject for foresters who have had little or no exposure to the subject.

Workplace conditions in forestry – both silviculture and harvesting – are a function of site conditions, climate, weather, terrain and tree characteristics. Forestry is one of the most dangerous work sectors. While reliable global statistics on accident and fatality rates are missing, the available data clearly indicates that forestry is a high-risk occupation.

Even among trained forestry professionals, the risk of accident is high. Farmers and other self-employed forest workers appear to be at even greater risk. One reason for this is that they only undertake forestry work or use forestry tools on an *ad hoc* basis and lack sufficient safety training, experience and knowledge.

This cannot, however, be used as an excuse to simply accept poor safety records. Much can be done to establish a safety culture that minimizes risks to worker safety and health.

A sound safety culture recognises that accidents will likely occur. The challenge is to reduce or avoid the consequences of such accidents. There is much that can, and must, be done to establish a safety culture in forestry.

The fundamentals of accident prevention are reduced hazard exposure and worker safety training. The first is often achieved through risk assessments to identify hazards and take action to minimize or, in a best-case scenario, eliminate them from the workplace. Although some hazards are intrinsic to forestry work, risks are not.

Accidents will happen even in the best of circumstances. Individuals and teams should be prepared for accidents at all times. This extends beyond forestry sector employees; rural households with self-employed members should have a planned response to accidents.

This publication recalls that the purpose of accident analysis is to identify what occurred, the causes of the accident and the ways in which similar accidents might be avoided in future. Reporting near misses is critical, because it provides information on hazardous behaviour and unsafe working methods and equipment that can be used to reduce the potential for future accidents.

When a hazard cannot be removed or controlled sufficiently, personal protective equipment (PPE) may be used. This equipment and clothing protects against health and safety risks at work. It includes items such as safety helmets, gloves, eye protection, ear protection, high-visibility clothing, safety footwear and respiratory protective equipment (RPE).

Child labour is a human-rights issue and of obvious relevance to occupational safety and health. Reliable data on child labour in forestry is almost completely absent. Evidence

suggests that children are particularly engaged in harvesting of non-wood forest products (NWFPs). Tree climbing is a major hazard. It is also likely that children work in nurseries, regeneration and stand tending. Children undertaking work is not inherently undesirable. Age-appropriate tasks that allow children to gain skills can be beneficial to their social development. Moreover, these activities may contribute to the household economy. What exactly is an age-appropriate task? National legislation may provide some guidance, but more operational guidelines are needed.

Women in forestry can, for reasons of physiological difference, be exposed more often than men to musculoskeletal disorders (e.g. carpal tunnel syndrome, tendonitis, etc.), respiratory diseases resulting from fire exposure, infectious and parasitic diseases, reproductive disorders due to chemical exposure, healthcare-specific incidents such as needle sticks, and anxiety and stress disorders. On average, women working in the forestry sector will have a working capacity one-third lower than their male counterparts, and this needs to be respected.

Heat stress occurs when the body is unable to dissipate body heat sufficient to its surroundings. Heat stroke is the most serious health risk posed by heat stress. It develops when a person works for a sustained period in hot conditions and becomes unable to continue sweating, and internal body temperature rises rapidly beyond 40 °C. Heat stroke is a medical emergency requiring immediate and qualified care. A person experiencing heat exhaustion is severely dehydrated and fatigued. Sufferers should be moved to a cool environment for rest and rehydration to restore their internal water balance. They should return to work only when fully hydrated, which may take up to 24 hours.

Risks and hazards associated with NWFPs differ from those resulting from timber harvesting. Hazards derive from activities like climbing, cutting with sharp tools, digging and gathering, picking, and long and/or heavy manual transport. The use of appropriate, well-maintained and sharp tools can mitigate cutting hazards. Proper cutting techniques will, of course, reduce risk. Training in planning, risk assessment and site preparation can also contribute to a safer work environment.

1 Introduction

The International Labour Organization (ILO) estimates that four percent of the world's annual Gross Domestic Product (GDP) is lost as a consequence of occupational diseases and accidents (e.g. ILO, 2013). See Table 1 for key facts.

TABLE 1
Some key facts on accidents and diseases

Work-related accidents and diseases	2-3 million fatalities per year
Work-related fatalities	6 000 per day
Occupational accidents	340 million per year
Work-related illnesses	160 million per year

Source: International Labour Organization (ILO) statistics quoted by Royal Society for Prevention of Accidents (2013).

Moreover, recent ILO data indicates that work-related accidents and ill health are on the rise. Indeed, Sir Thomas Legge's famous axioms (1929 and 1930, below), remain as relevant today as when they were originally written:

1. *Unless and until the employer has done everything – and everything means a good deal – the workman can do next to nothing to protect himself although he is naturally willing to do his bit.*
2. *All workmen should be told something of the danger of the materials they come into contact with and not be left to find it out for themselves – sometimes at the cost of their lives.*

The above indicates that improvements to occupational safety and health deserve our serious attention on humane, legal and economic grounds.

There are a variety of reasons to improve occupational safety and health on humane grounds. These include the prevention of suffering, maintenance of quality of life, and a fundamental belief that nobody should have to risk life and limb in return for employment. Disregard for occupational safety and health can also violate national and/or international legislation, leading to potential prosecution and/or civil action.

Injuries and fatalities can have both direct and indirect costs. Direct costs include payments made by organizations to employees who have incurred an injury or disease. Indirect costs include lost, delayed or degraded production. Moreover, an accident may result in damage to equipment and materials. The following is a summary of the potential costs and losses faced by both employers and employees as a result of workplace injury:

1. Direct costs:
   - medical treatment
   - lost wages

- sick pay
- damage to products or equipment
- higher insurance premiums

2. Indirect costs:
   - disability
   - reduced life expectancy
   - death
   - family and co-worker suffering
   - lost productivity
   - hiring costs
   - downtime (production may be disrupted due to an accident)
   - reduced productivity when worker returns (so-called "presenteeism")
   - costs of administrative response (the costs of investigations, supervision and employee relations during and after accidents)
   - additional recruitment costs (e.g. searching, screening, hiring and training replacements)
   - societal costs like hospitalization, rehabilitation and retraining

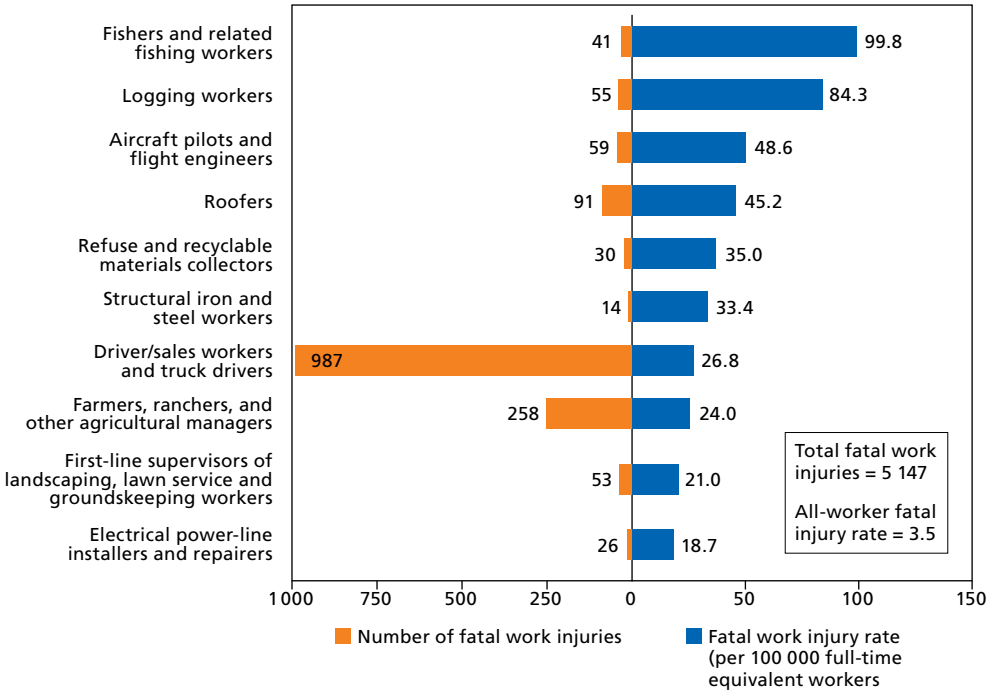
OCCUPATIONAL SAFETY AND HEALTH IN FORESTRY: A FIRST GLANCE

Forestry is often considered one of the world's most dangerous professions. In the United States of America, for example, accident insurance comprises 40 percent of the payroll (Poschen, 2011a). A large portion of forestry work consists of manual labour such as felling large, possibly rotten, trees using potentially dangerous tools and bearing a heavy physical load. Limited, if any, training, poor safety practices and long working days all contribute to potentially unsafe work conditions. Figure 1, below, demonstrates the high number of fatalities experienced by logging workers when compared with other civil occupations (Bureau of Labour Statistics [BLS], 2018).

In many cases, forestry workers are required to work with heavy machinery such as cableway carriages (a mechanical assembly that moves back and forth while suspended above the ground by the skyline, logs are attached to the carriage by a skidding line for yarding), frontend loaders, forklifts and trucks. Workers may also be exposed to adverse or extreme weather. Repetitive tasks and working over long periods in one position (e.g. operating machinery and work in nurseries) are major sources of overuse and musculoskeletal injuries.

Unfortunately, reliable statistics relating to fatalities and injuries in the forest industry are limited. Existing data tends to be drawn from developed countries, covering only those working in the professional sector. The Food and Agriculture Organization of the United Nations (FAO) has reviewed these estimates (2018). The available data do, however, indicate that forestry is one of the most dangerous – if not the most dangerous – sectors to work in (Figure 1). Accidents and fatalities occurring in the informal forestry sector or as a result of illegal logging (rampant in some locations) may not be recorded as forestry accidents, if they are reported at all. These accidents are no less tragic than those taking place in the official and legal forestry sector.

FIGURE 1
Fatality rates in selected civilian sectors in the USA in 2017



Notes: Fishers and related fishing workers and logging workers had the highest published rates of fatal injury in 2017. Driver/sales workers and truck drivers incurred the greatest number of fatal injuries.

Source: Bureau of Labour Statistics (2018).

In order to attract future generations to the sector, the forestry industry must improve its safety record and reputation. It may become increasingly difficult to attract young people to a sector known for its physically demanding work, modest salaries and poor safety record.

ABOUT THIS WORKING PAPER

The objective of this working paper is to support producer organizations, trade unions, training institutes and relevant public bodies in their efforts to improve occupational safety and health in forestry through training or extension work. In this context, "forestry" is understood to include regeneration, stand tending, logging (even-aged as well as uneven-aged stands) and small-scale sawmilling, including on-site conversion.

This document does not represent a complete account of occupational safety and health. Its objective is merely to provide a basis for training and extension.

It is not possible to produce a globally applicable training manual. Differences will include the types and extent of training provided, cultural background, equipment

used, site conditions and so on. Work hazards will differ depending on forest type: harvesting fast-growing acacia plantations, for example, bears little in common with selective logging operations in old-growth forests. In such cases, workload, heat exposure and hazards will differ widely. Similarly, there are significant differences in the safety challenges presented by thinning and final felling in plantation forestry and manual, motor manual and mechanized felling work.

This compendium is structured as follows:

- Part 1 provides a compendium summary and a brief introduction to occupational safety and health.
- Part 2 contextualizes the forest as a workplace, including a workplace problem assessment from a safety and health perspective. It concludes with a review of methods to manage these problems and provides some examples of improvements that have already been implemented in this regard.
- Part 3 considers the concept of a "safety culture," including how to introduce and implement this concept. It provides an example of the successful introduction of a safety culture in a developing country.
- Part 4 includes a case study illustrating how improvements to safety and health in the forestry sector in developing countries can be achieved.
- Part 5 concerns accident management. It reviews various types of Personal Protective Equipment and proposes methods to assess needs in this regard.
- Part 6 provides a brief review of gender issues and includes a summary of international resolutions and definitions relating to children at work and child labour.
- Part 7 provides a review of selected health issues in the forestry sector.
- Part 8 provides a review of selected safety issues in the forestry sector.

Most facts and examples in this report are drawn from the professional forestry sector, which includes workers employed on a formal basis. The facts, examples and improved practices quoted here are, however, also applicable in the informal sector. Efforts have been made to identify and provide examples from developing countries where possible, particularly where these relate to family forestry and other forms of non-professional forestry. The scarcity of examples relating to highly dangerous activities, such as selective logging in tropical high forest, is striking, particularly in light of the efforts directed towards promoting "Reduced Impact Logging."

This paper is part of FAO's work to reduce rural poverty and promote decent work in rural areas, and ultimately forms part of its work to contribute to the achievement of Sustainable Development Goals (SDGs) 1 (No Poverty), 3 (Good Health and Well-being), 5 (Gender Equality), 8 (Decent Work and Economic Growth) and 10 (Reducing Inequality).

Document scope

This document is predominantly focused on issues relating to harvesting and silviculture. The following issues fall outside the scope of this compendium:

- Ergonomics. This complex subject cannot be examined in a meaningful way in a document of this size. While ergonomics is referenced in several sections of this report, interested readers may wish to consult FAO (1992) or ILO (1992) for a detailed analysis.
- Issues related to road construction, firefighting, work with explosives, security (e.g. firewood collection and forest guarding) are not addressed here.
- Risks faced by third parties. This report focuses on the risks faced by forest workers. While the hazards to which third parties may be exposed during the course of forest management are in many ways similar to those affecting forest workers, the vulnerability of third parties is greater in some instances. For example, access to working sites (including authorized, unauthorized, controlled and uncontrolled access both during and outside working hours) may expose third parties to significant risks, including:
  - road accidents
  - logs falling from transport vehicles
  - dust and noise pollution associated with transport
  - fire
  - exposure to chemicals
  - children may be put at risk by accessing sites close to housing, climbing on fallen trees or coming into contact with materials left on site including vehicles, waste materials, etc.

KEY CONCEPTS AND DEFINITIONS

Hazard

A hazard is anything that has the potential to cause harm, whether to the detriment of the safety or health of a person, or damage to property, equipment or the environment. The potential of harm is inherent in the substance or machine or poor work practice etc. (Canadian Centre for Occupational Health and Safety [CCOHS], undated).

Examples of hazards include machinery, tools, dangerous substances, poor workplace layout, poor organization, methods or practices, attitudes, etc.

Risk

Risk is the chance or probability that a hazard will actually result in injury or illness or damage to property, equipment or the environment, together with an indication of how serious the harm could be, including any long-term consequences (CCOHS, undated).

$$\textit{Risk} = \textit{severity of harm} \times \textit{probability of harm}$$

While hazards are intrinsic to a given substance or process, risks are not and so will vary depending on the risk reduction measures applied. Pesticides are intrinsically toxic (i.e. hazardous). Spraying them can pose major risks to farmers or workers. If properly controlled, risks can, however, be reduced to acceptable levels.

When deciding on the acceptability of risk it is important to take into account the gender, age and health of the workers for whom the assessment is being conducted and also to bear in mind their input.

Accident

An accident is an unplanned or unforeseen event (World Health Organization [WHO], 2009). Accidents result in fatalities, injuries and damage to equipment or the environment. Accidents that do not result in damage are termed "near-misses" and should be reported.

Occupational safety and health

Occupational safety and health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs (ILO and WHO, 1950).

Activities that fall within the rubric of occupational health roughly include:

- Identifying and assessing the risks posed by health hazards in the workplace. This involves monitoring the factors in the workplace environment and working practices that may affect workers' health. It also requires a systematic approach to the analysis of occupational accidents and diseases.
- Advising on planning and organization of work and working practices – including workplace design – and on the evaluation, choice and maintenance of equipment and substances used at work.

PHOTO 2
A tractor with no roll bar pulling a big load on an old carriage. An accident could be very serious

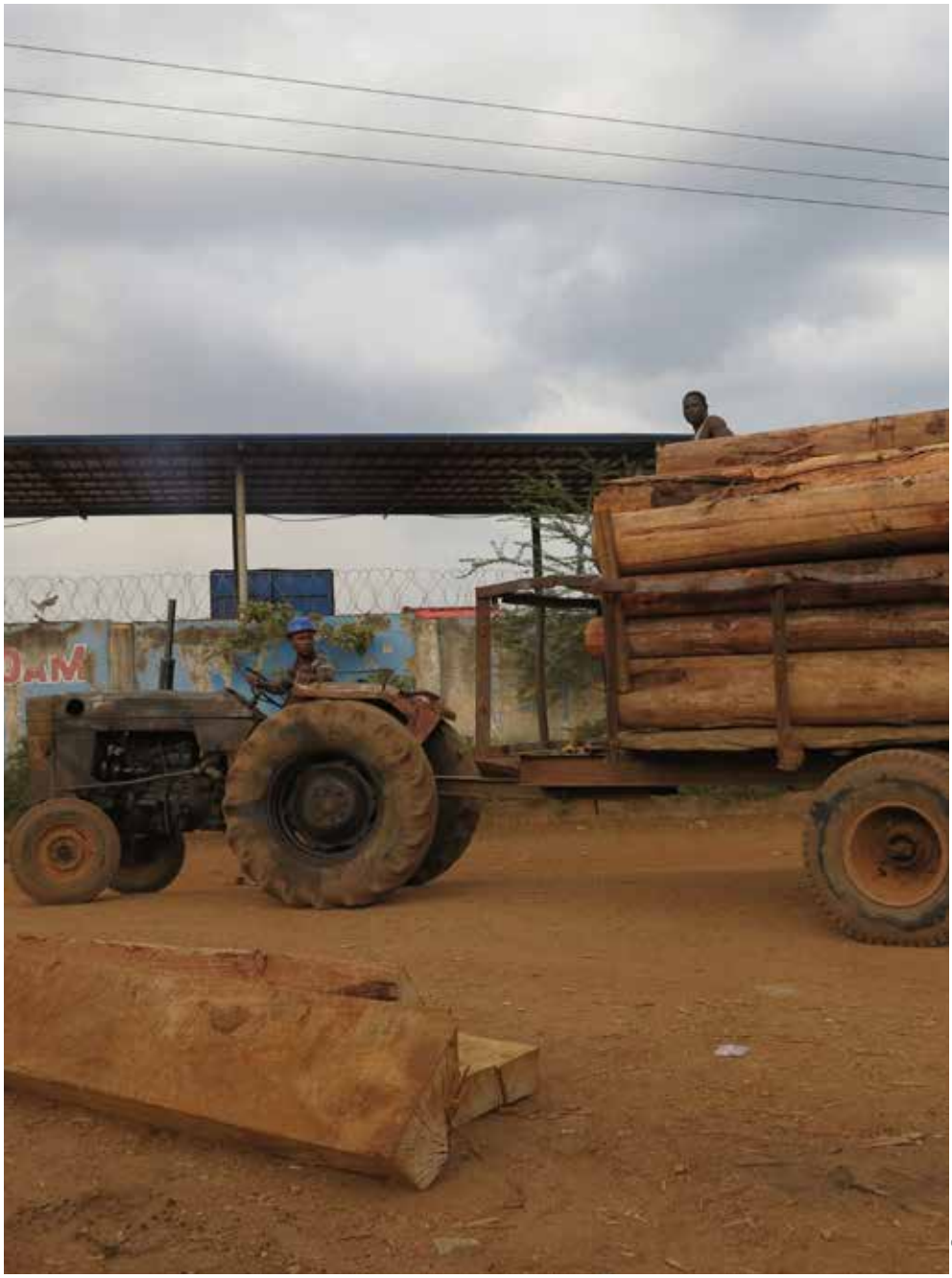


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PHOTO 3
Worker helping to load a timber truck, a very risky task

2 The forest as a working environment

GENERAL

The forestry workplace differs from more controlled working environments. The worksite is exposed to differing climatic conditions and variations in terrain, while the trees and stands themselves are highly variable. The remainder of the site, including surrounding communities and infrastructure (such as power lines, fences, roads and embankments), public access and even wild animals, expose the forest worker to challenges that workers in other sectors will not generally encounter or manage. In this way, workplace conditions are a function of site conditions, climate, weather, terrain and tree characteristics. Every forestry worksite has unique working conditions and must be planned and managed accordingly (FAO, 1993).

Further, the (hu)man, machine and material resources required for forestry work (herewith referred to as the "3Ms") present their own unique challenges. Physical resources consist of people (e.g. manual labour, machine operators and supervisors – referred to as the collective "Man"), machines (e.g. chainsaws, agricultural tractors and skidders) and materials (e.g. herbicides, oils, diesel, spare parts and small hand-held implements). In developed countries, the following generalizations can be made about the 3Ms in the forestry sector:

- Man: human resources are usually sufficiently educated and trained. Experienced supervisors, managers and contractors lead workers and operators.
- Machines: the introduction of modern forest machines has overcome some worksite challenges by allowing operators to work from the safety of the machine cab (Lewark, 2005). However, even modern forestry machines must still cope with challenging site conditions such as rain, high winds, steep slopes and varying tree sizes. While physical conditions in the forest itself have not changed, working from inside a machine has allowed operators to manipulate their environment and reduce exposure to traditional hazards.
- Materials: management of materials is usually well understood. In general, only safe and environmentally acceptable materials are used.

In developing countries, the following generalizations can be made regarding the 3Ms in the forestry sector:

- Man: workers and operators are usually poorly educated and trained, often led by inexperienced and poorly educated supervisors and managers. There may be differences in the treatment of male and female workers.

PHOTO 4
A steep, slippery and wet workplace made safer by mechanization. Note the choker setter in the lower right-hand corner

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- Machines: the presence of modern forestry machinery is usually scarce. The sector instead relies on manual labour, motor-manual operations and basic, usually low-tech machines.
- Materials: management of materials is comparatively inadequate. Certain materials that are harmful to people and the environment may still be used.

Forestry operations in many developing countries are therefore occurring in unenviable conditions, carried out by poorly trained people using machines and materials that are ill-equipped to cope with the safety challenges posed by the difficult working conditions. However, this cannot be used as an excuse for forest managers to simply accept poor safety records. There is much that can be done within these constraints to establish a safety culture that minimizes risks to worker safety and health. This document highlights the steps required to improve safety in the context of developing country forestry conditions.

A sound safety culture recognizes that accidents will likely occur. The challenge is to reduce or avoid the consequences of such accidents. Therefore, there is naturally much that can, and must, be done to establish a safety culture in forestry operations in developing countries.

Kantola and Virtanen (1986) summarize the factors contributing to greater accident risk:

- **Environment**: Extreme temperatures and humidity, abundance of undergrowth, presence of bothersome plants, insects and animals and difficult terrain;
- **Social conditions**: Poor diet, inadequate housing, poor clothing and inadequate medical care;
- **Lack of government services and protection**: Deficient labour legislation and regulations, inadequate efforts in work science, incomplete/non-existent accident statistics, poor enforcement capacity;
- **Lack of vocational training**: Inadequate or absent training on proper working techniques and accident avoidance;
- **Lack of permanent work force**: Predominantly comprised of casual labourers with limited skills;
- **Weak motivation**: Unstable employment, low wages, lack of professional rewards and appreciation; and
- **Insufficient supervision, weak organization and poor health services**: Unsafe working techniques, lack of appropriate clothing and Personal Protective Equipment (PPE), deficient facilities for rest and meals and deficient first aid training and medical services.

THE WORKFORCE

Even among trained forestry professionals, the risk of accident is high. Farmers and other self-employed forest workers appear to be at even greater risk. One reason for this is that they only undertake forestry work or use forestry tools on an *ad hoc* basis and lack sufficient training, experience and knowledge of work safety. Studies in the formal forestry sector concur that three worker categories experience a disproportionately high accident frequency: unskilled workers; young workers; and those new to the profession (Poschen, 2011a). In the late 1980s, 73 percent of accidents in Swiss forestry affected workers with less than one year's experience. Similarly, three-quarters of these accident victims had no or only rudimentary training (Wettman, 1992).

Forestry jobs are broadly divided into those related to silviculture and those related to harvesting. Silviculture work includes site preparation, planting, fertilizing, weed control, pruning and pest control. Fire management-related work is usually carried out by silviculture workers and has a unique set of hazards. Tree planting and weed control are often seasonal and may have dedicated workers employed specifically for this period. The most common harvesting job is chainsaw operation. Other common harvesting jobs involve operating extraction equipment and choker/wire setters. Various measurers and other workers carry out *ad hoc* functions on landings, while others are involved in log moving/stacking/loading functions. Finally, truck drivers and their assistants transport logs to the next point in the value chain. Harvesting normally comprises at least 50 percent of the total number of workdays per hectare (Poschen, 2011a). Harvesting work is usually the most strenuous and involves the use of hazardous tools and machinery.

In developing countries, the ratio of supervisors to foremen is one to three, while the ratio of supervisors to workers is one to forty. The ratio for industrialized countries

can be much lower. In Oregon (Anonymous, 2019) forestry safety regulations call for a competent person on each jobsite with authority to:

a. supervise all personnel at the site; and
b. enforce the company's safety and health programme.

Forestry workers are usually either directly employed by a forestry company or indirectly employed by contractors bound by contracts with specific service-level agreements. Even though significant geographical differences exist regarding the use of labour or contractors, there has been a general trend towards the increased use of contractors. The employment of contractors and their employees can be uncertain: at its maximum, the employment period will be the length of the contract, but it could be as little as one or two days in order to smooth work quantity fluctuations. Because a contractor is always under pressure to reduce costs to obtain future contracts and to remain profitable, there is a temptation to focus only on those aspects of the business that directly reduce costs and improve productivity, sometimes to the detriment of safety. Studies have shown that accident rates are higher where workers are contracted when compared to similar operations carried out with own labour. Contract labour also has a reputation for high turnover levels. International Labour Organization reports suggest employee turnover rates of nearly 50 percent per year in some countries, with more than ten percent leaving the forestry sector altogether each year (Poschen, 2011a).

PHOTO 5
A forest machine about to go down a slope. The machine has been tethered to improve safety and facilitate work on steeper areas.

©John Garland

PHOTO 6
Serious accidents can also happen when operating machinery

Government departments responsible for monitoring occupational health and safety in the forestry sector face challenges in carrying out their mandate. Worksites are often remote, fragmented and difficult to access. Safety inspectors may not have requisite knowledge of forest operations and their hazards, while governing regulations may be inadequate to address the particular safety and health needs of the sector.

The most common wage system is one of piece rates, where remuneration is solely determined by the output of each worker or team. The downside of this is that workers often end up working in ways that are detrimental to both their physical health and their safety.

Forestry wages usually fall below the average of other industrial sectors in the same country. This can result in migration away from the sector. Contractors and their employees may also work 50 to 60 hours per week to compensate for these lower wages, leading to fatigue and body strain and with related social implications.

Forestry work tends to be manual and physically demanding. Industrial forestry work is predominantly carried out by men; the proportion of women in the formal workforce seldom exceeds 10 percent. Some jobs, however, such as planting or tending to young stands and raising seedlings in tree nurseries, tend to be carried out by women (Poschen, 2011a).

MANAGEMENT

Even the most thoroughly developed and tested safety programmes will not be effective in an organization lacking visible leadership and commitment by management.

This commitment must come from the very top down, comprising more than simply promotional material for a company's website or a requirement related to managerial performance appraisals. Managers and supervisors must not see safety and health training as a drag on productivity but should recognize its independent value. Workers, for their part, need to recognize that they themselves are their own best assets.

Key performance areas in the forestry sector fall into the following broad categories:

- safety (and health) – protection of workers, management, community and the general public;
- productivity – operational efficiency;
- environmental – protection of high priority environmental aspects;
- quality – waste reduction and meeting operational and customer specifications; and
- social – meeting general employee needs and addressing those of the community and general public.

To keep things simple for the manager and supervisor in the developing world context, these key performance areas are summarized by the acronym SPEQS (Safety, Productivity, Environment, Quality and Social).

If managers recognize the importance of workplace safety, they will consider prevailing risks and attempt to select systems best able to mitigate them. Specific risk mitigation measures must then be put in place for those risks that remain after system selection. Management will also be responsible for balancing conflicts between environmental issues and Occupational Safety and Health Administration (OSHA) regulations, such as removing hazardous trees from a stand, the placement of skid trails, or where logging is initiated in a stand (Myers and Fosbroke, 1995).

It takes an experienced manager to change the safety culture of an inherently dangerous forestry environment. This challenge is exacerbated where workers have limited education; receive comparably small wages; would probably choose an alternative job were other options available; and where systems and jobs are not as safe as possible.

The section below provides a summary of hazards, reasons for accidents and ways to control them, and examples of positive developments.

Primary hazards in forestry:

- **Extreme heat and cold**: high temperatures reduce work output and may lead to heat stress and dehydration, which can in turn affect judgement. Cold weather can reduce dexterity, blood flow, muscle strength and balance.
- **Terrain and site factors**: risks include machinery accidents and rock falls. Finely textured soils (e.g. clays) and logs become slippery when wet.
- **Falling trees and branches, chainsaw "kickbacks" and tree hang-ups** pose serious risks to workers' lives.

- **Noise** from chainsaws and brushcutters can lead to hearing loss if hearing protection is not used. Noise further isolates the worker, reducing awareness of, for example, machinery, trees and surrounding wildlife.
- **Hand-arm vibration**: hand-held tools can damage nerves, tendons, muscles, bones and joints and cause damage to the hands and forearms, affecting blood circulation.
- **Loading and unloading** causes hazards such as falling and rolling logs. The risk of serious injury in log landings can be reduced by safe working routines and adequate Personal Protective Equipment.
- **Chemical hazards**: chemicals may be used in nurseries to protect seedlings prior to planting. Chemicals are also used for weeding in some cases and for pest control. Chainsaws also produce fumes.
- **Biological hazards**: these include allergic reactions to plants, pollen and insect bites. Wildlife can pose a serious risk, particularly to children.
- **Non-wood forest products (NWFPs)** are often harvested in remote locations where help may be far away if accidents occur. Tree climbing, cutting, digging, gathering, picking and manually transporting products are common harvesting activities, all of which have associated risks. Other hazards include heavy, repetitive or static work, the use of inappropriate tools, difficult terrain and contact with poisonous

PHOTO 7
An old agricultural tractor without roll bar used for skidding. A death trap.

plants and venomous animals. The most common hazard is accidents associated with cutting. In addition, work is often undertaken by women and children and security issues such as sexual assault and kidnapping can be quite serious.

Causes of injuries and fatalities in forestry

- **Lack of commitment** to occupational safety and health from society and limited capacity to enforce legislation/conduct labour inspections.
- Several authorities/ministries may share or divide **responsibility** for forestry safety at a national level.
- Contract workers may have an economic **incentive to take risks**.
- **Contracting** is competitive and may not require safety infrastructure from bidders.
- Workers are often **untrained**. Trained workers may not have received training in handling known risks.
- Systematic **reporting and analysis of accidents** and near-misses is seldom undertaken in a structured way.
- Attitudes towards safety – the **safety culture** – in forestry needs to change. Required changes include:
  - safety supervision (e.g. correcting the mistaken belief that working alone is ok)
  - norms and culture (e.g. unhelpful stereotypes about masculinity may predispose workers against adopting safe work practices)
  - approaches to risk taking (everybody does it!)
  - management behaviour (e.g. managers indicating that not bothering about, and not investing in, safety is ok)
  - operator management (e.g. working long hours is fine).

Eight important steps to reduce accidents in forestry

1. **Hazard identification** and **risk control**: determine which hazards are present in the workplace and take steps to eliminate or minimize them.
2. **Safe work procedures**: describe in writing, or by other means, how to carry out specific tasks safely. Videos can be very useful.
3. **Orientation, education, training and supervision**: prepare workers for the job and make sure they continue to work safely. This is particularly important for new and young workers.
4. **Safety inspections**: identify workplace hazards so they can be eliminated or controlled.
5. **Incident investigation**: find out why an accident or injury occurred so the causes can be corrected.
6. **Health and safety meetings**: provide an opportunity for workers and supervisors to communicate any concerns about workplace health and safety.
7. **First aid**: determine what level of first aid equipment is required for the workplace and make sure everyone knows what to do if someone is injured on the job.
8. **Records and statistics**: maintain documentation to help identify recurring problems and ensure that hazardous conditions are corrected.

Things can be improved

Fatalities and injuries in forestry can be and have been reduced in developed countries. But these reductions can also be achieved in developing countries, as demonstrated in Chile (Table 2). The reduction of fatalities over time in Chilean forestry is presented in Table 3. These two tables show that persistent work towards improving safety can save lives and limbs.

TABLE 2
Injury rates in the forest sectors of selected countries, states and provinces

Country	2011	2012	2013	2014	2015	2016	2017	2018
USA – State of Washington				4.08	5.5	6.8	6.7	6.2
Canada – British Columbia	4.5	4.8	5.2	5	4.8	4.9	4.6	4.5
USA – Oregon	4.1	3.9	4	3.6	4.2	3.4	3.2	2.9
Australia	2.9	1.8	1.9	2.5	3	3.1	2.9	2.7
Finland	1.5	1.6	1.6	1.4	1.3	1.2	1	0.8
New Zealand	3.3	3.2	2.7	1.6	1.2	1.1	0.9	0.6
Chile	1.3	1	1.4	1.5	1.1	1	0.9	0.7
Sweden	0.7	0.7	0.8	0.7	0.8	0.7	0.6	0.5

Source: Garland, unpublished.

TABLE 3
Fatality rate in Chilean forestry 1995–2018

4 year period	Fatalities
1995–98	46
1999–2002	28
2003–06	30
2007–10	46*
2011–14	16
2015–18	22

*Includes fatalities in a helicopter crash that killed 13 people.
Source: Garland (manuscript).

In May 2019, ILO held its first sectoral meeting on promoting decent work and safety and health in forestry for some time. As a result, ILO will commence further work on safety and health issues in forestry, a promising development. It is hoped this initiative will help to reduce health hazards, injuries and fatalities. A very good report on this issue was published ahead of the sectoral meeting (ILO, 2019).

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PHOTO 8
Training in progress. Note the Personal Protective Equipment used.

3 Safety culture in the forestry sector

WHAT IS A "SAFETY CULTURE?"

"Safety culture" refers to a durable corporate atmosphere that impacts safety management in a given organization (i.e. "the way we do safety around here"), while "safety climate" reflects a membership's shared perception of the way in which an organization is managing safety at any given time (i.e. "what we think of safety right now") (Cooper, 2016). Organizations with a positive safety culture are characterized by communications founded on mutual trust, shared perceptions of the importance of safety and confidence in the efficacy of preventative measures (Cooper, 2000).

> *A true safety culture ensures every employee has the best chance of going home to their families at the end of a workday injury free*

Safety culture generally refers to a shared set of safety-related attitudes, perceptions and behaviours among individuals in an organization (Zohar, 1980). Safety climate considers employee perceptions of the safety culture in an organization (Choudhry, Fang and Mohamed, 2007). This distinction between "climate" and "culture" is important. Climate embraces perceptions, attitudes and beliefs about risk and safety. It is measured using questionnaires, providing a "snapshot" of the state of safety. Culture is more complex and long lasting and reflects more fundamental values, including those of society in general.

If a positive safety culture exists, most elements of the safety system will be effective. It can even be argued that, with the right culture, an organization does not need a safety programme, as safety already forms an integrated part of the management process.

Key factors such as effective communication and training, building relationships and trust and an accessible hazard reporting system are cornerstones of companies with a good safety culture. As has been indicated, building an effective safety culture is only possible with good leadership, but it begins with the organization's safety leader understanding the "cornerstones" that make up a safety culture. A true safety culture

ensures every employee has the best chance of going home to his or her family at the end of a workday injury-free (Environmental Health and Safety Today [EHS Today], 2016).

In companies with strong safety cultures, safety is embedded in daily management. Only attending to safety reactively and during safety meetings and audits is indicative of poor safety leadership. This occurs because managers attend only to indicators on which they are measured.

> *Effective safety cultures accept that mistakes are an inevitable part of the workplace, but are relentless about learning from those mistakes*

Incident rates only provide information on how many people were hurt and how badly. They do not provide data on what leaders are doing to prevent accidents and incidents. It is possible that only a small number of safety incidents may occur under managers who take no action to improve safety. This lack of incidents may reinforce a view that no further management effort is required. But building an effective safety culture requires a change in the way safety is measured, including a focus on the proactive behaviours of all employees.

Blame and negative consequences undermine safety culture. Backward-looking accountability is about assigning blame. In successful safety cultures, forward-looking accountability acknowledges mistakes and harm caused but identifies necessary changes

PHOTO 9
Completely unprotected worker in a small sawmill

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and assigns responsibility for them. Effective safety cultures accept that mistakes are an inevitable part of the workplace, but are careful to learn from those mistakes.

Sound safety cultures are characterized by good relationships at all levels. This enables open, honest discussions about what works and what does not, mistakes that have been made and what needs to change. Leadership behaviours that contribute to creating good relationships set clear expectations, provide helpful feedback, acknowledge good work, seek to understand problems/issues rather than blaming, actively listen, follow through on commitments, remove roadblocks and ask for feedback on personal effectiveness.

Exceptional safety requires more than simply following procedures, complying with safety and health standards and wearing PPE. Instead, people must look for and report hazards, give peers feedback on safe and at-risk behaviour, volunteer for safety committees, make suggestions for improvement and, most difficult of all, admit to mistakes so lessons can be learned. When people are recognized for what they do well regarding safety, they will be more engaged and invested in achieving an exceptional safety culture.

In summary: sustainable changes in safety performance require a safety culture. Changes in safety culture require consistent leadership and repetition. A fundamental change to the values of the target audience is required. A commitment to safety that comes and goes according to funding priorities is not enough.

Who wants a safety culture and why

A safety culture benefits staff at all levels in different ways. A summary of the primary benefits and beneficiaries is provided below.

Owners and/or managers

- Efforts towards improved safety and health are not a drag on enterprise but an opportunity to gain organizational competitive advantage.
- Safety culture provides an entry point for improved training and a basis for developing teamwork and catalyses the integration of new technologies.
- Safety culture helps maintain a company's social licence to practice forestry. Serious injuries and fatalities naturally lead to negative attitudes towards the organization in particular and the sector more broadly.
- Leaders must acknowledge this negative hypothesis: you can't prove your efforts prevented the accident that did not happen. Leaders must therefore take a leap of logical faith that their efforts will be successful.

Supervisors

- Safety and health should not be viewed within the rubric of cost minimization but instead as a management action taken to improve the organization as a whole.
- Safety culture assists general skills training, builds teamwork and improves relationships with workers.
- Safety culture demonstrates both motivation and demotivation to workers.
- Safety culture establishes a common framework for interacting with workers that is both positive and effective.

Workers

- Workers will benefit from fewer injuries and health problems.
- Workers will benefit from an improved career trajectory.
- Workers will have a basis for developing relationships with their co-workers.
- Workers will have greater autonomy and responsibility for their work.
- Workers will have a framework for relating to supervisors and managers.

IMPLEMENTING A SAFETY CULTURE

The behavioural change necessary to establish and maintain a safety culture requires effort. In the context of safety, "effort" denotes the interaction between intensity and persistence (i.e. how much energy a person expends to improve safety in the face of impediments and for how long). Prioritizing safety over production is an example of directing efforts to improve safety. Once the units of "effort" are identified, it is possible to develop criteria against which to measure people (Cooper, 2000).

The process of introducing a safety culture can be said to consist of five stages (e.g. Eeckelaert *et al*., 2011):

1. **Emergence**. Safety is defined by technical and procedural solutions and regulations. Safety is not recognized as a key business risk. Many accidents are deemed unavoidable and part of the job. Many operational staff are not interested in safety.
2. **Management**. Safety is recognized as a business risk and efforts are made to prevent accidents. Safety is managed in terms of adherence to rules and procedures and engineering controls. Accidents are deemed preventable. Managers believe that most accidents are due to the unsafe behaviour of workers. Senior management is reactive in its involvement in safety and health.
3. **Involvement**. Involvement of supervisors and workers in safety and health is deemed critical for improvements. Management acknowledges that many factors cause accidents and the root causes can originate from management decisions. Most supervisors and workers are prepared to work with management to improve safety and health. Most employees accept personal responsibility for their own safety and health. Safety performance is monitored and the data is used.
4. **Cooperating**. Staff are convinced that safety and health is a moral and economic imperative. Employees recognize that a wide range of factors cause incidents and the root causes are often related to management decisions. Supervisors and workers accept personal responsibility. It is recognized that all employees must feel valued and be treated fairly. The organization makes efforts to implement proactive measures to prevent accidents. Safety performance is measured and monitored using all available data. Non-work accidents are also monitored and healthy lifestyles are promoted.
5. **Continuous improvement**. Prevention of injury or harm, both at work and at home, is a core company value. Complacency does not occur. It is understood that the next accident is always imminent. A range of indicators is used to monitor performance. Methods to improve hazard control mechanisms are perpetually

sought. All employees know that safety and health is a critical aspect of their job. They accept that prevention of non-work injuries is also important. The organization makes substantial efforts to promote safety and health at home.

Forestry organizations, especially small- to medium-sized businesses in developing countries, must critically examine where they are located on the path towards achieving a good safety culture. Even the forestry industry in a developed country such as New Zealand underwent a process of self-examination following a series of fatalities. The subsequent investigation found that no single failing had caused the incidents, nor would simple solutions be enough to reduce poor safety outcomes. Instead, a multifaceted, material change to the New Zealand forestry sector's safety performance was required (Clark, 2014). This included:

- changes to safety beliefs and values (at all levels of management and among workers) including the genuine personal belief that all accidents are preventable;
- strong safety leadership from both forest owners/managers and principle contractors
- enhanced training for workers; and
- greater research and development into steep slope-harvesting systems and adoption of existing mechanization options by contractors.

Safety cultures fail when leaders are unable to recognize the requirements described above. According to a study of 8 747 employees across heavy industry, only 24 percent of leaders demonstrate strong safety leadership behaviours. Why is this the case? For those organizations falling into the remaining 76 percent, poor safety leadership could result in:

- a misalignment of vision and expectations around safety-related decisions;
- reduced discretionary effort and compliance;
- reduced willingness to report incidents and hazards; and
- increased incident frequency and severity (SENTIS, undated).

A poor culture creates an atmosphere in which non-compliance with safe working practices is acceptable. It is then impossible to take effective action to solve safety and health problems. Organizations with poor safety culture often have poor attitudes towards all processes and procedures, resulting in poor product quality and financial control, as well as poor safety and health (Institution of Occupational Safety and Health [IOSH], undated).

SAFETY CULTURE AND FORESTRY

There are many guidelines and publications on the subject of safety and health, whose principles are broadly applicable regardless of the industry in question. By methodically applying such principles to the forestry context, a safety culture will develop over time. WorkSafe Victoria, Australia (2007) provides a neat description of a safety culture adopted by various stakeholders. Safe Work Australia provides a web platform including relevant documents (Safe Work Australia, undated). The safety culture outlined in the Approved Code of Practice for Safety and Health in Forest Operations (ACOP) (2012) is the result of many years of negotiations based on a common concern over the accident rates in New Zealand forestry. The Association of Oregon Loggers (undated) provides

a code of conduct in which the safety and health of workers is prominent. The Logger Safety Initiative in the State of Washington (Washington State Department of Labour and Industries, undated) is a partnership between government and private industry leaders to improve safety. It is easily accessible via the web.

"Safety and health in forestry work: An ILO code of practice" is an overarching global guideline on forestry safety and health published by ILO in Geneva (ILO, 1998). The objective of the four-section code is to: protect workers from occupational safety and health hazards in forestry work and prevent or reduce the incidence of illness or injury by providing practical guidelines. See Table 4 for a summary of the code's first three sections.

Developing a safety culture is always a partnership activity including partners outside the organization such as government bodies and labour unions who may have a wider experience both with different organizations and working in different industry sectors.

TABLE 4
ILO Code of Practice, sections 1–3, cross-referenced to the relevant level of governance

	Part 1 Legal Framework and General Duties of Care	Part 2 Enterprise Level Framework	Part 3 General Requirements
Regulatory Authorities	• Legal framework and duties of competent authorities • Duties of labour inspectorates	• Enterprise safety and health policy • Safety and health management	• Employment conditions • Qualifications of managers and supervisors • Training and skills testing for workers • Safety requirements for tools, machines and hazardous chemicals • Work clothing and PPE • Testing and certification of equipment
Senior Management and Large Contractors	• Responsibilities and duties of employers • Duties of manufacturers and equipment suppliers	• Enterprise safety and health policy • Safety and health management • Assignment of responsibility • Identification and management of risks	• Employment conditions • Qualifications of managers and supervisors • Training and skills testing for workers • Qualifications of contractors • Safety requirements for tools, machines and hazardous chemicals • Work clothing and PPE • First Aid, emergency rescue and occupational health services • Shelters, housing and nutrition • Reporting, recording and investigation of occupational accidents and diseases

Table 4 continues

Table 4 continued

	Part 1 Legal Framework and General Duties of Care	Part 2 Enterprise Level Framework	Part 3 General Requirements
Junior Management and Small Contractors	• Duties of managers and supervisors • Responsibilities and duties of contractors	• Organization of personnel • Provision of resources • Communication and information • Documentation	• Employment conditions • Training and skills testing for workers • Qualifications of contractors • Work clothing and PPE • Testing and certification of equipment • First Aid, emergency rescue and occupational health services • Shelters, housing and nutrition • Reporting, recording and investigation of occupational accidents and diseases
Labour Unions	• Duties of labour inspectorates • Responsibilities and duties of employers • Rights and responsibilities of workers • Duties of manufacturers and suppliers of equipment	• Safety and health management • Identification and management of risks • Organization of personnel • Provision of resources	• Employment conditions • Qualifications of managers and supervisors • Training and skills testing for workers • Qualifications of contractors • Safety requirements for tools, machines and hazardous chemicals • Work clothing and PPE • Testing and certification of equipment • First Aid, emergency rescue and occupational health services • Shelters, housing and nutrition • Reporting, recording and investigation of occupational accidents and diseases
Workers	• Rights and responsibilities of workers	• Identification and management of risks • Documentation	• Employment conditions • Training and skills testing for workers • Work clothing and PPE • Testing and certification of equipment • Reporting, recording and investigation of occupational accidents and diseases

Source: ILO (1998).

Section IV of ILO's code of practice (1998) provides technical safety and health guidelines for the forestry worksite, including general provisions (planning, organization and basic protection), silvicultural operations, harvesting and high-risk operations (e.g. tree climbing and clearing of windthrows). It includes useful advice on safe use of machinery and tools.

Interviews with 26 contractors in the eastern United States who had been successful in their work on safety shared several key characteristics that made their operations safer. They were effective people managers who: 1) were able to maintain a stable crew, keeping turnover to a minimum; 2) hired primarily experienced wood workers; 3) had highly mechanized operations; 4) promoted teamwork; 5) insisted on mandatory use of Personal Protective Equipment; and 6) demonstrated a strong managerial commitment and a safety-conscious attitude (Reisinger *et al.*, 1994).

Occupational health risks are higher in developing countries. Governments also have fewer resources for prevention, research and enforcement of occupational safety standards, making it difficult to establish strong safety cultures (ILO, 2012). It is within this context that we must set about establishing a safety culture in forestry specifically for small and medium-sized businesses.

The most hazardous operations in forestry are timber harvesting, work at landings and transport. Forest managers must therefore ensure all technical and procedural safety elements are in place before behavioural change is attempted. It must also be remembered that no parts of a logging operation are absolutely safe. There are, however, places "in the clear" where workers have the best chance of avoiding injury if the unexpected occurs (see separate section below). When developing a successful safety and health programme, the objectives must be clear. Dialogue and discussions at all organizational levels facilitate ongoing improvement to safety and safety culture (Ek *et al*., 2014; Tobisch *et al*., 2005).

To keep forest workers safe, we must examine human factors, including workplace, equipment and job design, work environment, physical activities, information transfer and personal factors. In forestry, where manual work predominates, one cannot modify on-site factors such as the outdoor temperature, precipitation, wind, mist, slope, ground conditions and ground irregularity to suit the worker. Instead, these must be controlled by the best means possible through systems/operations/jobs.

Because people in the forestry sector will encounter many more hazards than their colleagues in other sectors, we must examine the worksite and worker behaviour. One area of specific importance in a non-mechanized forestry environment is risk tolerance, which involves weighing a number of factors that influence a decision to either accept or reduce risk. We must understand the factors that influence people to take chances and understand why they make the decisions they make. The employee needs to identify the hazard, perceive the risk and then make a decision regarding whether the risk is acceptable or not. Depending on the decisions taken, the result will be considered an "at risk behaviour" or a "safe behaviour." The safety culture of a large multinational forest company is described in Box 1.

There are ten factors that influence risk tolerance (Fennell, 2015):

1. Overestimating capability/experience (increases risk)
2. Familiarity with the task (increases risk)
3. Seriousness of outcome (decreases risk)
4. Voluntary actions and being in control (increases risk)
5. Personal experience with an outcome (decreases risk)
6. Cost of non-compliance (decreases risk)
7. Confidence in the equipment (increases risk)
8. Confidence in protection and rescue (increases risk)
9. Potential profit and gain from actions (increases risk)
10. Role models accepting risk (increases risk)

Additional factors such as aggressive management style and, for workers, unfavourable piece rates will also influence risk tolerance by increasing risk. Social acceptance of risks and general risks in society are important factors that may affect risks in both ways.

BOX 1

The safety culture of a large multinational forest company

The company has seven key elements in its approach to safety and health:

1. **Annual Plans**. The plans are developed and implemented for all businesses and facilities to address safety priorities. These plans are based on facility safety audits, behaviour-based safety observations and lessons learned from key indicators (such as near-miss reports and safety incident trend analysis).
2. **Corporate Standards**. The company continuously develops and implements global safety regulations specifying standards and processes for identifying and eliminating safety and health hazards. Its philosophy is "one company with one set of expectations, standards, and processes globally."
3. **Employee Involvement and Engagement**. Success depends on the full engagement of employees, contractors and visitors. Employee ownership of safe conditions and behaviours is the key to injury-free operations.
4. **Leadership**. The most senior leaders are actively engaged in safety programmes, ensuring adequate emphasis is placed on other high-profile safety initiatives. Leaders at all levels – from first line supervisors to elected officers – are responsible for ensuring safe operations.
5. **Metrics, Goal-Setting and Accountability**. Annual safety goals are set for all teams. Safety incidents and near-misses must be reported promptly and consistently, and lessons are learned from global best practices.
6. **Risk Elimination**. Hazard risk assessments and safe behaviour audits are used to identify and eliminate unsafe conditions and behaviours. Colleagues are engaged in these processes and use cross-functional teams to spot unsafe conditions and behaviours that need to be addressed.
7. **Training and Awareness**. Regular safety training to equip employees and contractors with the knowledge and skills required to ensure all work safely. Most importantly, all employees and contractors are empowered to stop work if unsafe conditions or behaviours are observed.

Source: Multinational forest company.

Because forestry work takes place in such a hazardous environment, it is important to understand what level of risk will be tolerated by workers. If the forestry industry is to reduce its accident frequency, we must (Fennell, 2015):

- believe we can work without injuries
- understand and integrate human factors
- fully integrate behavioural approaches
- understand and reduce risk tolerance.

Safety leadership starts at the highest organizational level, creating an overall environment in which safety is valued and supervisors and workers take the lead in hazard control. Supervisors expect safe behaviour from subordinates and directly

involve them in the identification of problems and their solutions. For workers, safety leadership means reporting deficiencies, seeing corrective actions as a challenge and working to correct these deficiencies (Poschen, 2011b).

In developing countries, the forestry sector does not have a record of involving workers in decision-making. Their involvement in the process towards establishing a good safety culture is, however, of utmost importance. Employees should be provided with sufficient training to identify risks; be involved in all phases of programme implementation; not be told specifically how to perform tasks, as different techniques may be equally efficient; and should be able to identify high risk tasks (McLean and Rickards, 1998).

Successful improvements to safety and health have occurred in developing countries (e.g. Chile and South Africa), but may not have been documented on a national scale. Chile provides one example of documented improvement over time. The greatest lesson from the Chilean experience is that improvements to safety and health are not a drag on the development of the forest sector. Rather, they represent a fundamental building block for enhanced productivity and sectoral development.

The participation of employees can be encouraged by the use of incentives. The success of an incentive programme will be influenced by how the employees participate and whether or not the incentive is perceived as fair. If goals are set too high or employees think their efforts will not result in their attainment, the programme will not be effective. In addition, the greater the lapse in time between the safe performance of a job and the reward for its completion, the less influential the incentive system will be. Research has shown that rewards must be frequent and tied to improved performance. If possible, employees should be involved in the selection of safety performance priorities. In such cases, management must ensure that attention to priority behaviours does not result in neglect of other important job functions. The criteria and means of successful job performance must be clearly communicated, including frequent feedback to programme participants (Planek, undated).

In small forestry organizations and companies, it may be necessary for a senior manager or owner to assume total responsibility for the safety programme. As an organization grows, however, it may not be possible to dedicate the time required to ensure a safety programme is successful. It may therefore be necessary to assign some responsibilities to others.

All participants must understand their specific safety responsibilities. For example, if the company policy states that supervisors are responsible for safety, it means little unless the following are in place:

- management has a system establishing a clear definition of roles, including the activities required to fulfil the safety responsibility;
- supervisors understand how to fulfil their roles, are supported by management, believe the tasks are achievable and carry out their tasks as a result of proper planning and training;
- supervisors are regularly monitored to ensure they have completed their defined tasks (but not measured by an accident record) and feedback is provided to determine whether or not tasks should be changed; and

BOX 2
The safety champions

Workplace safety champions are the beating heart of a strong safety and health culture. They are passionate about safety, take an active role on safety committees or lead by example among their peers.

Anyone can be a workplace safety champion. At one organization it might be a shift supervisor skilled at supporting safe behaviour, and at another it could be an accountant who sits on a safety and health committee and pushes for cutting-edge human error training.

It's incredibly difficult to replicate their keen awareness, insight and enthusiasm for safety. But it's possible to spot people who could be the next safety champion if they only had a little additional encouragement.

No two workplace safety champions are identical. But almost every single one of them has at least one standout quality that helps them excel. Here are some qualities to look for when trying to identify potential workplace safety champions

- They lead by example
- They are safe 24/7
- They start discussions on safety
- They take initiative
- They are willing to learn and engage with new ideas
- They recognize the human factors that prevent compliance
- They are encouraging

The first step to creating a strong culture of safety is to notice those who are doing a good job; through them, you can create improvements and build upon existing structures. It's also prudent to reward these champions, encouraging them to continue promoting workplace safety.

Source: SafeStart Blog (2017).

- there is a reward contingent upon task completion in the performance appraisal system or in whatever is the driving mechanism of the organization.

Accountability is a key part of safety culture. It is only when workers see supervisors and management fulfilling their safety tasks on a daily basis that they believe management is credible and genuinely committed when they signed the safety policy documents (ILO, 2011b).

Safety champions assist the effective establishment of a safety culture, see Box 2.

Having a management responsibility for safety and health means that the supervisor is the employer's agent in that area. The supervisor is the primary person responsible for the safety of those who work in their care. The employer has authorized the supervisor to be their representative for the safety and health programme (Luria *et al*., 2008):

- showing the purpose of the safety and health programme;
- identifying the safety and health personnel implementing the programme;
- providing ongoing evaluation of employee's safety performance; and

- acting as the competent person in your area with authority to supervise all personnel and enforce the safety and health programme.

However, the forestry worker also needs to know exactly what is expected of him/her. Workers further always need to keep the message in Box 3 in mind. The general duties of the employee regarding safety and health are as follows:

- take reasonable care of his/her own safety and health;
- obey all legal and lawful instructions from the employer;
- report all unsafe acts and conditions;
- report all incidents and accidents;
- do not endanger one's own or others' lives by working without permission (outside of scope of authority);
- report to your supervisor or clinic if you are ill;
- attend all scheduled medical examinations;

BOX 3

One of the pillars of occupational safety and health

You are your own best asset!

It should not take a near fatal event or near-miss accident at work for you to realize that you are your own best asset: you, yourself, your body, your mind. If all your finances, your home, your cars and your toys were swept away by fire, flood or catastrophe, you could start again and achieve your goals in a short time – if you are intact. Those who depend on you deserve to have you as a spouse, a parent, a sibling, a son or daughter, a friend or a colleague at work. They need you in their lives.

The importance of this attitude in the workplace could change the way workers and managers approach safety and health decisions. I have witnessed and investigated (and even experienced) serious forest accidents and near-misses. Workers in these situations may have made different decisions if the thought that they are their own best asset was guiding their approach, as follows:

- *you might not make the mistake of trying to cut the tree that has a tree hanging from it;*
- *you might take the five extra steps to put yourself further in the clear;*
- *you might step off the stump carefully, rather than jump off and use up one of the 300 jumps (my estimate) allowed before you have knee damage;*
- *you might avoid the health risks that will shorten your working career by what you put in your body; and*
- *you might stop to assess the risks rather than just taking action.*

You would do these things because there are those who care and depend on you, and you are your own best asset.

Source: Garland (1999).

- get enough rest when not at work to reduce stress and fatigue and eat healthy foods; and
- get medical help if unable to work due to illness.

In order to achieve an optimal safety culture, it is important that management's commitment to the involvement of workers is more than merely lip service.

New Zealand has policies in place to control safety problems associated with the use of contractors in forest operations (a practice increasingly followed in many countries). There, the hiring company must ensure contractors have a documented safety management system in place before commencing operations and must periodically audit the effectiveness of this system (Ministry of Business, Innovation and Employment, New Zealand, 2012).

KEY ELEMENTS OF WORKPLACE RISK ASSESSMENT

Risk assessment is a key tool in managing occupational safety and health at an enterprise level and provides employers and businesses with the means to be proactive, identify hazards and take action to remedy problems before they cause an accident or illness. A very brief introduction to risk assessment is provided below, noting the subject merits a publication of its own. The International Labour Organization (2013) proposes the following five steps:

1. Identify hazards.
2. Identify who might be harmed and when.
3. Evaluate the risk – identify and decide on safety and health risk control measures. This requires the following sub-steps:
   a. identify what you are already doing in terms of existing risk control measures
   b. identify what further risk control measures are necessary.
4. Record who is responsible for implementing which control measures and the relevant timeframe. Implement the safety and health risk control measures (decide who is responsible for doing what and when).
5. Monitor and review your risk assessment and update when necessary.

Risk control measures 3 (a) and (b) should be guided by the hierarchy of risk control measures in the following order:

- Risk Control Measure 1: Elimination or substitution of hazards
- Risk Control Measure 2: Tools, equipment, technology and engineering
- Risk Control Measure 3: Safe work methods, practices, organization, information and training
- Risk Control Measure 4: Hygiene and welfare
- Risk Control Measure 5: Personal Protective Equipment (PPE)
- Risk Control Measure 6: Health/medical surveillance.

A model risk assessment form, based on ILO (2013b), is found in Figure 2, page 34.

PHOTO 10
A choker setter (hookman) in action

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Identified hazards can be categorized according to the likelihood they will cause an accident. This can be expressed as:

1. Rare: has rarely happened, if ever
2. Unlikely: possible, but is not expected to happen
3. Moderate: can be expected to happen once a year
4. Likely: will probably occur, but is not persistent
5. Almost certain: occurs regularly

The potential consequences of hazards will also differ. This can be classified according to the below:

1. Insignificant: no injury or ill health
2. Minor: short-term impact
3. Moderate: semi-permanent injury or ill health
4. Major: disabling injury or ill health
5. Catastrophic: potentially fatal

Risk can be expressed as:

$$\textit{Risk} = \textit{Severity} \times \textit{Likelihood}$$

Table 5, below, provides an example of a practical application of the workplace assessment process in a sawmill. A proposal for a template for workplace assessment is found in Figure 2.

TABLE 5
A workplace analysis in a sawmill

Step1	Step 2	Step 3		Step 4		
What are the hazards?	**Who might be harmed and how?**	**What are you already doing?**	**What further action is necessary?**	**Action by whom**	**Action by when**	**Done**
Exposure to wood dust	All workers (35) risk lung diseases, e.g. asthma, from inhaling wood dust. Machine operators (15) at higher risk of exposure Hardwood dust can cause cancer, particularly of the nose	Dust is swept up regularly Good washing facilities and shower already available Disposable dust masks are provided and regularly replaced	Fit each dust-causing machine with dust extraction equipment Remind staff never to sweep dry wood dust, to use vacuum cleaner or, if necessary, wet dust before cleaning Machine operators to be trained by competent person in use and basic maintenance of dust extraction equipment			
Machinery including circular saws, vertical spindle cutters and planers	Machine operators (15) and other workers at risk of serious and possibly fatal injuries if in contact with moving parts of machinery, particularly saw blades	All machines guarded according to manufacturer's instructions Machine guards inspected regularly, maintained to ensure good condition. Workers have sufficient space at machines to work safely All workers trained in safe use of machines by competent person	Fit braking devices to reduce the rundown time for cutting tools Only machines fitted with brake controls will be purchased in future Explore possibilities for introducing chip limited tooling Re-check with workforce that machine guards are inspected regularly and defects are reported promptly Download information sheets on the safe use of machines used in the workshop. Pin them up in the workshop and restroom			
Manual handling	Workers may suffer musculoskeletal disorders such as back pain from handling heavy or bulky objects and machinery parts They also risk cuts when handling or splinters when handling pallets	Workers trained in correct manual handling techniques Workers and machine tables set at a comfortable height Strong, thick gloves provided for handling tooling and pallets	Where possible, store tooling next to the machine to reduce carrying distance Remind workers to ask for a new set of gloves when old ones show wear and tear, and not lift objects that are too heavy Introduce lifting and handling aids such as panel handlers to reduce the risk of injury			

Source: ILO (2013b).

FIGURE 2
Template for a written workplace assessment

RISK ASSESSMENT TEMPLATE **Enterprise:**

Section/unit:

Date:

STEP 1: What are the hazards?	**STEP 2: Who may be harmed and how?**	**STEP 3: What are you already doing?**	**What further action is necessary?**	**STEP 4: How will you put the assessment into action?**		
Spot hazards by: • Walking around the workplace; • Asking employees what they think; • Checking manufacturer's instructions; • Contacting your trade association. Don't forget long-term hazards.	Identify groups of people. Remember: • Some workers have particular needs; • People who may not be in the workplace all the time; • If you share your workplace think about how your work affects others; • Members of the public. Say how the hazard could cause harm.	List what is already in place to reduce the likelihood of harm or make any harm less serious.	You need to make sure that you have reduced risks "so far as is reasonably practicable." An easy way of doing this is to compare what you are already doing with best practice. If there is a difference, list what needs to be done.	Remember to prioritize. Deal with those hazards that are high-risk and have serious consequences first.		
				Action by whom	Action by when	Done

STEP 5:	**Review date:**
Review your assessment to make sure you are still improving, or at least not sliding back. If there is a significant change in your workplace, remember to check your risk assessment and, where necessary, amend it.	
Assessment completed by:	**(signature)**

Source: ILO (2013b).

PHOTO 11
Heavy work, no protective equipment

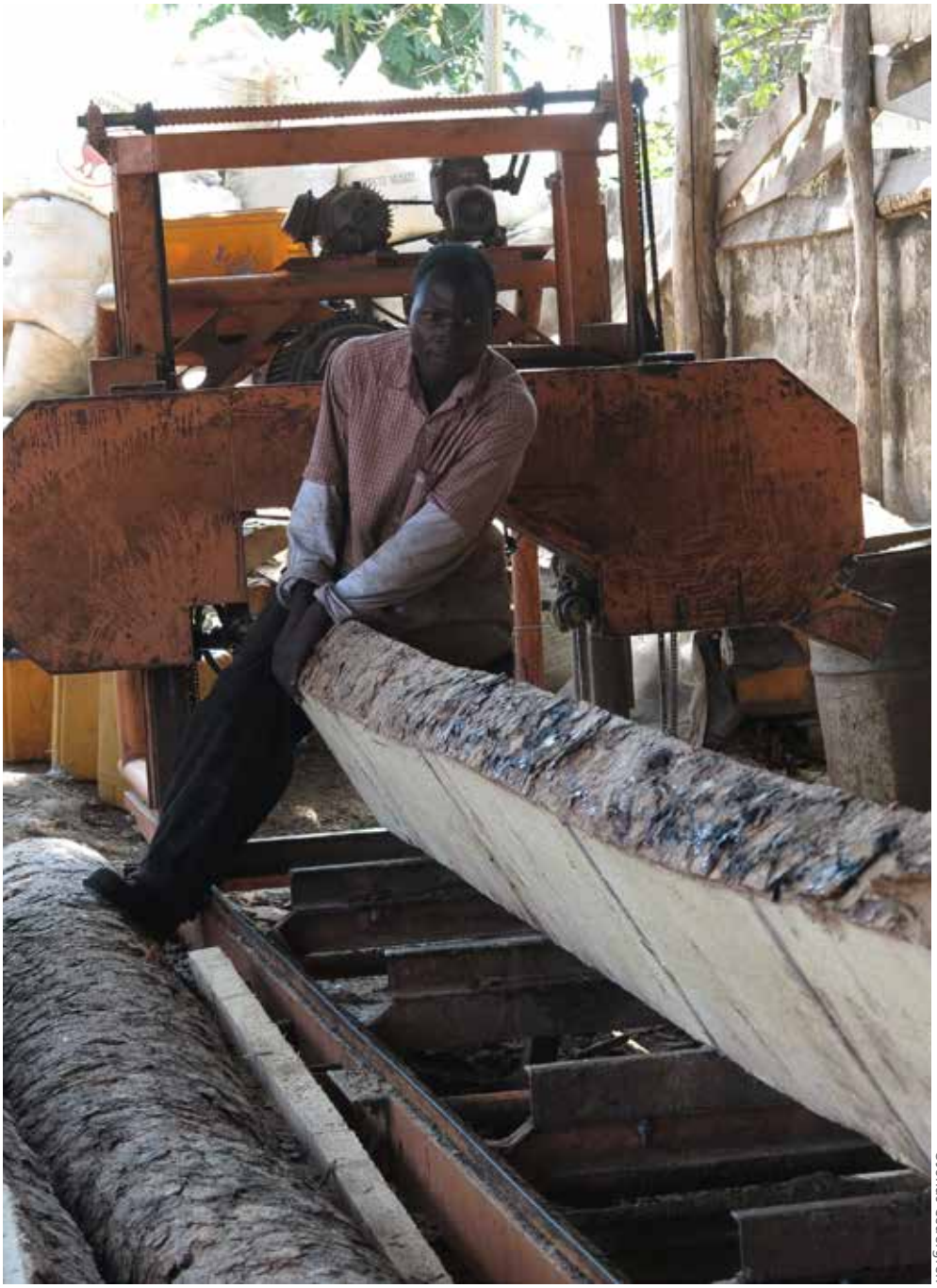

PHOTO 12
Work at a landing in Chile. Workers wearing protective equipment

BOX 4

Safety can be improved – the Chilean example

The text in this box is based on Garland (manuscript).

Chile provides a useful case study demonstrating how improvements to safety and health in the forestry sector can be achieved.

In the 1990s, the safety and health conditions of Chile's forest workers was similar to that of the western United States of the 1940s. While some mechanized logging equipment was imported for harvesting purposes, Chile's safety culture remained inadequate. Many accidents and fatalities involving chainsaws and yarding operations occurred. As the number and seriousness of these accidents and health risks increased, many sectoral stakeholders and society more broadly became concerned, including:

- families of injured and deceased workers;
- co-workers on production teams;
- supervisors and managers in contracting firms;
- forestry managers and owners (including boards of directors of large foreign conglomerates);
- mutual insurance companies providing compensation and medical treatment to the sector;
- federal and regional safety administrative units;
- medical professionals providing treatment to workers;
- safety professionals providing advice to the sector;
- unions and worker organizations representing the sector;
- professional forestry institutions and academic forestry professionals;
- forest industry associations and their members;
- legal professionals representing claimants; and
- the broader public by way of news and media reporting.

Both the breadth and intensity of stakeholder concern brought significant pressure to bear on the forestry sector to address safety and health. European investors in a Chilean forest company, for example, required the local general manager and his operations manager to go to Europe and explain to the Board of Directors both the circumstances in which a worker died and planned remedial action. This was a powerful signal to the Chilean forestry sector. Other stakeholders exerted similar pressure towards improved safety and health.

Since then, and moving forward to the present, many stakeholder meetings and two international conferences on "Work in the Forestry Sector" established that the Chilean forestry sector was on a "Trajectory of Development" for safety and health and was on course for continued improvement. In order to establish the Trajectory, the sector sought national and international advice and guidance. Later, as work progressed, experts provided assessments and feedback. Adjustments were made as appropriate. Leaders of Chilean industry, government, academia and the private sector emerged as advocates for new

Box 4 continues

Box 4 continued

approaches and institutions to support safety and health. Training and certification were used as a mechanism for improvements. Vast improvements to hygiene and nutrition in the worker camps were made early on. Other improvements occurred across forestry services (planting, pruning, etc.), logging, transportation and wildland fire fighting. Since that time, fatalities and accidents have decreased and health conditions have vastly improved. Safety and health measures have now become institutionalized in large corporations and contracting firms. Industry and contractor associations, along with unions and governmental safety agencies, continue to work cooperatively.

Prior to these efforts, accident and fatality reporting in Chile was low. Today, these statistics are complete and valid. As mechanization has increased (with work taking place from within protected cabins), there has been a commensurate decrease in accidents and fatalities. Collaboration between industry and various institutions has also helped to reduce this tally. A distinction must, however, be made between industrial operations and small-scale operations, which experience higher accidents and fatalities.

From the 1990s, harvest levels in Chile increased from less than 15 to 47 million cubic metres. During this time, national logging employment increased from 14 000 million to over 50 000 million (this number is now decreasing). Despite the higher activity level with more employees, fatalities have declined.

At present, the health performance of Chile's industrial forestry operations is commensurate with, or better than, other comparable forestry regions. Like other advanced forestry countries and regions, Chile, the United States of America and Europe face a difficult workforce situation. The workforce is aging, recruitment of new workers for difficult work is problematic and skilled machine operators are in high demand. Workers remain highly valued. While increased mechanization will help eliminate accidents and fatalities, other hazards such as maintenance of machinery, and even simply walking in difficult terrain, will remain. The greatest safety and health challenge is to find courageous advocates and safety champions within the sector to drive progress. Current successes rest on the vision and efforts of earlier leaders now passing into retirement.

Source: Adapted from Garland (manuscript).

PHOTO 13
A poorly organized workplace is a risk in itself

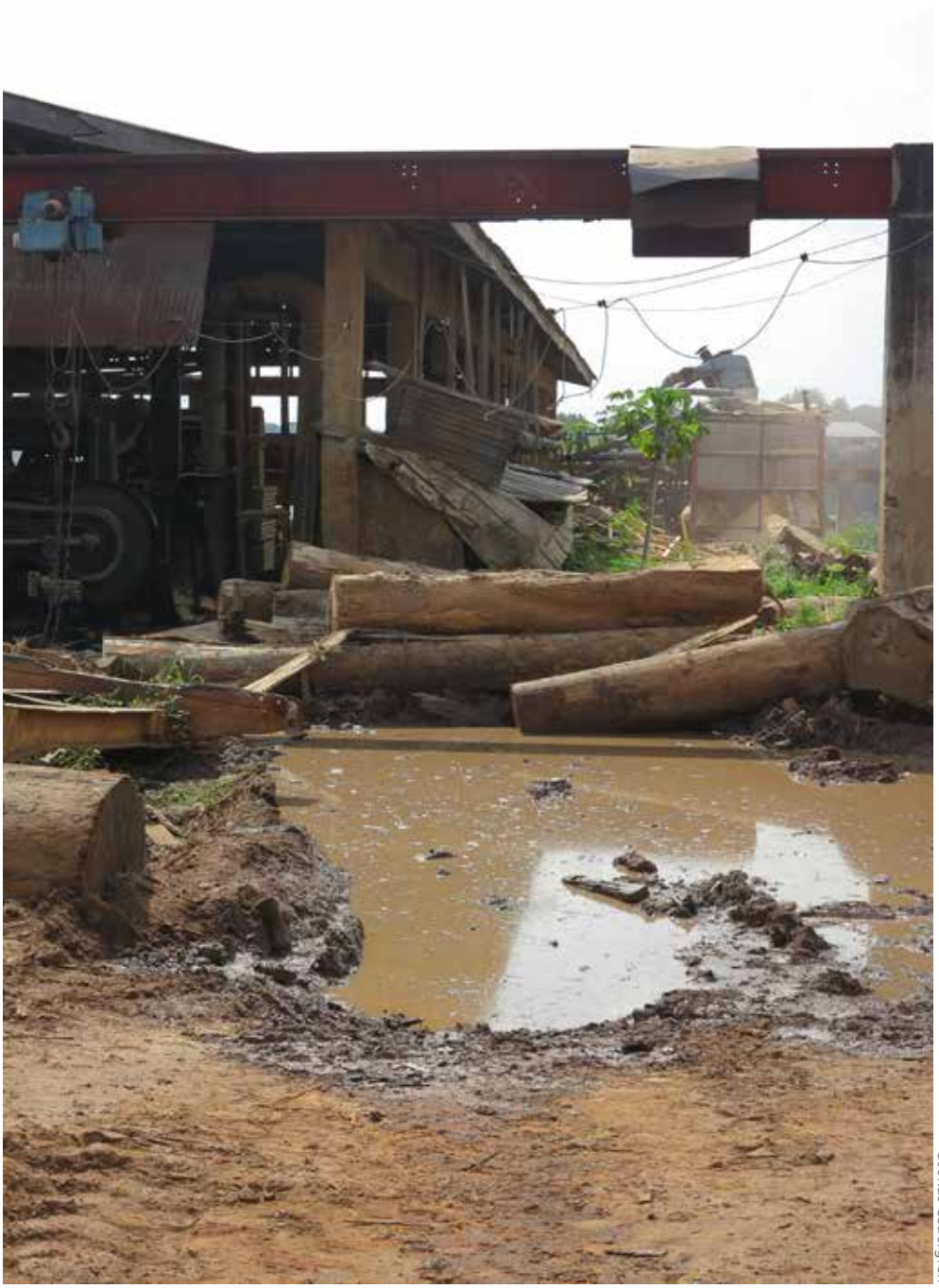

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PHOTO 14
Training in progress

4 Accident prevention and readiness

The fundamentals of accident prevention are reduced hazard exposure and worker safety training. The first is often achieved through risk assessments to identify hazards and take action to minimize or, in a best-case scenario, eliminate them from the workplace. Although some hazards are intrinsic to forestry work, risks are not. Risk will depend on training and risk reduction measures in place. Both training and PPE are necessary to reduce the risk of an accident occurring and, if one does occur, minimize its severity.

The risk perception of individual workers is very important and should always form part of training. Fatigue, easily caused by factors such as dehydration, is detrimental to cognitive ability, while physical fitness will improve perception.

Keeping machinery and mechanical devices in good condition and operating them responsibly reduces accident risks in all forest operations. Ensuring that all operators are capable of maintaining and operating their machinery is a critical step in this process.

Ensuring operators are healthy, fit, sober, aware of their job requirements and the work of others in the same area will contribute greatly to operational safety.

Fatigue is a safety hazard. Working hours should therefore not exceed the number specified in national legislation or agreements. Working days should include breaks. Taking short breaks helps maintain vigilance at work.

PHOTO 15
Things to remember before you go to work

- You are responsible for your safety and the safety of others
- All accidents can be prevented
- Follow safety advice, do not cut corners
- If you do not know how to, don't do it
- Stick to proper equipment, and use it properly
- Assess risks before you act
- Use protective equipment

Accidents will happen even in the best of circumstances. You and your working team should be mentally prepared for accidents at all times. It is important that not only employees, but also rural households with self-employed members, and indeed everybody exposed to work hazards, have a planned response to accidents. All team members should be aware of the relevant emergency plan. The plan may well need to be updated when workplaces or tasks change. Local circumstances will dictate the details of the plan. Generally, plans will include: provisions for fast evacuation of injured persons; details on how to transport/call for help; and preparation of a place where injured persons can rest while waiting for evacuation.

Basic first aid equipment is valuable (even more so if workers have received first aid training). It is good practice to ensure all employees have a first aid bandage in one of their pockets at all times. Training should go beyond first aid and include, for example, fire-fighting, transport of injured colleagues and heat management (see below) among others.

Following the rules below will not prevent accidents from occurring, but will increase chances of survival:

- Be mentally prepared for anything. Unlikely events are nevertheless events that take place. Whenever you start work, ask yourself whether a relevant plan is in place.
- You must be able to describe your location when calling for help. This may be a matter of life or death.
- In some countries there are free-to-use apps used by emergency services to identify your location from a smartphone GPS.
- You must know where your colleagues are at all times. They depend on you if the worst happens. If somebody does not show up as agreed at an agreed location, you must immediately find out why.
- Never rely only on emergency calls (112, 911, 999, etc.). The location of an accident may be too remote for rescue personnel to attend and assist – it is important to remember that remoteness is a risk in itself.
- Everybody must take responsibility and act in an emergency. This includes knowing how to operate communications equipment and, more importantly, whom to contact and what to say.
- A Plan B must be in place prior to an accident occurring. If your communications equipment does not work, this may mean seeking help from others. This is something that needs to be practised in a non-emergency setting.
- Test communications equipment regularly. Whenever relevant, make sure that batteries are loaded and spare batteries are available.
- Ensure you are aware of those working close to you. Knowing this can save lives.
- Accident preparedness not only involves administering first aid and calling for help. It could also include preparation for fires, landslides, avalanches, etc.
- You must be prepared to evacuate a workplace.
- You must be prepared to call for help. This means there must always be a Plan B in cases where telephones may not be working.

A BRIEF SAFETY CHECKLIST

- **Employers** should perform a workplace assessment. Hazards should be identified and removed if possible. Risks should be evaluated, reduced, controlled to low levels and recorded.
- **Employees** should cooperate with their employer in safety and health matters. Work supervisors should be informed about safety concerns. Employees should of course adhere to safety procedures.
- **Safety management**. Have safe working systems been developed? Are accidents and hazards reported? Which workers are most at risk?
- **Equipment and practices**. Is equipment safe, adequate for the job, maintained and appropriately stored? Are hazardous substances safely used and stored? Have employees been properly trained and instructed and are they appropriately supervised?
- **Indoor workplaces**: do the relevant parts of nurseries and workshops have adequate lighting, good ventilation, heating and cooling? Are building interiors in good condition? Is there sufficient work space? Is noise controlled?
- Does **PPE** meet standards? Is the equipment appropriate and have workers been trained in its use?

ACCIDENT REPORTING AND ANALYSIS

The text below is based on Garland (2018), a publication dedicated to accident reporting and analysis.

Prompt and official accident and illness reporting in forestry is in the best interests of the sector.

The purpose of accident analysis is to identify – in an unbiased fashion – what occurred, the causes of the accident and the ways in which similar accidents might be avoided in future. The availability of an investigation protocol for those at accident scenes will assist in accident investigation and analysis. Accident reporting, in turn, is the collation of forestry accident reports. Reports should be written simply so as not to exceed the subject-matter knowledge of users.

Those employers participating in workers' compensation insurance or a national social insurance programme have reporting obligations. Other insurance arrangements will likely require reporting depending on the nature of the insurance cover. Self-insured organizations require accident reports. General industry accident reports are used to:

- estimate the causes and magnitude of accident problems;
- identify and prioritize the need for preventative measures;
- evaluate the effectiveness of preventative measures;
- monitor risks, issue warnings and conduct awareness campaigns; and
- provide feedback for those involved in prevention.

Accident reports contain important data such as injured worker details (age, education, gender, etc.); time/day/month of accident; body part injured; type of injury; duration of injury; type of accident (e.g. fall or blow); employment period; job class; activity prior; tools/equipment; injury agent; and accident description.

The utility of accident reporting derives from the patterns emerging from a large number of accident reports occurring under similar circumstances. The standardization of reporting allows comparisons among sectors, forestry regions and countries, and helps identify the prevention efforts needed.

Much detail is lost in summarizing accident reports. In many existing systems, important information may not be recorded at all (e.g. site information such as slope gradient, tree size/condition, specific equipment, actual experience versus employment with firm, weather, fatigue indicators and use of PPE). There is a need, therefore, to include forestry-related data in accident reporting schemes.

In cases where equipment is a potential accident cause, machine manufacturers may be liable for damages. Manufacturers keep proprietary control of their records of accidents and machine damage, but accident analysis can help identify problems and potential solutions, where such records are made available through litigation or accident investigations.

Effective accident reporting and analysis leads to cooperative efforts to improve safety and health, including:

- elimination of hazards or the substitution of unsafe practices with safer processes;
- introduction of engineering controls such as guards for shearing and cutting tools and safer technologies;
- improvement of organizational safety measures, work schedules, supervision and training; and
- increased use or improvement of PPE.

In some countries, unskilled or inadequately skilled labourers are undertaking forestry work. In such cases, it is important to provide adequate training materials in a relevant language that takes into account relevant cultural issues. A "macho" culture, for example, must be controlled when working chainsaws. Improved supervision of workers, as required by regulations and operational necessity, is another important safety measure.

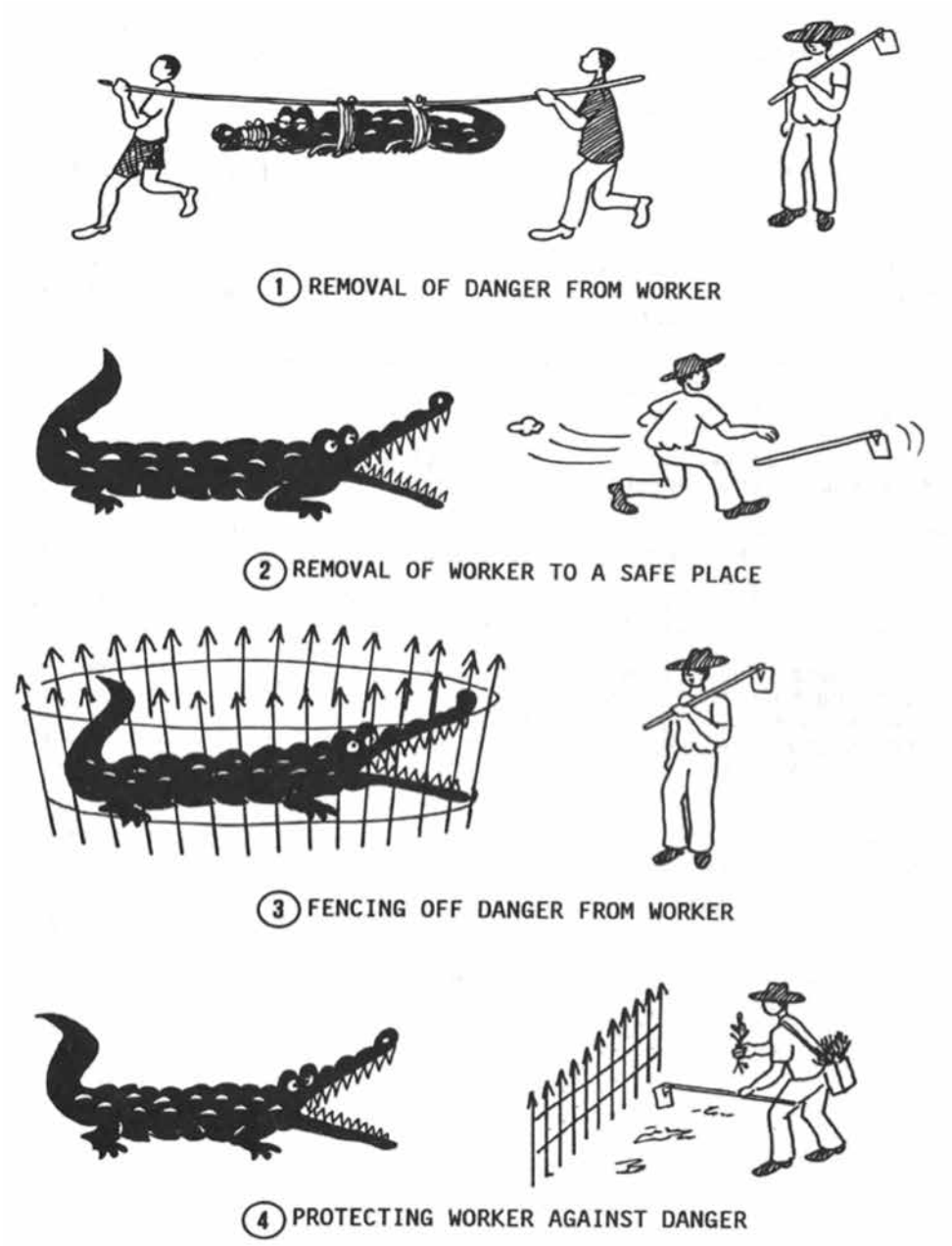
A near-miss is an unplanned event with the unrealized potential to cause injury to workers, an interruption to operations, or damage to equipment. Reporting these near-misses is critical, because it provides information on hazardous behaviour and unsafe working methods and equipment that can be used to reduce the potential for future accidents.

THE ROLE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

Hazards are common in forestry work and therefore workers must be protected. A proper hazard control programme follows the "hierarchy of control," including elimination, substitution, or engineering control(s) of hazards at their source or along the path between the source and worker. Many methods of hazard control are available, and the most appropriate to the specific situation should be used. Figure 3, below, illustrates the hierarchy of control measures.

In order to eliminate a hazard from the workplace or remove its potential to cause harm to workers, it is preferable to control a hazard at its source. Measures such as: the isolation of hazards; ventilation; application of additional safety features to existing equipment; redesign of work processes; purchase of new equipment; or substitution with

FIGURE 3
Coping with workplace hazards



Source: ILO (1992).

a non-hazardous material may be required. Administrative controls include safe work practices, education/training and housekeeping. When the hazard cannot be removed or controlled sufficiently, PPE may be used. This represents the last level of protection where other methods are not possible or available. PPE is equipment or clothing that protects against health or safety risks at work. It includes items such as safety helmets, gloves, eye protection, ear protection, high-visibility clothing, safety footwear and respiratory protective equipment (RPE). Employers have responsibilities towards the provision and use of PPE at work, including managing the risk that a worker wearing PPE feels protected or invincible and thus behaves more recklessly.

When formulating a PPE strategy, the primary elements for consideration are:

- protection of workers
- compliance with applicable laws/regulations/standards/guidelines
- compliance with internal company requirements
- technical feasibility.

Personal Protective Equipment should only be used:

- where other controls are not available or adequate
- during activities such as maintenance, clean-up and repair where pre-contact controls are not feasible or effective
- during emergency situations.

This equipment is worn to minimize exposure to specific hazards. If PPE is still required after other controls have been implemented, it must be provided to employees free of charge. In cases where high-risk hazards remain even where engineering controls and safe work systems are in place, PPE should be worn to reduce worker risk. These risks include:

- lung injury, e.g. from breathing in contaminated air
- head and/or foot injury, e.g. from falling materials
- eye injury, e.g. from flying particles
- skin injury, e.g. from contact with chemicals
- injury to the body, e.g. from exposure to extreme heat or cold.

The starting point for PPE is to consult Section 7 of the ILO Code of Practice for Safety and Health in Forestry Work (ILO, 1998). As discussed in the sections above, maintenance of a safe work environment and elimination of potential hazards is the first step in establishing a safety culture. Personal Protective Equipment is only used as a last line of defence in places where it is not practicable to control hazards at their source (Occupational Safety and Health Council Hong Kong, 2001).

The use of PPE in a workplace is itself an indication of a potentially hazardous work environment. Due to the disadvantages of PPE, it is not used for low-risk hazards, but as a major method of injury prevention. In order to effectively control the hazard, the equipment and clothing must be reliable and effective, used properly and carefully maintained, and the user must undergo adequate training (Occupational Safety and Health Council Hong Kong, 2001). It should be noted that some PPE has a short service life. Safety helmets should, e.g., be replaced after a single major impact and chainsaw pants can be rendered unfit by oil contamination within a short time.

Using PPE is only one part of a complete hazard control programme. It does not reduce the hazard itself nor does it guarantee permanent or total protection. Rather, a variety of strategies is needed to maintain a safe and healthy environment.

Because forestry work often takes place in hot and humid climates, it is important to consider the role of fatigue when implementing a PPE programme. It is well documented that fatigue is a significant contributor to all kinds of accidents. Biggs *et al.* (2011) found that during an average shift, South African forestry workers experienced dehydration to an extent that compromised both their safety and productivity regardless of season, gender or job category. The FAO document "Managing heat in agricultural work: Increasing worker safety and productivity by controlling heat exposure" should be consulted. This document does not intend to repeat the results of that report, but its recommendations on clothing are important (Wästerlund, 2018).

Designing a PPE programme

A PPE programme must be comprehensive, including managerial commitment and detailed planning. A good PPE programme consists of the following essential elements:

- hazard identification and risk assessment
- selection of appropriate controls
- selection of appropriate PPE
- fitting
- education and training
- management support
- maintenance
- programme auditing.

The importance of PPE programmes should be equal to all other programmes and practices. If the use of PPE is new, management must ensure that the PPE selected is suitable (comfortable, well-fitting and cool in hot climates). Workers should get used to wearing PPE.

Implementation and worker buy-in will be improved by maximizing their involvement in this process. Workers and others should be educated about the role of PPE and trained to use it. Worker compliance will be poor if PPE is unattractive or uncomfortable (Canadian Centre for Occupational Safety and Health, undated).

PPE and worker behaviour

PPE use can result in changed working methods or increased work speed. The protective equipment may cause the worker to take more risks due to a distorted sense of safety, which leads him/her to underestimate risk and reduce care. Research has found that PPE use reduces the number of injuries and blows but increases the number of twisted joints. The clothing adds weight to the worker, can reduce visibility and increase careless errors (Albizu-Urionabarrenetxe *et al.*, 2013). For example, ear protection reduces the ability to hear warning signals from co-workers or the environment. This suggests there are times (or activities) during which some PPE should not be worn.

Check regularly that PPE is used. Supervisors and management must investigate why PPE is not being worn.

The effect of climate on the worker and PPE

Wästerlund (2018) carried out a comprehensive review of managing heat in agricultural work (see below for practical advice on heat management). Its conclusions and recommendations, summarized as follows, are important when considering PPE in forestry:

- Because many agricultural tasks are physically demanding, the body commonly produces considerable excess heat. Workers could, therefore, be at risk of heat stress even in moderately warm conditions, especially if workers are wearing protective clothing that restricts heat dissipation.
- In hot environments, workers should wear thin, light-coloured clothing (if the work does not require special protective clothing). Bare skin should be covered to avoid sunburn and reduce the risk of skin cancer. Workers should wear broad-brimmed hats to protect their heads from heat exposure (the brain is especially sensitive to radiative heat exposure). Many hard hats do not provide adequate shade for the face and neck area. The photo below shows what progressive companies are issuing to workers to overcome this issue.
- Employees should be trained to drink frequently because thirst is not a reliable indicator of the body's requirements for fluids. Such training should be adapted to the cultures of employees. Fluids should be relatively cool (15–20 °C), coffee and tea should be avoided and alcoholic beverages should not be permitted. It is best to drink small quantities of water frequently.

Clearly, the use of improper or unsuitable PPE can compound climatic conditions, especially heat exacerbated by high humidity.

PHOTO 16
A hard hat adapted to heat

©Andrew McEwan

Personal Protective Equipment selection

Personal Protective Equipment must be carefully selected and employees must be adequately trained to use it properly, including understanding how to detect and report faults. The following questions should be asked during selection:

- Who is exposed and to what?
- How long will they be exposed?
- How much are they exposed to?

Once selected, PPE should be accredited against an acceptable safety standard. The PPE must be appropriate to the user's size and weight. Workers will be more likely to accept and wear PPE if they assist with its selection. If more than one item of PPE is worn at a time, ensure they can be worn together. Workers must then be instructed and trained in how to use it, understand why it is needed, when to use it and what its limitations are (Health and Safety Executive, United Kingdom, undated).

PHOTO 17
Personal Protective Equipment not adapted to local circumstances (heat)

©Walter Kollert

The following guidelines can be used for selection (Canadian Centre for Occupational Safety and Health, undated):

- Match PPE to the hazard. Do not overdesign the PPE systems or forestry workers will become hot and fatigued. The PPE must, however, protect as required according to the risk level of the hazard.
- Obtain advice: not all PPE is created equal. Alternatives exist and may be more comfortable or cooler in hot climates.
- Involve workers in evaluations where possible. If they feel part of the process they will be more accepting of the PPE.
- Consider physical comfort (ergonomics): if PPE is unnecessarily heavy or poorly fitted it is unlikely to be worn. There are many examples of this problem in forestry, such as heavy chainsaw pants, whereas lighter versions exist that are just as safe. Important factors to consider are the thermal insulation of the material and the potential for transferring moisture (e.g. sweat and rain) through the fabric (Wästerlund, 2018).
- Evaluate cost considerations: the overall cost must be evaluated over time. A higher initial cost may be more cost effective in the long term due to increased worker productivity and reduced chance of accident.

- Review standards: performance standards must be reviewed to minimize or eliminate exposure to injury using PPE.
- Check the fit: PPE samples can be collected and employees can be fitted for the correct size. It defeats the point of PPE if it fits poorly (posing a safety hazard in itself) or the employee does not wear it.
- Perform regular maintenance and inspections: it is counterproductive to have labourers wearing faulty PPE. It hinders their performance and does not provide the required level of safety.
- Conduct education and training: training must take place on how to fit, wear and care for PPE.
- Audit the programme: one needs to know how successful any programme has been.

Types of Personal Protective Equipment

Table 6 provides a general overview of the types of PPE, hazards resulting from their use, the body part affected and additional notes.

TABLE 6
Personal Protective Equipment types for various body parts

	Hazards	PPE	Notes
Eyes	Chemical splash, dust, projectiles, gas and vapour	Safety spectacles, goggles, face screens, face shields, visors	Make sure chosen eye protection has the right combination of impact/dust/splash protection for the task and fits the user properly
Head and neck	Impact from falling or flying objects, risk of head bumping, hair becoming tangled in machinery, chemical drips or splash, climate or temperature	Industrial safety helmets, bump caps	Some safety helmets incorporate or can be fitted with specially-designed eye or hearing protection
Ears	Noise – a combination of sound level and duration of exposure, very high level sounds are hazardous even if of short duration	Earplugs, earmuffs, semi-insert/canal caps	Provide hearing protectors appropriate to the type of work and make sure workers know how to fit them Choose protectors that reduce noise to an acceptable level, while allowing for safety and communication
Hands and arms	Abrasions, temperature extremes, cuts and punctures, impact, chemicals, electric shock, vibration	Gloves, gloves with a cuff, gauntlets and sleeving that covers part or all of the arm	Chemicals quickly penetrate some materials – take care in selection Barrier creams are unreliable and are no substitute for proper PPE Wearing gloves for long periods can make the skin hot and sweaty, leading to skin problems. Using separate cotton inner gloves can help prevent this

Table 6 continues

Table 6 continued

	Hazards	PPE	Notes
Feet and legs	Wet, hot and cold conditions, electrostatic build-up, slipping, cuts and punctures, falling objects, heavy loads, chemical splash, vehicles	Safety boots and shoes with protective toecaps and penetration-resistant, mid-sole wellington boots and specific footwear and trousers, e.g. for chainsaws	Footwear can have a variety of sole patterns and materials to help prevent slips in different conditions, including oil or chemical-resistant soles. It can also be anti-static, electrically conductive or thermally insulating Appropriate footwear should be selected for the identified risks
Lungs	Dusts, gases and vapours	Respiratory protective equipment (RPE)	Some respirators rely on filtering contaminants from workplace air. These include simple filtering face pieces and respirators. Make sure respirators fit properly, e.g. for tight-fitting respirators (filtering face pieces, half and full masks) The right type of respirator filter must be used as each is effective against only a limited range of substances Filters have only a limited life
Whole body	Heat, chemical splash, spray from pressure leaks or spray guns, contaminated dust, impact or penetration, excessive wear or entanglement of clothing	Conventional or disposable overalls, boiler suits, aprons, chemical suits	The choice of materials includes flame-retardant, anti-static, chain mail, chemically impermeable, and high-visibility

The section below focuses on the types of PPE listed above and their relevance to forestry, with examples (Occupational Safety and Health Council, 2001):

1. Protective goggles: goggles are not commonly used in forestry as they tend to mist up during outdoor work where most physical exertion is required. They are also not commonly required to overcome hazards as other forms of eye protection are usually suitable. However, they can be used to protect against dust, particles, flying chips, chemical splattering and smoke.
2. Safety glasses: commonly used in forestry for protection from particles, flying chips and the impact of fragments. They are often used during brush cutter operations, chipping, manual debarking and chemical spraying.
3. Face shields: very important for flying objects during operations with brush cutters or chainsaws. Can be used together with safety glasses.
4. Ear Protectors: each forestry machine must be analysed to determine noise levels. Prolonged exposure to high noise levels will result in hearing loss. Infrequent exposure to high noise levels could lead to irritability, reduced concentration, hearing damage and accidents. Hearing damage is permanent and preventative measures are therefore important. Chainsaw and brush cutters are known for high noise levels and certified earmuffs are therefore a requirement. Depending

on the noise level and distance from the noise source, it will be necessary to wear either earmuffs or earplugs.

5. Respirators: These are not commonly used in forestry, except when working with certain hazardous chemicals. The material data label will inform whether a respirator is required. For dust (e.g. timber extraction operators with no enclosed air-conditioned cab), mouthpieces are commonly used. These, however, make breathing difficult, especially during hot and humid weather.
6. Protective Gloves: gloves are used for most forestry tasks due to the prevalent risk of hand injury. Chainsaw operators, planters, manual weeders and de-barkers all require specific gloves. People working with oils and chemicals should also use gloves. In these cases, additional protection may also be necessary by using protective ointments. Protective gloves must have a good tactile sense, elasticity and dexterity. They should not be slippery and must be easy to put on and take off. Depending on the job, they can be made from materials such as cotton, latex, nylon or leather.
7. Safety Footwear: most forestry work involves the risk of damage to feet. This can be from falling objects such as logs, chainsaw chains or manual tools such as picks, and stepping on objects or slips. The use of appropriate safety footwear reduces this risk considerably. The type of footwear required will be determined by risk factors such as:
   - being struck by hard, rolling or falling objects
   - sharp objects piercing the sole or body of the shoe
   - being scratched by sharp objects
   - slipping on wet surfaces
   - contact with chemicals and hot or cold surfaces.
8. Protective Clothing: forestry workers are exposed to various climatic, terrain and vegetation conditions every day. Protective clothing physically protects both the workers and their personal clothing. In general, PPE should be resistant to tearing, thorns and UV rays. It should comfortably permit necessary movement without being loose enough to catch on sharp objects, and include ergonomically placed pockets. The following PPE is commonly used:
   - general purpose protective clothing including raincoats
   - heat-resistant work clothing for fire-fighting and fire break burning
   - low-temperature work clothing
   - impermeable work clothing for protection against chemicals
   - brightly-coloured reflective clothing for increased visibility
   - work clothing to prevent cuts from equipment (e.g. chainsaws).

Use of Personal Protective Equipment

In order to ensure PPE provides the required level of protection, the following factors must be considered (Occupational Safety and Health Council Hong Kong, 2001):

- Proper selection: as indicated, the nature and degree of potential hazards must be considered. PPE must not only control the hazard but also be comfortable and easy to use.

- Correct use: forestry includes many hazardous jobs. It is therefore very important that PPE is used correctly.
- Correct maintenance: because forestry jobs take place outdoors, PPE will be exposed to the elements. It should be cleaned and dried after use, properly stored and regularly inspected. Damage to PPE should be reported as soon as it is detected.

Other Personal Protective Equipment considerations

In order to be effective, PEE must be worn whenever hazards are present. Allowing employees to work without PPE on jobs of very short duration is not acceptable (Canadian Centre for Occupational Safety and Health, undated).

When not in use, PPE must be looked after and properly stored. It should be kept dry during storage and cleaned before being placed into storage. The correct spare and replacement parts must be kept in stock. Employees must be held accountable for its proper use and care.

Safety signs can be a useful reminder that PPE should be worn. These signs should be clear about who should wear PPE. Too many generic safety signs include long lists of PPE, but do not specify which jobs they apply to and one cannot expect all people to wear PPE unnecessarily.

BOX 5
Training

Planning training programmes for employed workers or contractors working for larger companies is fairly straightforward as they can be reached through their employers. It is far more challenging to reach farmers and other self-employed workers as they are usually not organized. Furthermore, they often do not have the means to be able to afford to spend time in a training programme nor to pay for this training. Training schemes for these groups can often be profitable investments for the society as training costs are offsets by the savings from reduction in accident frequency and severity. Another advantage of basic education, core work skills, and lifelong learning opportunities is that workers can maintain and improve their employability, resulting in a more skilled and productive workforce to the benefit of the entire society (ILO, 2004).

Source: Garland, Undated a.

TRAINING FOR SAFE AND EFFECTIVE LOGGING TECHNIQUES

You can't think of training as a one-shot deal. You need a total system of training for each job. Each firm has heavy responsibilities to provide sufficient training so each worker can perform safely. The bonus is that training also makes workers more productive.

Before you start, put yourself in the trainee's place and think how you would like to be trained. How can you improve on trial-and-error learning? As a trainer you are the coach of a crew that must perform like athletes, work together like a team, and solve problems like geniuses! Besides your own technical skills, your greatest asset is patience.

People remember much more of what they see than what they hear. Draw pictures in the dirt. They remember much more if they do it as part of the training. Only telling someone what to do is often not enough.

Use positive feedback to get the correct performance. Shouting and negative feedback loses its effectiveness quickly. Repeat key ideas often. Use performance checks to track progress.

Training guidelines

These guidelines are offered to help you do a more effective training job on any logging technique.

1. *Procedures.*
2. *Explain the technique calmly and slowly, step-by-step. Tell them how, why, when and where to use the technique.*
3. *Demonstrate the technique at a normal pace, but make sure they understand the steps before speeding up the process.*
4. *Let the trainees try it.*
5. *Provide coaching. Start by saying something positive. Give only two or three points of correction on each trial. Don't point out all the errors at once.*
6. *Let trainees try it again. Ask them to talk through what they are doing. Ask them what felt right or wrong.*
7. *Have trainees practice the technique. Tell them after a time a check will be made on their performance.*

Performance Checks

Either the trainer or the supervisor should undertake a performance check on the trainee following some practice and operations. Additional instructions and/or practice may be required. Individuals unable to make it past a couple of performance checks should be counselled into some other work.

Points to Remember

Start slowly. Make sure trainees use proper techniques, then go for speed. It is easier to form good habits than to correct bad ones. You may have to "set up" a training situation, e.g. use a "bridle" with the end of the log in the air rather than covered with brush.

Give Them Short Rules to Remember

"Put a roll on a big log to get it moving."

BOX 6

The supervisor and safety and health

The supervisor is the employer's agent. S/he is the primary person responsible for the safety of those who work in his care. The employer has authorized him/her to be their representative for the safety and health programme:

- showing the purpose of the safety and health programme;
- identifying the safety and health personnel implementing the programme;
- providing ongoing evaluation of employee's safety performance;
- implementing a disciplinary action to address unsafe work practices;
- acting as the competent person in his/her area with authority to supervise all personnel and enforce the safety and health programme.

The supervisor has specific responsibilities to:

- supervise and enforce the employer's safety and health programme;
- verify that all employees:
  – can safely perform assigned tasks
  – have received adequate job safety instruction and training;
- periodically review the safety performance of each employee;
- provide job safety and health instruction, training or disciplinary action to an employee when the employee is working in an unsafe manner;
- closely supervise each employee who is receiving job safety and health instruction and training; and
- require all employees to demonstrate their ability to safely perform their work task before permitting them to work independently.

The supervisor is the person employees come to in case of accident and so her/his first aid and CPR (cardio-pulmonary resuscitation) skills need to be current and s/he should be prepared to use them. S/he will be involved in hazard identification and elimination, preserving an accident scene, accident investigation, employee involvement, training, evaluating employees and recordkeeping.

Although some supervisors give the appearance of knowing everything about the jobs they supervise, this is probably not the case. Logging jobs are complex and supervisors cannot be expected to be experts at all of them. Some skills require constant practice. Supervisors must demonstrate how to perform a task safely and effectively. This includes identifying the hazards relevant to each job and how these can be either eliminated or mitigated.

There can be no barriers to working safely and workers, supervisors and managers all have the same goal: to come home safely at the end of the day. Supervisors are the key communicators to promoting mutual trust between workers and managers in the best interests of employee safety and health.

Box 6 continues

Box 6 continued

Supervisors need to know how to **motivate** people by rewarding proper actions, immediately correcting improper actions and using disciplinary procedures to ensure compliance. However, supervisors also need to understand what **demotivates** people. Rewarding someone for improper actions (like ignoring safety violations for selected workers) or punishing a worker for doing the right thing (e.g. not responding to workers who raise safety concerns) is demotivating. Demotivating actions spread mistrust through an organization like wildfire.

The supervisor's overall safety responsibility is to identify hazards and unsafe worker behaviours and correct them before an accident occurs. There is no more important job.

Supervisors may be concerned that training another worker is tantamount to grooming a replacement. They may get the message that production is prioritized above everything. In order to strengthen and preserve the safety chain of supervision, employees must trust supervisors, supervisors must trust managers and managers must trust owners.

Source: Garland, Undated b.

NEW EMPLOYEES

The first few days on a new logging job are vital for both the employee and employer (Garland, undated c). Get off to a good start on training for production and safety. Remember the circumstances of a new job. Everything is happening so fast. Not much is remembered. You may have an employee completely new to logging or someone who claims to be experienced. The main supervisor needs to tell the new employee and the crew what is expected of them. Do this in a positive way.

Position your orientation and training programme in the context of future employee development over the coming weeks and months. Fix responsibility for training and direct supervision. Early mistakes can be fatal.

Explain the accident prevention programme, orientation and on-the-job training, and encourage questions. Tell new employees not to do anything beyond their skill set and encourage them to get help as necessary. Tell the crew not to ridicule new employees. Make a visual competence check of new employees claiming to be experienced. Make sure PPE is used.

Tell workers about safety meetings, accident investigations and how to report injuries, and give them copies of the safety and health rules. Make sure they know who has first aid training and where the supplies are. Instruct them on emergency radio procedures and evacuation plans. Give them the basics of fire-fighting, equipment and tool use.

Communication patterns among the crew, including whistle and hand signals, require detailed training. Don't tolerate horseplay or inattention. Explain company disciplinary procedures. Make new employees responsible for their learning and check on their progress periodically.

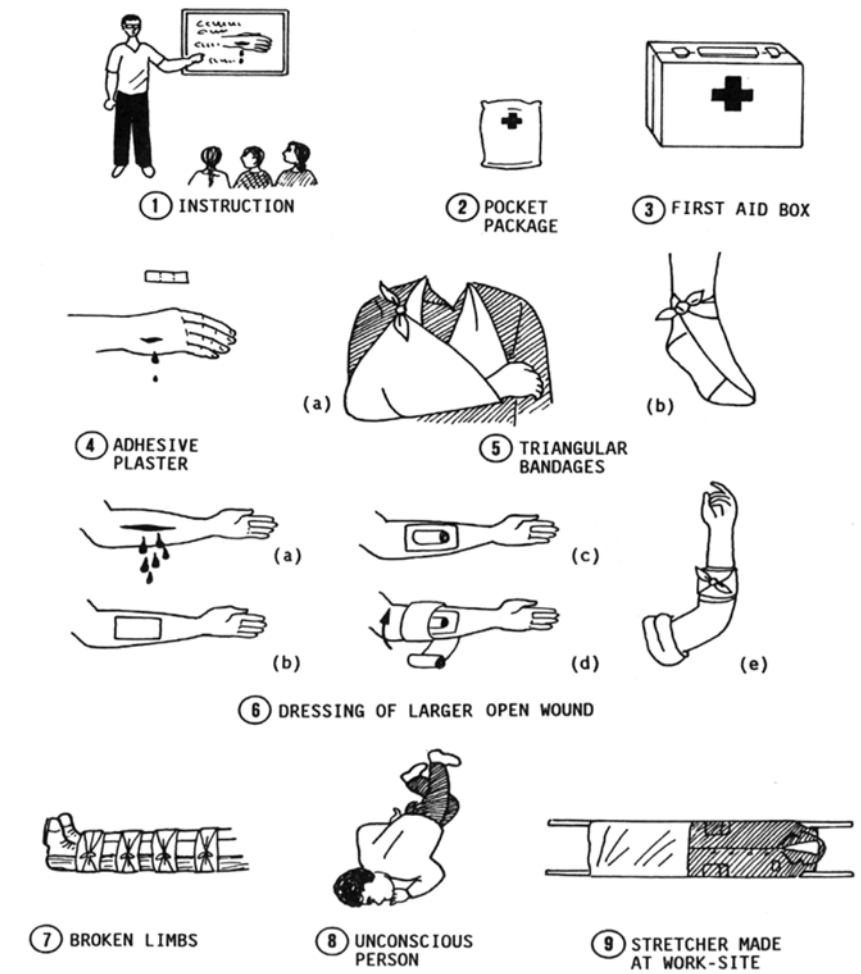
FIRST AID

Training in first aid is very important. In case of accidents, fellow workers should be able to effectively provide first aid. All workers should carry a pocket-sized first aid package. Worksites should include a first aid box containing small and medium-sized adhesive plasters and rolls, roller bandages, sterile compresses, triangular bandages, safety pins, a pair of scissors, forceps, a disinfectant and a short guide.

Workers need to know how to provide first aid for large, bleeding open wounds by covering them with sterile compresses. Some essential first aid advice is provided in Figure 4.

FIGURE 4

First aid essentials. Lives and limbs will be saved if these are practised regularly.



Source: ILO (1992).

PHOTO 18
Good practice. A harvester at work in a storm-damaged area. Mechanization is a dependable way of reducing accidents

PHOTO 19
Salvaging windthrown timber in steep terrain is very dangerous

©Raffaele Spinelli

PHOTO 20
A young (too young?) worker doing a dangerous job with no protection at all in a less-than-ideal working environment

5 Children at work and gender issues

CHILDREN AT WORK AND CHILD LABOUR

Child labour is a major global concern. There are an estimated 152 million child labourers worldwide, of which 71 percent work in agriculture, including forestry (ILO, 2017). Child labour in agriculture is often intertwined with poverty and social injustices and is part and parcel of the production system. The ILO further estimates there are 4.3 million children in forced labour, some 20 percent of the global total.

Key observations by the ILO (2017) include:

- There are signs that overall child labour is decreasing. Since the first global ILO estimate in 2000, child labour has decreased by more than 90 million and the number of children in dangerous work has almost halved. Unfortunately, this trend has not been matched in the agriculture sector, where child labour has increased by 10 million since the previous global estimate released in 2013.
- There is a strong correlation between child labour, conflicts and disasters.
- Most child labour occurs in the family (either on family farms or as part of family work gangs, e.g. on plantations).
- Child labour is most prevalent in low income countries, but is not only a low income country problem
- Boys seem to be at greater risk of child labour, while girls are more likely to face a double burden of responsibility for work combined with greater time spent on household chores (which is not accounted for in child labour estimates).

BOX 7

Definitions and principles relating to child labour

Child labour

Work that impairs children's well-being or hinders their education, development and future livelihoods. A child is anyone up to the age of 18 years.

Age appropriate tasks for children

ILO has determined the following age limits for age appropriate work:

- 13 years for light work
- 15 years for ordinary work
- 18 years for hazardous work

Age appropriate tasks/children's work becomes child labour when children:

- are too young for the work they are undertaking;

Box 7 continues

Box 7 continued

- work for too many hours for their age;
- are not able to fully benefit from compulsory schooling due to work;
- undertake work of a hazardous nature or in hazardous conditions;
- work under slave-like conditions; or
- are obliged to undertake illicit activities.

Hazardous work

Tasks considered hazardous are determined at a national level in consultation with worker and employer organizations.

Light work

According to ILO guidelines, light work is permitted from 13 years of age. An example of permissible light work could be light, non-hazardous agricultural work near home undertaken for a couple of hours after school and under parental supervision. In the absence of specific national definitions, the cut-off point should be 14 hours for a reference week.

Worst form of child labour

ILO Convention 182 (ILO, 1999) has defined the worst forms of child labour as:

- slavery and similar practices, e.g. trafficking, debt bondage, serfdom and forced labour;
- the use, procurement or offering of a child for prostitution or pornography;
- the use, procurement or offering of a child for illicit activities; and
- work likely to harm the health, safety or morals of children (hazardous work).

Youth

- Children have normally reached the minimum age for full employment at the age of 15, which ideally corresponds to the age of completion of compulsory education.
- The United Nations (UN) defines "youth" as persons between the ages of 15 and 24 years. Youth of up to 18 years should not be engaged in hazardous work or other worst forms of child labour.

Source: FAO (2015).

Reliable data on child labour in forestry is almost completely lacking. Nevertheless, ILO (2017) has reported serious violations of fundamental rights in forestry work, including child labour. The ILO (2017) also reports that indigenous communities are subjected to bondage on agricultural and forestry estates and logging concessions. In these circumstances, entire families may be subjected to forced labour.

Child labour is a human rights issue and thus of obvious relevance to occupational safety and health.

The use of child labour in forestry is poorly researched. Practical advice on this topic is therefore not as specific as may be desired.

The ILO's conventions on child labour are legally binding and should be respected. Convention 138 allows children to perform light work from 13 years of age, provided the work is not classified as a worst form of child labour. National legislation determines what is considered light work.

Children undertaking work is not inherently undesirable. Age appropriate tasks that allow children to gain skills can be beneficial to their social development. Moreover, these activities may contribute to the household economy (for definitions see Box 7, above). What exactly is an age appropriate task? National legislation may provide some guidance, but more operational guidelines are needed.

Evidence suggests that children are particularly engaged in harvesting of non-wood forest products. The safety issues related to harvesting these products is summarized in a special section below. Tree climbing is a major hazard. A question parents should ask themselves is whether they would feel comfortable if their child was climbing high trees, even with proper training and equipment.

It is also likely that children work in nurseries, regeneration and stand tending. The relevant safety issues for these tasks are addressed below. Chemicals in forestry are most prevalent in nurseries. Children should also follow all safety prescriptions.

Many countries prohibit work with a chainsaw until a child reaches 18 years of age.

GENDER ISSUES

Forestry and agroforestry systems are not gender-neutral and activities are typically gender-differentiated: men are usually employed in felling and transport activities of forest products, while women tend to play specific roles in forestry and agroforestry value chains and mainly deal with processing and sales of forest products. This does not mean that women cannot also be involved in felling activities and the fact that they mostly deal with the transformation of products does not exempt them from risk of accidents. Falling trees and loose branches, even relatively small ones, are extremely dangerous and can cause serious accidents. Furthermore, the handling of trees during transport and conversion is also a risky job that can result in serious injury.

The persistent lack of gender-disaggregated data in the forest sector makes in-depth analysis difficult. However, because of differentiated societal roles, expectations and responsibilities, female workers are exposed to different physical and psychological risks and may face special and additional problems compared to those faced by men.

In many societies, gender-differentiated behavioural norms and social perception of women's roles, unequal power relations and gender-based discrimination in labour legislation and customary systems persist, denying women access to qualified information, professional education, training and participation in decision-making processes. As a result, women may have lower literacy levels, knowledge, professional skills and technical competencies, as well as less organizational, leadership and entrepreneurial experience. In addition, they often work in the informal economy – sometimes as unpaid family workers – and are absent or under-represented in local workers' organizations, associations, unions and forest user groups.

Women in the forest sector might also encounter a hostile work environment in which they may be unfairly treated and/or sexually harassed by co-workers and supervisors who hold antiquated views about women's presence and abilities in a traditionally male-dominated industry. A hostile work environment can be distracting for female workers, potentially leading to reduced safety performance behaviours and increased safety incidents. Female workers may also be reluctant to report safety concerns for fear of retaliation.

All this makes female workers in the forest sector particularly vulnerable and unable to adequately protect themselves to prevent potential accidents, injuries and risks.

Understanding and analysis of the sexual division of labour, biological differences, employment patterns, social roles and social structures is therefore of paramount importance and can help trainers to recognize gender-specific patterns of occupational hazards and risks.

In traditionally male-dominated sectors such as forestry, women can, for reasons of physiological difference, for example, be exposed more often than men to musculoskeletal disorders (e.g. carpal tunnel syndrome, tendonitis, etc.), respiratory diseases resulting from fire exposure, infectious and parasitic diseases, reproductive disorders due to chemical exposure, healthcare-specific incidents such as needle sticks, and anxiety and stress disorders. It would therefore be appropriate to conduct thorough ergonomics studies for technology-related interventions to address and resolve these gender-specific issues.

Because they often bear the primary burden of domestic and childcare responsibilities, women also experience more work-family conflict than men. This can negatively impact performance and well-being at work and at home.

It is important to meet the needs of female employees in this traditionally male-dominated sector and eliminate gender discrimination. Such discrimination includes a failure to provide skills and safety training to female employees, excluding women from information sharing and failure to provide female-appropriate safety equipment (such as PPE which is usually made to fit an average male). The ultimate goal is not to provide special treatment for women, but rather to ensure that policies, programmes and safety precautions address gender issues, taking into account physiological differences, unequal power relations and sociocultural norms and barriers.

In Occupational Safety and Health (OSH) terms, integrating gender issues and perspectives into the formulation and monitoring of policies, programmes and preventative measures to reduce gender inequality means:

- carefully exploring links between gender roles, safety and health in the forest sector;
- analysing risks to both male and female workers;
- collecting and developing sex-disaggregated OSH data;
- incorporating the findings from OSH research into policy-making and workplace action; and
- fully involving both male and female workers in the decisions that affect their safety and health at all levels.

In particular, empowering women and increasing their participation in decision-making can make an enormous difference. Greater inclusion of women in education,

professional training, safety training courses and rule-making can considerably reduce the level of workplace accidents, occupational hazards and risks. It can also create significant development opportunities for women, generating important spill-over benefits for their households and communities.

The following observations are found in Poschen (2011a):

- In general, women have a working capacity a third lower than men in the forestry sector.
- Women often perform planting and stand tending work.
- Many countries restrict the weight to be lifted and carried by women to 20 kg, a limit often disrespected.
- Carrying excessive loads of firewood has resulted in health complaints, including miscarriages.

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PHOTO 21
A partly protected worker (no eye protection) using an old-fashioned chainsaw with no de-vibration

6 Selected health issues in forestry

As discussed in previous sections, forestry work often involves heavy manual labour, including exposure to machinery vibration and exhaust. Work takes place outdoors, meaning workers are subject to heat and cold and difficult ground conditions. In many areas, animals capable of harming workers, such as snakes, are present. A brief account of some health issues arising in forestry is provided below.

BOX 8

Physical health hazards

Setting limits for an acceptable working environment is difficult. The interaction of temperature, humidity, wind and clothing means conditions may vary even within a single workplace (see text on heat stress and problems relating to PPE and heat).

Shocks resulting from hitting hard knots when de-limbing with an axe, or hitting stones during planting, can cause problems for elbows and hands.

Serious hearing impairments are common among chainsaw operators. The noise levels from chainsaws usually exceeds 100 dBA and a professional operator might be exposed to this for five or more hours each day. As reducing noise levels is difficult, ear protection is essential.

Workers using old chainsaws may suffer from "white fingers" caused by vibrations.

Operators of older machines can be subjected to rain, heat, cold and dust. Machines with open cabins often experience high noise levels. Operating machines in rough terrain can cause lower back pain. Vibrations give rise to repetitive strain injuries (RSI) in the neck, shoulders, arms and hands.

Vibration damped seats can reduce these problems. Improved techniques for handling cranes and job rotation can help to reduce these problems.

Chainsaw work often involves piling (i.e. heavy repeated lifting). The risk of musculoskeletal injury can be very high. The use of maximum force in particular can lead to sudden injuries. The risk of RSI as a result of chainsaw work is generally low. Risks increase when undertaking more specialized work such as felling ahead of a processor.

Even skilled chainsaw operators with good technique should not work for more than five hours a day with the chainsaw running. Adjustments should be made for extreme weather.

Wind is an important factor in chainsaw work. Even moderate winds can make directional felling impossible, and strong winds can bring down trees, making the forest a dangerous working place.

Source: Poschen (2011a).

BOX 9
Biological hazards

Forestry employees are exposed to health hazards from animals, plants, bacteria, viruses, etc. Workers may suffer from allergic reactions to plants and wood (sap, sawdust, bark, thorns, etc.). Protective clothing may be required in some instances. Local knowledge is required for efficient control.

Use of draught animals like horses, donkeys, elephants or oxen can lead to a variety of unforeseen situations, some of which are very dangerous. There is also a risk that these animals will transmit diseases. Draught animals should only be handled by qualified professionals.

The greatest biological hazard in the forestry context is infections and diseases transmitted by, for example, insects, viruses, bacteria and bites from higher fauna. While it is not possible to give an account of all diseases transmittable this way, Augusta (2011) includes an extensive account. In additional to local knowledge, access to healthcare, including inoculations as needed, is important.

The World Health Organization (WHO) provides a general assessment of the snakebite problem (WHO, 2019). The main points are:

- An estimated 5.4 million people are bitten annually, envenoming 2.7 million.
- Snakebite accounts for between 81 000 and 138 000 deaths and three times as many amputations and permanent disabilities annually.
- Those most affected are agricultural workers and children. Because of their smaller body mass, children often suffer more as a result of snakebites.
- Proper clothing, especially footwear, can reduce this problem.

Source: Augusta (2011).

PHOTO 22
Log yard. To be safe, work needs to be well organized.

BOX 10
Chemicals

Many machines used in forestry are powered by two-stroke engines (e.g. chainsaws and brushcutters). All of these emit aromatic and aliphatic hydrocarbons and a variety of impurities. Complaints of irritation of the upper respiratory tract and eyes, headaches, nausea and fatigue can partly be explained by exposure to exhaust from these engines.

Chemicals in forestry are used in nurseries to protect seedlings in the establishment phase and control competition in regenerating areas. Chemicals may also be used to control weeds and insects in young stands.

Workers handling treated seedlings in the nursery and until they have been planted should be informed about risks and safe handling methods, including the need for personal hygiene.

Three very important rules apply to the use of chemicals:

1. Workers working with potentially hazardous chemicals should be properly trained in handling the substances and made to understand the risks involved.
2. Protective clothing as specified on the container must be worn and respiratory devices should be used if toxic chemicals are dispersed. Heat is an issue that must be taken seriously. Work should take place during the coolest hours and windy conditions should be avoided.
3. Chemicals should be dispersed using equipment, in good condition, as recommended by the manufacturer.

Source: Kangas (2011).

HEAT STRESS

Heat stress occurs when the body is unable to dissipate body heat sufficiently to its surroundings. It is important to maintain the body's internal temperature of 37 °C. Otherwise, internal organs will not function properly. Females sweat significantly less than males, which make them more vulnerable to heat stress. Children, especially the young, are more vulnerable to heat stress than adults. Heat stress may increase the risk that pregnant women will give birth prematurely or to babies with birth defects. Warm climatic conditions also affect mood and behaviour, and unsafe behaviour becomes more common in hotter environments, increasing the risk of accidents.

Many activities in agriculture and forestry require protective clothing, which is often designed to prevent contact with surrounding hazards. The use of such clothing may, however, reduce the body's capacity to dissipate heat.

Heat stroke, which can be fatal in the absence of swift, effective treatment, is the most serious health risk posed by heat stress. It develops when a person works for a sustained period in hot conditions, is unable to continue sweating, and the inner body temperature rises rapidly beyond 40 °C. Heat stroke is a medical emergency requiring immediate and qualified care.

A person experiencing heat exhaustion is severely dehydrated and fatigued, often suffers from giddiness and nausea and may have a headache. Sufferers should be moved to a cool environment for rest and rehydration to restore their internal water balance. They should return to work only when fully hydrated, which may take up to 24 hours.

Climatic heat affects labour productivity, primarily through dehydration. It is important, therefore, that management ensures sufficient fluids are available and workers are made aware of the need to remain hydrated. Moderate dehydration amounting to a body mass loss of four percent may reduce physical work output by 50 percent.

Wästerlund (2018) provides recommendations on how to cope with heat in outdoor work including:

- Heat stress can be an issue even in moderate heat, especially if protective equipment restricting heat dissipation is used.
- Coping mechanisms should not be fully delegated to employees.
- In hot environments, workers should wear thin, light-coloured clothing (if protective clothing is not required). Bare skin should be avoided to prevent sunburn and skin cancer.
- Workers should wear broad brimmed hats to protect heads from heat exposure.
- Fluids should be provided at workplaces and workers should be trained to drink frequently. Thirst is not a reliable indicator of the body's requirement for fluids. Training needs to be adapted to cultures prevalent at worksites.
- Rules of thumb regarding the daily intake of fluids range between 2 litres for light work in temperatures about 10 °C to 15 litres per day for hard work in temperatures of about 30 °C. The temperature of fluids should be 15–20 °C. Coffee and tea are to be avoided.
- It is best to drink small quantities regularly.
- Children should not be made to work in hot environments for extended periods. The response of children to work in hot environments is poorly understood.

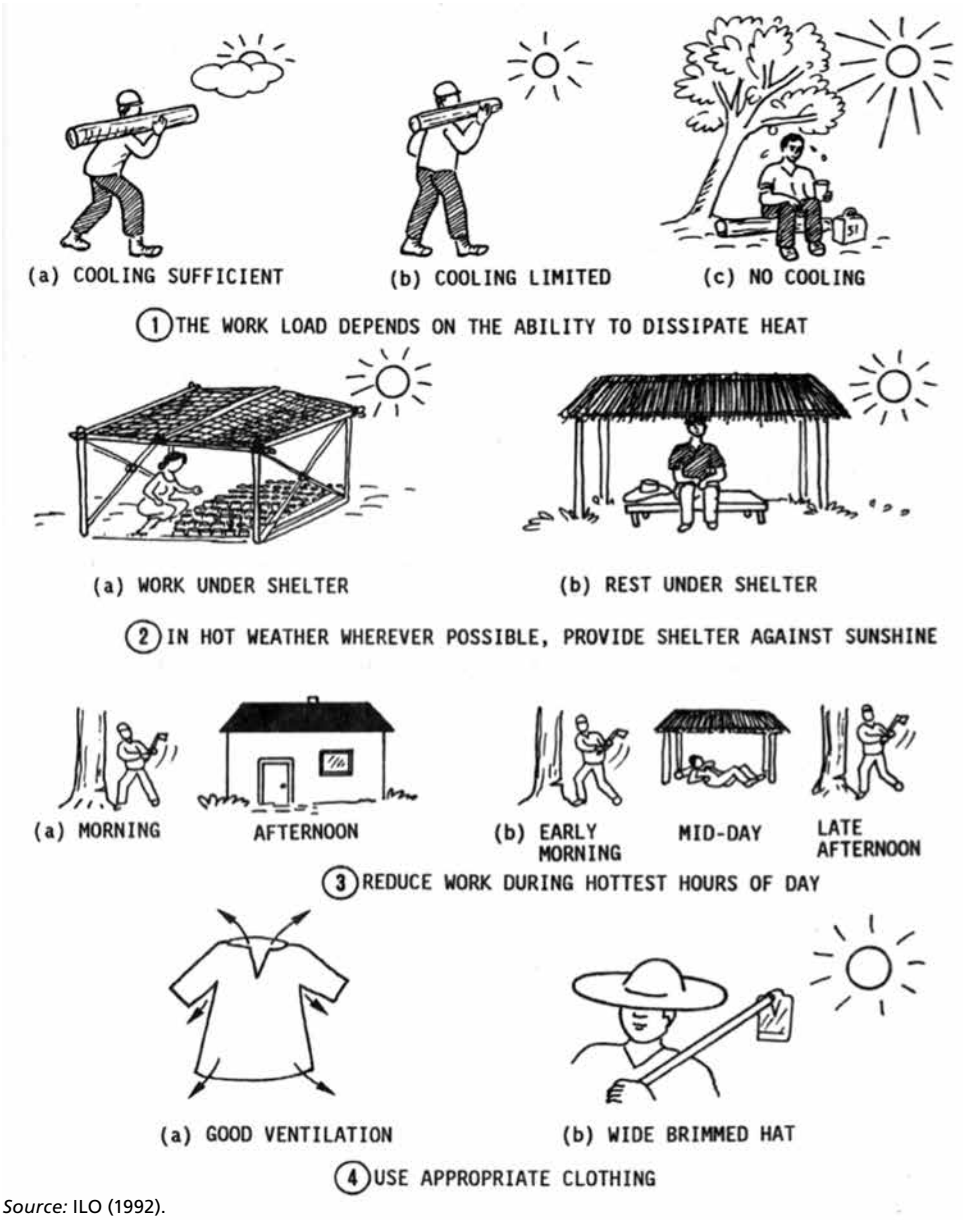
PHOTO 23
Heavy work causing fatigue, heat stress and possibly accidents. Worker adequately equipped.

©Andrew McEwan

When is hot too hot?

There is of course no single answer to this question. The Department of Labor of the United States of America (undated) provides some guidance, Table 7. Figure 5 gives some guidance on how to manage heat at work.

FIGURE 5
Heat stress in a nutshell



Source: ILO (1992).

TABLE 7
Temperatures and required precaution levels.
Fahrenheit (F) has been converted to Celsius (C) according to (F-32) x 5/9

Heat Index	Risk Level	Protective Measures
Less than 32°C	Lower (Caution)	Basic heat safety and planning
32°C to 39°C	Moderate	Implement precautions and heighten awareness
39°C to 46°C	High	Additional precautions to protect workers
Greater than 46°C	Very High to Extreme	Triggers even more aggressive protective measures

Source: Department of Labor, United States of America (undated).

Watch out when:

- the temperature rises
- humidity increases
- heat from the sun increases
- there is no air movement
- no controls are in place to reduce the impact of equipment that radiates heat
- protective clothing or gear is worn
- work is strenuous.

Notes about heat-related illnesses

Heat-related illnesses include heat stroke, heat exhaustion, heat cramps and heat rash. Heat stroke can be fatal and requires emergency care. Symptoms and first aid advice are provided in Table 8.

TABLE 8
Symptoms and first aid advice in case of heat-related disease

Illness	Symptoms	First Aid
Heat stroke	• Confusion • Fainting • Seizures • Excessive sweating or red, hot, dry skin • Very high body temperature	• Call for emergency help While waiting for help: • Place worker in shady, cool area • Loosen clothing, remove outer clothing • Fan air on worker; cold packs in armpits • Wet worker with cool water; apply ice packs, cool compresses, or ice if available • Provide fluids (preferably water) as soon as possible • Stay with worker until help arrives
Heat exhaustion	• Cool, moist skin • Heavy sweating • Headache • Nausea or vomiting • Dizziness • Light-headedness • Weakness • Thirst • Irritability • Fast heart beat	• Have worker sit or lie down in a cool, shady area • Give worker plenty of water or other cool beverages to drink • Cool worker with cold compresses/ice packs • Take to clinic or emergency room for medical evaluation or treatment if signs or symptoms worsen or do not improve within 60 minutes • Do not return to work that day

Table 8 continues

Table 8 continued

Illness	Symptoms	First Aid
Heat cramps	• Muscle spasms • Pain • Usually in abdomen, arms or legs	• Have worker rest in shady, cool area • Worker should drink water or other cool beverages • Wait a few hours before allowing worker to return to strenuous work • Have worker seek medical attention if cramps don't go away
Heat rash	• Clusters of red bumps on skin • Often appears on neck, upper chest, folds of skin	• Try to work in a cooler, less humid environment when possible • Keep the affected area dry
Remember, if you are not a medical professional, use this information as a guide only to help workers in need.		

Source: Department of Labor, United States of America (undated).

PHOTO 24
The personal protection heat dilemma

Protective equipment is worn, as it should be in this type of work. However, wearing protective gear in hot climates can generate heat exhaustion. Workers will need water, rest and shade.

©Andrew McEwan

Basic protective equipment is worn to control heat stress.

©Andrew McEwan

PHOTO 25
Well-prepared food and drinks served at a shaded place near the logging site

PHOTO 26

Machinery at work on a landing. To be safe, work needs to be well organized at landings

©Jonas Cedergren

PHOTO 27
Unsafe behaviour when loading logs at a landing

7 Safety issues

Accounts of some key safety issues in forestry (mainly related to harvesting), followed by advice on how to manage them, are detailed below. This account is by no means complete, but is intended to describe and offer advice on some key safety issues and encourage a "safety first" approach among readers.

WORK WITH CHAINSAWS

As shown in Figure 6 (Härkönen, 1978), the main types of injuries caused by chainsaws are:

- kickbacks
- cutting/ripping with the saw
- noise
- vibrations
- chain breakage

In addition, exhaust fumes are a potential fire hazard during refuelling and can cause burns from accidental contact with hot engine parts.

Kickbacks can occur when the nose of the guide bar is used for cutting with maybe only two cutters in the wood at a given time. When the chain jams – which happens easily – a rapid kickback occurs. In such cases, there is no time to take cover. It is particularly risky when the upper part of the nose is used. Serious injuries caused by kickbacks can be avoided by following the advice below:

- do not cut with the nose;
- kickbacks with short guidebars have less force and short guidebars also make inadvertent cutting with the nose less likely;
- kickbacks are not generally a problem with very long guidebars used only for felling;
- use high quality chains and keep them sharp. Do not lower depth gauges below recommended limits;
- always use a filing gauge;
- grip the saw with your thumb around the handle; and
- check that the front handle guard and chain brake work properly.

Saw cuts may occur when felling trees when attention is directed more towards the falling tree than the chain. The left leg is particularly susceptible to this kind of injury. Most incidents happen when the feller trips or slips. These accidents can be very serious. Risks can be reduced if:

- both hands are kept on the saw when the chain is in motion;
- safety pants or chaps are used; and
- safety boots with heavy grip treads are used.

Noise generated by chainsaws impairs hearing. This is a condition that does not come on suddenly. Rather, sufferers will discover they can no longer hear, e.g. birdsong, while at work.

PHOTO 28
Feller wearing no protective equipment. Remember that you are your own best asset

Earmuffs or earplugs must always be used. Ear protection should be kept clean to avoid ear infections.

Vibrations can cause circulatory disorders in smaller blood vessels. In cold conditions workers may get white fingers and loss of sensation. Chainsaws should always be equipped with dampers between the engine and handle section. Properly sharpened chains help reduce vibrations. Keeping hands and wrists warm during work reduces the incidence of white fingers.

Chain breaks are dangerous as the chain might be running at a speed of 20 metres per second. Accidents can be likened to receiving a lash from a whip, only a lash from a chain with cutters will potentially be far more devastating to the receiver. Most incidents affect the right hand. Fatalities are not unknown.

Chainsaws should have a guard at the rear handle and a chain catcher under the clutch cover.

Risks of breakage are greatly reduced if chains are properly sharpened, correctly tensioned and well lubricated. Before work commences, chains should be inspected for cracks and other defects. Depth gauges that are set too low will cause strain on the chain, so chains should be filed using gauges.

Safe working techniques

Felling a tree is risky and always will be. Figure 6 summarises the main risks involved in chainsaw work.

Risks posed by work with chainsaws will differ depending on the type of operation, size of trees, logging system, type of terrain, forest type and so on. Work in early thinnings in Scandinavia is, for example, quite different to selective logging in tropical high forests. Both jobs include hazards that can lead to serious personal injury. For tropical trees, this is illustrated in Figure 7.

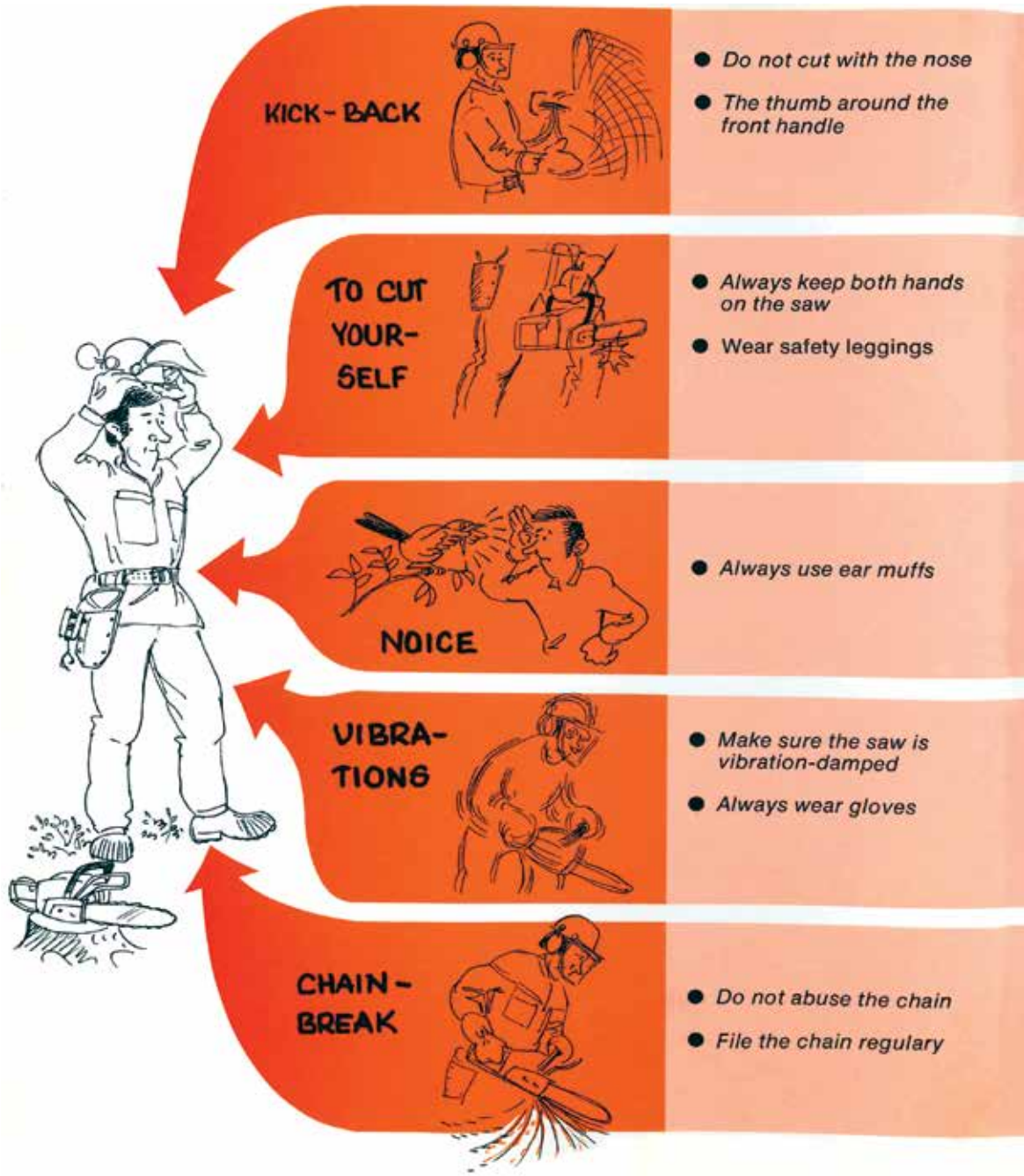
Kickbacks are more common in logging operations where trees are de-limbed, such as in forest plantations.

The advice below is designed to make selective logging less risky:

- Working alone should be avoided in selective logging in natural forest.
- The safe distance from a feller at work is double the height of the tree being felled.
- Two escape routes should be cleared before felling commences – ideally at angles of 135 and 215 degrees from the intended felling direction. Circumstances may, however, dictate otherwise, especially in selective logging.
- Check for dead and hanging branches: they could be fatal.
- Create sufficient clear working space.
- Operating a chainsaw above shoulder height can cause a serious kickback injury.
- Do not walk around with the chainsaw running.
- Beware of falling trees, branches and lianas, especially in selective logging.
- Hung-up trees should be dislodged immediately. Should this prove impossible, an area around the tree must be properly flagged as a warning.
- Use machines with safety cabins to dislodge hung-up trees.

Hazard and risks in tree felling are summarized in Table 9

FIGURE 6
Main risks when working with chainsaws and how to control them



Source: Härkönen (1978).

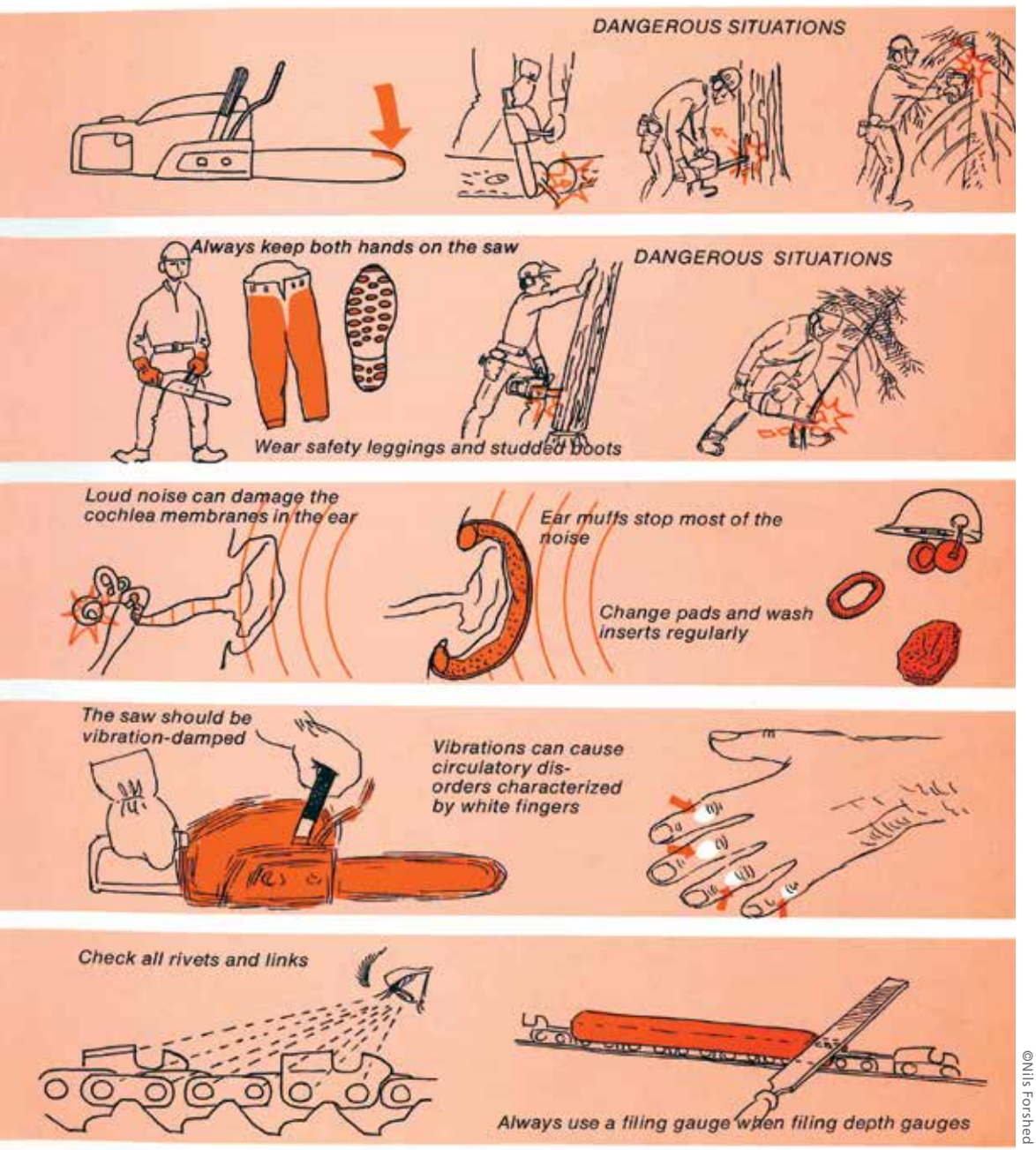


TABLE 9
Hazards and potential risks in tree felling

Task	Physical hazards	Possible errors and violations	Possible consequences	Remedial action		
				Design	Training	Procedure
Preparations for work day	Operating environment	Failure to accurately determine work plan/ other fellers in work	Struck by falling trees/ limbs			pre-work checklist
		Failure to ensure chainsaw is properly maintained/sharpened	Chainsaw slip/ lacerations			pre-work checklist
		Failure to check condition and presence of hammer and wedges, PPE and other safety equipment	Injuries from wedge or hammer, injuries to unprotected body parts (e.g. eyes)			
		Failure to pack adequate food, sun protection and water for weather conditions/ length of time on site	Dehydration, fatigue, sunburn	Appropriate clothing & accessories		
Walk to work area	Slippery conditions underfoot, including slope, mud, slash, logs, rocks	Failure to notice underfoot hazards and adjust walking style to accommodate/ avoid them Rushing and taking short-cuts Walking on logs	Fall injuries Musculoskeletal injuries	Footwear and footwear attachment		
	Tripping hazards, including bushes, rocks, logs, limbs, holes, drains	Failure to notice and adjust walking style to accommodate/avoid them Rushing and taking short-cuts Attention failure/ concurrent visual task	Fall injuries Musculoskeletal injuries	Footwear and footwear attachment		
	Moving vehicles, falling trees	Getting lost Lack of knowledge regarding position of other fellers/vehicles Attention failure/ concurrent visual task	Struck by/blow against injuries	High visibility improvements Person sensors		
Assess stand hazards	Stand characteristics	Failure to adequately assess/analyse felling environment and environmental conditions Failure to identify stand lean	Struck by falling tree/ limb injuries			Checklist for assessing hazards
Fell trees in stand	Tree characteristics	Failure to identify hazards specific to tree lean, limb weight	Struck by falling tree/ limb injuries			Use industry guidelines and procedures

Table 9 continues

Table 9 continued

Task	Physical hazards	Possible errors and violations	Possible consequences	Remedial action		
				Design	Training	Procedure
	Saw	Failure to use correct saw starting procedure	Chainsaw laceration			
	Limbs released under tension when cut Falling limbs, trees, cones or other debris Saw movement under pressure/ kickback	Incorrect cutting practice Failure to adequately consider hazards	Struck by limbs or other objects Chainsaw laceration			
	Hammer or wedge Wedge forced out of backcut by tree movement/ pressure	Incorrect wedging practice Incorrect felling cuts/ chainsaw use Poorly maintained equipment. Failure to wear PPE	Struck by hammer or wedge (most commonly wedge propelled from tree cut) Musculoskeletal problems	Wedge design		
	Hammer or wedge Wedge forced out of backcut by tree movement/ pressure	Incorrect wedging practice Incorrect felling cuts/ chainsaw use Use of poorly maintained equipment Failure to wear PPE	Struck by hammer or wedge (most commonly wedge propelled from tree cut) Musculoskeletal problems	Improved foot/ hand/ arm protection Lighter chainsaw design		
	Falling tree being felled Hang-ups, windthrow Falling limbs, cones and other debris Chainsaw kickback	Incorrect felling practice (e.g. standing in wrong position) Violation of no standing within two tree lengths rule and other felling rules Felling into standing trees Failure to avoid overhead hazards Failure to wear appropriate PPE	Struck by tree being felled, falling limbs and other debris Struck by hang-ups, butt rebound Chainsaw laceration Foreign body injuries			
	Underfoot hazards – trip and slip Falling tree debris	Failure to turn off chainsaw or activate chainbrake once cuts completed Failure to follow planned escape route Failure to clear adequate escape route (e.g. leaving potential tripping hazards)	Chainsaw lacerations Struck by tree being felled, hung-up, falling limbs and other debris Slip, trip or fall injuries Musculoskeletal injuries			

Reproduced from Ashby et al. (2002).

FIGURE 7
Potential causes of fatal injury during tropical tree felling

Examples of risks when felling a big tree in a natural forest

When trees fall they may pull down other trees (1). Branches from neighbouring trees (2 and 3) break and may swing backwards (4). Climbers are torn off or may break and snap back (5).

Source: FAO and ILO (1980).

PHOTO 29
Work at a landing with many opportunities for things to go wrong

WORK AT LANDINGS

The log landing brings together ground workers and machinery operations, creating risks which should be carefully managed. Initial planning for the log landing and workflow will minimize potential problems.

Hazards and risks at landings include:

- falling trees or limbs
- moving machinery
- rolling or sliding logs
- chain-shot or other material thrown by machinery on landing
- uneven ground
- slips and trips
- skin exposure to hazardous chemicals.

Everyone present at a landing should understand the meaning of hand signals, whistles and horns. Chasers, for example, should signal to yarder operators to control the landing of logs; those doing saw work should visually communicate with loader operators; trucks and loader operators establish horn signals to control movements. When signals are unclear, lines and machines should not move until the signals are acknowledged. Visual signals should be given from positions in the clear. There should be no excess communication! Problems should be resolved before work begins. When an

PHOTO 30

Typical scene from a landing with big logs and heavy machinery, and risks for serious accidents

PHOTO 31
Log loading at a landing; accidents using this method could be very serious

unusual activity is called for, communicate before you begin. When a hazard is spotted, everyone should take responsibility for correcting it.

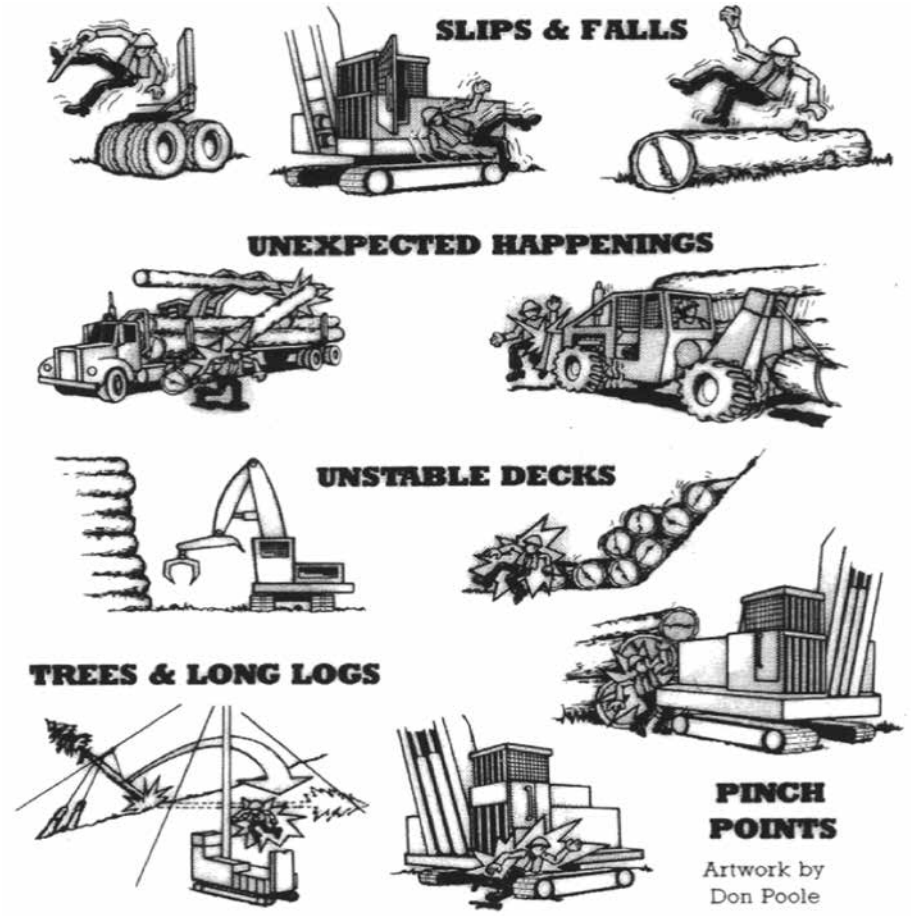
Landing arrangements, traffic routes and log handling will minimize hazards. Loading positions, deck locations and limbing areas will be identified to make work safe. There should be truck turnarounds, fire truck parking, etc. Pinch points should be eliminated or barriers erected. Everyone should know the hazardous areas of moving lines or machines. As conditions change, the landing should be reorganized to be safe and effective. Everyone must be responsible for keeping the landing clear and organized. Someone must be responsible for maintaining tools and rigging in assigned locations. Machine operators need to take care of their own machines, oil spills, access ladders and so on. Gravity is always acting on logs and lines to move them in unpredictable ways. Before releasing control, make sure the situation is stable. Stabilize any known points of instability before continuing work. If something gets out of control, rash decisions should not be taken that may compound the problem. Think the situation through and regain control.

Workers should not put themselves or their machines in a position that creates a hazard. Workers should position themselves where they can be seen. Brightly-coloured vests and hard hats should be worn. Workers should face hazards and avoid being blindsided. They should signal before changing position. They should know their limitations and those of their machines, and when to reposition.

When work settles into a comfortable routine, the landing team will know what to expect of other workers. Patterns are familiar to old hands but new workers need full explanations. Problems arise when routine work masks hazards and one makes assumptions about what workers will do. One must be able to predict how the work will go, how the machinery will move, where the logs will go and then allow oneself a margin of safety for the unexpected. Figure 8 gives a summary of some safety issues at landings.

FIGURE 8
Hazards at the landing

The landing is a concentration of logging activities in a confined place. There are several kinds of hazards commonly recognizable at landings. Solutions to the hazards vary depending on how your landing arranges its work, but there are some common characteristics of safe and efficient landings. Let's look at hazards first:



Source: Garland, undated d.

IN THE CLEAR

No places on a logging operation are absolutely safe. There are places "in the clear" where work takes place and workers have the best chance of avoiding injury if the unexpected happens. For new workers, "in the clear" means doing exactly what experienced crew members tell you to do. Forest workers must make judgments about what being in the clear means for their jobs. This is illustrated in Figure 9.

There are no absolute distances measured in feet or inches to put you in the clear. Experienced loggers know an impact zone surrounds every activity (e.g. falling trees, upended logs). There is also a secondary danger zone where trees hit one another and knock them down or logs trigger other log movements. Sometimes guidelines such as "twice the height of trees" or "twice the length of logs" are used to help workers make judgments about safe distances.

You might use natural barriers like being behind trees, rocks or large stumps or over a ridge to get in the clear. Stay on your feet and pay attention to hazards in front of you, but keep alert in all directions – especially uphill where gravity can send hazards your way.

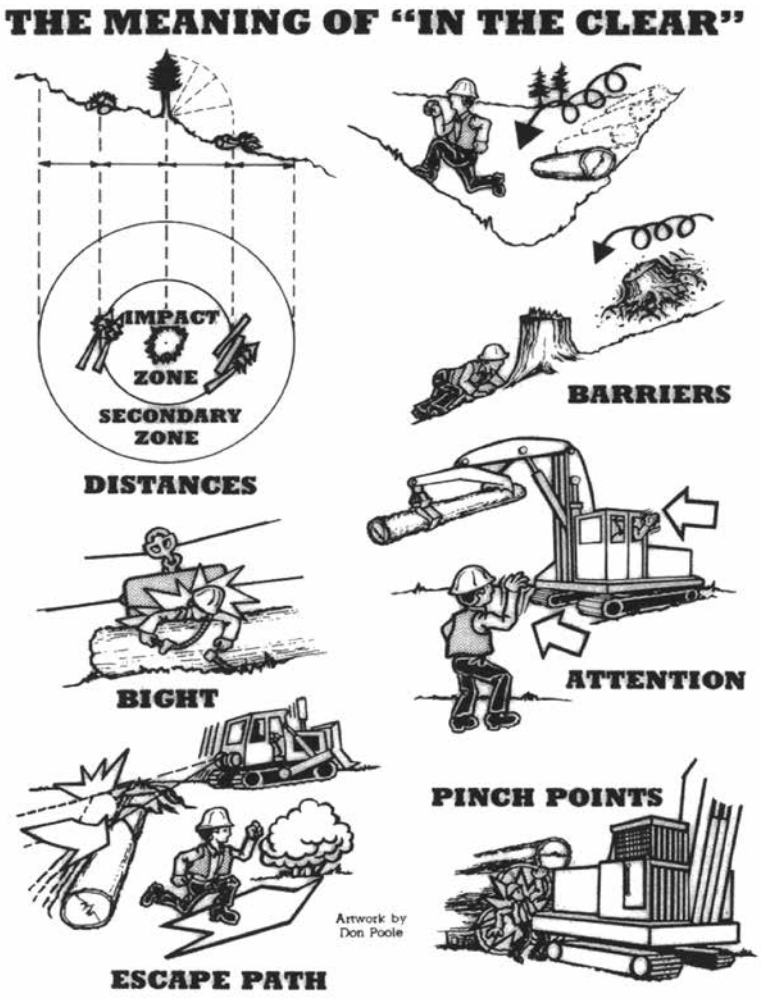
For equipment operations, being in the clear means putting enough distance between yourself and the machine that a sudden unexpected movement would not put you in jeopardy. Get the logger's attention before you pass any logging machine. Stay out of the "bite" (locations where, if rigging failed or lines broke or slackened, the slashing or falling lines would be deadly).

Being in the clear means having a clear path of escape available and avoiding working in hazardous, confined places (watch pinch points). Its meaning varies with every logging situation. It is a matter of knowing which hazards to expect, how unexpected actions can trigger other hazards and putting enough distance or barriers between you and the likely hazards.

You must make the final judgment!

PHOTO 32
Putting "in the clear" into practice

FIGURE 9
Are you really "in the clear?" You may have to think twice before deciding.



Source: Garland, undated e.

BOX 11
Potential failure zones in cable yarding

Loggers need to estimate where an in the clear position is by identifying the "potential failure zone" of the operation, especially trees and rigging. This zone can be defined as:

Box 11 continues

Box 11 continued

Potential failure zone: an area that could be impacted by the failure of any part of a standing tree anchor, tail or intermediate support tree as the result of forces or loads imposed on the tree by guy lines, running lines or skylines. The boundaries of the zone encompass the area into which the tree, or parts of the tree, could fall, slide or roll and all trees, logs, lines and material be impacted by the tree failure.

Working near standing tree anchors and tail/intermediate support trees

1. Affected personnel must be notified of the potential failure zone of any tail tree, intermediate support tree or standing tree anchor.
2. A competent person must determine the boundaries of the potential failure zone.
3. The boundaries of the potential failure zone must encompass all trees, logs, lines and material that could be impacted by the tree failure and the area into which the tree, or parts of the tree, could fall, slide or roll.
4. Before lines are tensioned, personnel must be in the clear of the turn and the potential failure zone of a standing tree skyline or running line anchor.
5. Personnel working around tail and intermediate support trees must be in the clear of the turn and out of the potential failure zone before lines are tensioned.
6. If the potential failure zone cannot be determined, personnel must move at least 1.5 tree lengths from the base of tail and intermediate support trees. They must be in the clear before lines are tensioned.
7. A competent person must instruct affected personnel in the safe work practices required for work activity in any potential failure zone. This instruction must identify the:
   (a) boundaries of the potential failure zone;
   (b) potential for the boundaries of the failure zone to change when line pull and line angles change; and
   (c) limitations or restrictions on entering or working in the potential failure zone.

Source: Garland, Undated f.

SALVAGE LOGGING

Salvage logging is the removal of trees that are dead, damaged or dying as a result of injurious agents (other than competition) in order to recover economic value that would otherwise be lost. It is sometimes referred to as salvage cutting or salvage felling. Wind, fire, insect infestation, disease, tsunamis and floods may cause large-scale forest damage. In the aftermath of a natural disaster, timber from salvage operations can provide immediate relief (e.g. energy and shelter) and be used for reconstruction.

Work in forestry is sometimes referred to as a "3D" job: it is dangerous, difficult and dirty. A fourth D, for deadly, is sometimes added. As discussed in previous parts, workers often lack training in some countries which, when combined with difficult operating conditions in salvage logging, can lead to accidents. Chainsaw work in salvage operations is considered to be among the most dangerous civilian jobs in the world.

PHOTO 33
Salvage logging in northern Italy

Although it is difficult, if not impossible, to avoid accidents entirely, proper working techniques and appropriate planning to reduce hazards can reduce their frequency. The establishment of priority salvage areas and a structured working sequence, as well as an assessment of the timber volumes available for salvage, will enhance salvage efficiency. Planning instruments and assessment methods are required for these tasks.

Salvage operations differ significantly between regions. Large-scale wildfires are, for example, uncommon in North and Central Europe, but quite prevalent in North America and Australia. Different technologies will be employed depending on forest and tree types (e.g. natural vs. plantation forests, hardwoods vs. softwoods). Salvage operations have been the subject of few studies. Operational planning, post-disaster priority setting and methods to assess damaged area and volume have received only limited attention. Similarly, specific safe working techniques for felling, cutting, preparing and extracting wood from damaged areas in salvage operations have not been studied extensively.

Windthrow can cause (Ministry of Fisheries and Forests, Fiji, 2008; WorkSafe New Zealand, 2014):

- unstable root plates
- suspended stems under high tension and compression
- stems wedged between standing trees
- stems leaning into standing trees
- uprooted trees/flat on ground
- spars
- shattered tops
- stem snap (broken trees)
- suspended hazards
- wind lean (whole tree bent like a bow)
- top lean (lower half of tree straight, top likely to straighten up again)
- restricted access, i.e. heavy slash
- undesirable or disrupted felling patterns
- defoliation.

In addition to the damage listed above, fire can lead to:

- dead and brittle material in the heads of trees
- unstable burnt stems
- charcoal and ash.

Insect damage can cause:

- dead and brittle stems
- unstable stems in strong winds.

Finally, hazards and risks in tree felling are summarized in Table 9. Advice on how to work with blown-over trees was compiled following the cyclone Lothar, which hit Germany in 1999 (Odenthal-Katabka, 2005). It includes the following essential advice:

- No one should work alone in the forest.
- Keep in contact with other people (visual, verbal communication, radio contact).
- The nearest meeting point must be named in work instructions.

- If an accident occurs do not transport the injured person to the meeting point or to the hospital on your own.
- During the rescue operation, remember: Safety before haste!
- Late help is better than no help at all. Attach great importance to your own safety!

SMALL-SCALE SAWMILLING

This section concerns on-site conversion of logs, mobile and semi-mobile sawmills, and small-scale sawmills more generally. In many regions, small-scale sawmilling is an important source of employment. These sawmills can be broadly classified as:

- chainsaw mills
- single circular-sawmills
- twin circular-sawmills
- bench-type mills with a small circular saw
- horizontal band sawmills
- band sawmills

Safety and health hazards and issues arising in these mills include rolling and falling logs. Methods to mitigate these hazards include hydraulic lifting and designs with logs at ground level. Falling and slipping into blades/bands is an obvious hazard that can have disastrous consequences. Falling into the saw when removing lumber is a very serious hazard, while manual lumber lifting can cause damage to hands. Hands are also at risk from stacking and loading. Damage from wood slivers is an almost constant risk. Table 10, page 94, provides a list of methods to reduce these risks.

Slips, trips and falls are general hazards with potentially disastrous consequences. Workers can also be exposed to toxic chemicals like fuels, oils and solvents.

Finally, it is important that the design capacity of equipment used is not exceeded. Logs too big can cause blades to jam, and logs too heavy can cause supports to collapse.

Health hazards in small-scale sawmilling include (Garland, unpublished):

- muscle damage from heavy lifting;
- cumulative trauma to back, legs and muscles from improper lifting techniques;
- hearing damage from noise;
- lung damage from sawdust, some of which may be carcinogenic;
- damage from exhaust gases; and
- infections caused by wood slivers.

Studies examining occupational safety and health in small-scale sawmilling in Ghana, Kenya and Nigeria (Bello and Mijinyawa, 2010; Ekhuemelo and Ojo, 2016; Ogoti Mong'are *et al*., 2018; Ochire-Boadu and Lawer, 2014; and Odibo *et al*., 2018) come to the following general conclusions:

- Dedicated training programmes are required: learning by doing is not sufficient.
- Refresher training provided at regular intervals is needed.
- Training is also needed for employers.
- Use of protective equipment is lacking and attitudes to its use must improve.

SafeWork Australia (2014) summarizes hazards in mobile sawmilling and makes recommendations on how to control them (see Table 10):

TABLE 10
Specific hazards, risks and control measures associated with mobile sawmills

High risk activity or hazard	Reduced risk solution	Preferred solution
Material from saw blade/band flying towards operator	Personal Protective Equipment, e.g. eye protection	Operator does not stand on the cutting line of the saw
Operator's fingers or limbs coming into contact with saw blade/band	Use mechanical device to feed logs through saw bench	Saw blades guarded Machine cannot operate while hands remain in contact with the material being cut
Moving and locating logs manually	No interim solution	Logs moved and lifted by machine fitted with rollover and falling object protective structures
Manually lifting and stacking firewood, boards or sleepers	Regular housekeeping to minimize the effects of sap and reduce force	Mechanical aid to lift boards, posts and sleepers

Source: SafeWork Australia (2014).

NURSERIES AND TREE PLANTING

Nursery workers work with a lot of moving machinery (e.g. fork lifts and trucks), can be exposed to chemicals and are often exposed to heat. Repetitive tasks and working for an extended period in the same position are major causes of overuse and musculoskeletal injuries (MSIs) among workers in greenhouses and nurseries (Anonymous, 2011). These injuries will not only prevent them from working, but can also affect their quality of life for weeks, months or even years.

Work in nurseries and especially within greenhouses poses significant risks for heat-related illnesses. Work schedules should, therefore, minimize exposure to heat and ensure employees do not work for prolonged periods in hot environments. Breaks should be taken in a cool, shaded or well-ventilated area rather than in the greenhouse itself.

Many countries regulate how dangerous substances should be marked. In British Columbia (Canada), for example, workplaces using materials identified as hazardous by the Workplace Hazardous Materials Information System (WHMIS) must follow WHMIS requirements (Anonymous, 2011). Consistent labelling standards help workers to recognize hazardous materials. Labels provide specific information on handling, storing and disposing of hazardous products. Additional regulations may govern the use of pesticides and other poisonous chemicals.

Training of nursery staff should cover heat stress, the risk posed by traffic in the nursery and customized training based on the chemicals used.

Tree planting is difficult work, involving significant cardiovascular and musculoskeletal strain. Yet the safety and health of tree planters has been the topic of few studies. Ninety percent of planters interviewed for a study in British Columbia (Smith, 1987) had suffered illness, injury or accident at some point in their careers. Accident and injuries seem to predominantly affect the lower extremities (see Table 11 and Figure 10 for details).

Long work days, strict quality control, commuting and piece-rate payment may contribute to fatigue and stress. Good working techniques and regular breaks both increase daily output and help to reduce these problems.

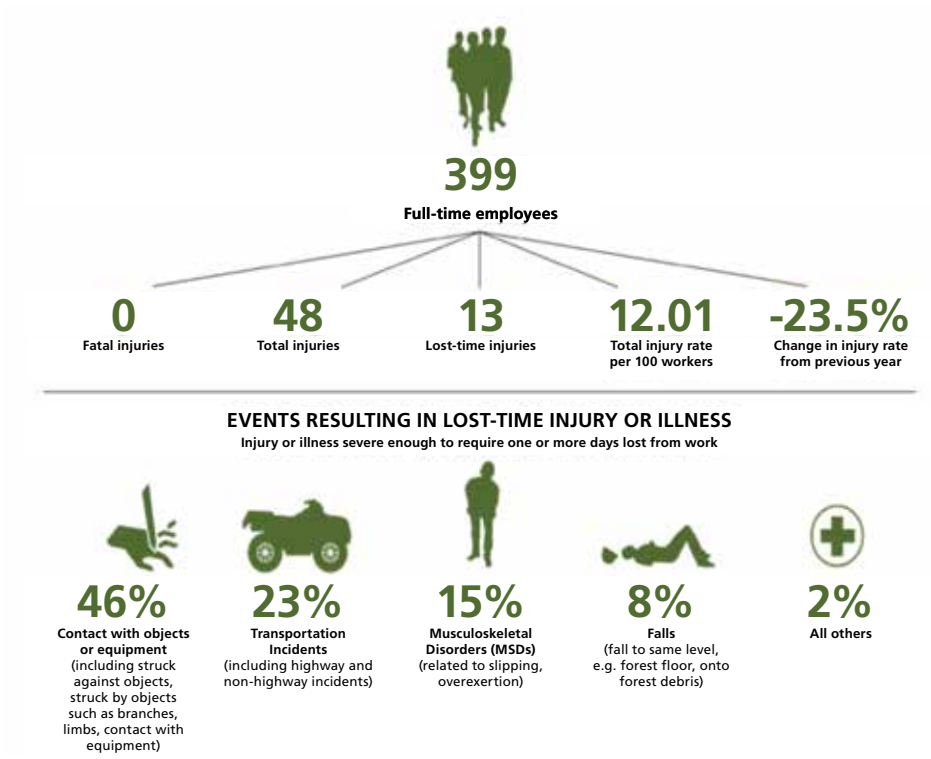
TABLE 11
Tree-planting accidents by affected body part

Body part	Percentage of total	Related causes
Knees	14	Falls, contact with tool soil, compaction
Skin	12	Equipment contact, biting and stinging insects
Eyes	11	Insects, insect repellents, twigs
Back	10	Frequent bending, load carrying
Feet	10	Soil compaction, blisters
Hands	8	Chapping, scratches from contact with soil
Legs	7	Falls, contact with tools
Wrists	6	Hidden rocks
Ankles	4	Trips and falls, hidden obstacles, contact with tools
Other	18	

Source: Giguere *et al*. (1991 and 1993).

PHOTO 34
A very dangerous working environment;
photo taken hours after Hurricane Alfrida struck Finland in early January, 2019

FIGURE 10
Ontario tree planters: worlplace safety and health snapshot 2014



Source: Workplace Safety North (2014).

Heat stress can be serious (see separate section dedicated to heat management).

Handling freshly sprayed seedlings may expose workers to pesticides and fungicides. Insect repellent can cause eye irritation.

Tree planting often entails carrying heavy loads to remote working sites.

NON-WOOD FOREST PRODUCTS

Non-wood forest products (NWFPs) are harvested by a very large number of people globally. Harvesting NWFPs is arguably the most common form of forest work. A multitude of hazards is associated with harvesting NWFPs, hardly surprising given they represent a very wide variety of forest products.

PHOTO 35
Unprotected worker in a small sawmill

PHOTO 36
Circular saw, unguarded

PHOTO 37
On-site conversion (a form of small-scale sawmilling): a challenging/dangerous work environment.

©Hubertus van Hensbergen

Risks and hazards associated with NWFPs differ from those resulting from timber harvesting. Security is an issue in many areas (e.g. firewood collection) and can pose serious risks to workers.

Non-wood forest products are harvested for a range of needs and purposes (subsistence, commercial or hobby/recreational). The hobbyist collector is much less likely to expose himself to risk than those who collect for a living.

The safety of the lone worker in a remote location can be problematic. Help may be unavailable in emergencies. While the absence of help may not affect the frequency of accidents, it can considerably increase their seriousness.

The environment in which NWFPs are found and the methods used to harvest them are often inherently hazardous. In addition, harvesting a product might entail exposure to

biological agents (a poisonous plant surface or poisonous snake), biomechanical hazards (e.g. due to repetitive movements or heavy loads), climatic conditions, safety hazards from tools and techniques (such as a laceration due to a careless cutting technique) and other hazards (e.g. difficult terrain, river crossings or working off the ground).

Manual harvesting methods are more common (including draught animals for harvesting and transport) than in other industries.

Cutting is probably the most recognizable and common cause of hazards associated with the harvest of NWFPs. Potential hazards are linked to tool selection and quality, size/type of the required cut, force required to make the cut, positioning of the worker and worker attitude.

The use of appropriate, well-maintained and sharp tools can mitigate cutting hazards. Proper cutting techniques will, of course, lower risks. Training in planning, risk assessment and site preparation can also contribute to a safer work environment.

Workers harvesting NWFPs are particularly vulnerable to the environmental effects of geography, topography, climate and season. After considerable physical effort has been exerted and fatigue sets in, weather conditions can contribute to work-related health problems and accidents (see Table 12).

TABLE 12
Non-wood harvesting hazards and examples

Non-wood harvesting hazards	Examples
Biological agents	Bites and stings (external vector, systemic poisons) Plant contact (external vector, topical poisons) Ingestion (internal vector, systemic poisons)
Biomechanical action	Improper technique or repetitive-use injury related to bending, carrying, cutting, lifting, loading
Climatological conditions	Excessive heat and cold effects, either externally induced (environment) or due to work effort
Tools and techniques	Cuts, mechanical hazards, draught animal handling, small vehicle operation
Other	Armed conflict, criminal assault, altercation, animal attack, difficult terrain, fatigue, loss of orientation, working at heights, remote locations, work on or crossing waterways

Source: Heinrich (2011).

PHOTO 38
Field training of tree planters

PHOTO 39

An example of conflicting interest. An area that has recently burnt. The many dead trees are valuable for biodiversity. They are also a very real danger for planters

Appendix

ILO CONVENTIONS AND GUIDELINES RELEVANT TO OCCUPATIONAL SAFETY AND HEALTH IN FORESTRY

Member states that sign ILO conventions are legally bound to uphold them. The ILO Governing Body has identified eight "fundamental" conventions, covering subjects considered to be fundamental principles and rights at work: freedom of association and the effective recognition of the right to collective bargaining; the elimination of all forms of forced or compulsory labour; the effective abolition of child labour; and the elimination of discrimination in respect of employment and occupation.

The eight fundamental conventions are:

1. Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
2. Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
3. Forced Labour Convention, 1930 (No. 29) (and its 2014 Protocol)
4. Abolition of Forced Labour Convention, 1957 (No. 105)
5. Minimum Age Convention, 1973 (No. 138)
6. Worst Forms of Child Labour Convention, 1999 (No. 182)
7. Equal Remuneration Convention, 1951 (No. 100)
8. Discrimination (Employment and Occupation) Convention, 1958 (No. 111)

The ILO Governing Body has also designated another four conventions as governance (or priority) instruments, thereby encouraging Members to ratify them because of their importance to the functioning of the international labour standards system.

The four governance conventions are:

1. Labour Inspection Convention, 1947 (No. 81)
2. Employment Policy Convention, 1964 (No. 122)
3. Labour Inspection (Agriculture) Convention, 1969 (No. 129)
4. Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144)

Other relevant conventions include:

- The Minimum Wage Fixing Convention, 1970 (No. 131) covers the main aspects of fair pay for workers. It requires countries to establish legislation for minimum wages for all appropriate wage-earning groups.
- The Human Resources Development Convention, 1975 (No. 142) requires ILO member states to develop policies and programmes of vocational training sufficient to meet employment needs.

- Convention 155 requires arrangements be put in place to ensure workers and their representatives are given appropriate information and training in OSH. This is related to Convention 161 on Occupational Health Services.
- The Indigenous and Tribal Peoples Convention, 1989 (No. 169) aims to protect the rights of indigenous and tribal peoples in independent countries and to guarantee respect for their integrity.

Sectoral guidelines and codes of practice are not legally binding, nor are they subject to ratification or to the ILO's supervisory mechanisms. They are, however, based on the full principles, rights and obligations set out in international labour standards, and nothing set out in sectoral guidelines and codes of practice should be understood as lowering such standards. Two influential ILO publications in this respect are the 1998 "Safety and health in forestry work" and the 2006 "Guidelines for labour inspection in forestry."

PHOTO 40
Poster at a worksite in Zambia

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For more information, please contact:

Forestry Department
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00153 Rome, Italy
E-mail: fo-library@fao.org
Web address: www.fao.org/forestry/en

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