

Eye Protection for Tree Planting: Risk Assessment

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Introduction

In recent years, several tree planting operators have encountered demands to use eye protection when planting. In some cases, these requirements are linked to specific site conditions such as recently brushed areas with excessive sharp upturned branches. In other cases, these requirements have been part of a more general policy from licensees for the use of eye protection by all workers regardless of their job or task. Tree planting workers have expressed concerns about the blanket assignment of eye protection for their work and have reported that the use of eye protection interferes with their ability to do their job. In response to these reports, the Forestry Safety Advocate has prepared this briefing to examine the use of eye protection in planting, and to help identify how and when such equipment may be appropriate.



This briefing note does not address any specific case or policy regarding eye protection, as each situation demands a thorough job-specific risk assessment that recognizes applicable regulations, guidelines, standards, and best practices. However, licensees that issue blanket policies for their contractors' workers to use eye protection not only may increase risks for workers, but also may run contrary to the Occupational Health and Safety Regulation and its guidelines.

Currently, the majority of tree planters do not wear (non-prescription) protective glasses, and there are no known planting employers that include eye-protection as a mandatory piece of personal protective equipment for general tree planting operations. Use of eye protection is required for some tasks performed in tree planting workplaces, including when operating ATVs (OSHR Section 16.54) and when operating other machinery (i.e. pumps and generators) in accordance with manufacturer specifications. However, there is no regulatory requirement for eye protection to be used when planting trees.

In evaluating the use of eye protection in any operations, the following considerations apply:

- The standard hierarchy of preventive controls endorsed by WorkSafeBC should be recognized and applied, with engineering and administrative controls evaluated prior to deciding to use personal protective equipment (PPE). If PPE is chosen to protect the eyes, there should be clear reasons why the other forms of control are insufficient. Engineering controls may be suitable for fixed work stations or use of machinery that may pose hazards to the eyes. Administrative controls may include training and education initiatives to help workers avoid eye injuries.
- Section 8.3 (1) of the OSHR (selection, use and maintenance of PPE) requires that PPE not in itself create a hazard to the wearer, and be compatible, so that one item of PPE does not make another item ineffective. This means that protective glasses must not create new hazards and must work interact effectively with head protection.
- The decision to require the use of eye protection must consider potential impacts it may have on worker safety, including interference with their vision. As per Section 8.3(2) of the OSHR guidelines, "If the use of personal protective equipment creates hazards equal to or greater than those its use is intended to prevent, alternative personal protective equipment must be used, or other appropriate measures must be taken." Therefore, consideration of eye protection in tree planting MUST identify and evaluate impacts on workers' ability to see and use their eyes to navigate their worksites and weigh these against any risks mitigated by use of glasses.
- Non-prescription eye protection must be provided and paid for by the employer (OSHR Section 8.2). This includes replacement of PPE that becomes worn or unusable through the normal course of work.
- Section 8.4 of the OHSR requires that workers and their Joint OH&S Committee be consulted in the evaluation of a workplace when considering the use of any PPE. This requirement clearly indicates the need for consultation PRIOR to implementing PPE requirements, and not after the fact.
- Face protectors and non-prescription safety eyewear must meet the requirements of:
 - (a) CSA Standard CAN/CSA-Z94.3-92, Industrial Eye and Face Protectors, or
 - (b) ANSI Standard Z87.1-1989, Practice for Occupational and Educational Eye and Face Protection.

Job Analysis

The most common accident types in tree planting are falls (on same level or from elevation) accounting for 28% of injury claims (2014-2018), with bodily motion being the most common source of injury (27%), and strains being the most common nature of injury (34%), and hands/fingers/ wrists being the most common body part injured (21%).¹ Lower extremity (leg, foot, knee) injuries as a broader category account for 28% of injury claims. Evaluation of eye protection for workers should include consideration of the most common types of injuries in the sector (falls and bodily motion) and the impact that glasses may have on workers' ability to manage these risks. By comparison, eye injuries account for 5% of claims. It is unclear, however, if the reported eye injuries actually occurred during the act of planting trees. Reports from the field indicated that eye injuries in companies registered in classification unit (CU) 703016 (tree planting or cone picking) have occurred due to various mechanisms of injury. These include splashing of chemicals into the eye, sudden release of metal-tipped elastic bungee cords, being struck by branches or other objects while planting trees, and using powered hand tools. While powered tools are not integral to the planting of trees, they may be utilized during maintenance or camp-related activities. It is noted also that many companies registered in CU 703016 also perform a small amount of brushing or clearing work using power saws while not being required to register in a separate CU. Most companies have implemented controls to protect workers eyes from the more serious risks, including mandatory eye protection when refueling machinery, using saws or other powered machinery, and eliminating elasticized bungee cords from use in securing boxes or securing FIST (truck) doors.

Anecdotal reports from the field indicate that it is common for workers to get loose debris in their eyes while planting trees, but this is generally low-velocity contact from dirt and debris kicked up by their shovels, rather than high-energy impacts as one may experience from debris ejected from a saw blade or other machinery. Clearly a proper risk analysis would seek additional information on these injuries to identify both the body part injured, and the mechanism of injury. Most importantly, the actual risk to workers' eyes while planting trees is based on hazards specific to the terrain. Workers have reported that they have utilized eye protection on worksites with notable hazards to their eyes, including recently brushed worksites with a proliferation of sharp cut-off branches, and under-story replant sites and burned juvenile forest replants where there are numerous broken or burnt branches at eye level. In these sites, workers have reported that glasses are not always fully effective as branches can easily slide under the edge of glasses, and workers tend to avoid the obvious objects that are immediately in their frontal field of view.

Many tree planting employers thus complete an evaluation of eye hazards as part of their evaluation of each worksite and prescribe eye protection when the site conditions require it. In short, eye hazards are generally seen as specific to individual worksites rather than the general

¹ WorkSafeBC Statistics. (2019). Classification Profile: 703016 Tree planting or cone picking. Years: 2014-2018.

job of planting trees, and eye protection is generally prescribed to specific tasks (such as operating machinery or handling fuels) when they are performed in tree planting worksites.

Use of eye protection for tree planters requires further consideration of the job and its unique demands in order to apply the OSHR's requirements to identify potential hazards created by the PPE.

Tree planting is among the most physical demanding tasks done in forestry, with workers exerting themselves at levels comparable to that of elite athletes, including reaching 40-60% of VO2 max (cardio performance) for up to 6 hours during the course of a working day.² These unique circumstances derive from workers needing to move quickly across variable terrain, while carrying significant loads, and continually bending and moving to plant trees. Workers perform their job in all weather conditions, and only cease work when rain exceeds safety thresholds for erosion or landslide, when winds threaten to fall timber, or when snow covers the ground.

It is imperative that tree planters maintain clear vision while working, as their job requires them to collect and process a wide range of visual information in order to identify appropriate planting spots and soil mediums, distinguish between different species of small seedlings, evaluate ground grade and footing when walking, and keep track of distant landmarks while traversing several hundred metres across cut-block settings. Workers must continually shift their vision from the ground (as they plant) to the horizon (as they navigate) and thus deal with constant changes in lighting and sun glare. Any factor that limits their vision poses potential limitations not only on their ability to perform their planting tasks to assigned specifications, but also their ability to safely navigate their work environment. With these integral work requirements considered, eye protection may only be practical if it can be maintained in optimal condition, without interference with the workers' ability to see.

The ability to maintain eye protection must account for the nature of the work and the conditions of the worksite. Tree planting involves intense physical exertion, far beyond the normal level of other jobs. This produces significant body heat and sweat, which can cause fogging and smearing of eye protection. This effect is compounded by tree planters needing to bend over to plant their trees several thousand times per day, creating conditions where sweat droplets can fall freely into the inside of glasses. Tree planting is also performed in all weather conditions in a very dirty environment, making cleaning of the glasses difficult. Workers manually insert seedlings into the ground by hand, resulting in their hands being covered in dirt.

Workers often wear protective gloves that are form fitting to protect their hands from chemicals applied to the seedlings. Often these gloves include a surgical-style nitrile liner that once removed cannot be reused. Glasses cannot be effectively cleaned with dirty hands, and it may be necessary to not only remove (and replace) gloves, but also to wash hands prior to

² Delia Robert. (2003). Strategies for Tree-Planters: Decrease Illness and Injury, and Increase Productivity. Available: https://www.prt.com/sites/default/files/training_strategies.pdf

cleaning the glasses. If the glasses become contaminated while a worker is in the middle of a work area (on a “bag-up”, it may not be possible to clean the glasses without ceasing work entirely. For reference, a worker completes between 5 to 15 “bag-ups” per day, of several hundred seedlings while covering several hundred meters of ground on each bag-up.

Finally, tree planting is performed in a variety of conditions and different types of terrain. This includes extremely technical terrain that is very difficult to navigate (such as most coastal settings) and flatter more accessible terrain where workers can move more quickly. In typical coastal settings, workers must move more slowly and deliberately, as footing and ground mediums are variable, and risks associated with unstable terrain and slipping are constant. In such terrain, workers tend to plant fewer trees for a higher price per tree, and workers are more likely to work in colder and rainier conditions (typical to the coast) as compared to the drier conditions characterizing the summer season when interior flatter areas are planted. In flatter terrain, speed of planting is much higher due to the easier movement for workers. Use of eye protection must therefore consider that application in coastal planting settings may cause greater problems due to the weather conditions in which fogging and contamination of glasses is more likely, and in which the demands of navigating the worksite are higher and where tripping incidents may be more serious due to the steeper coastal terrain.

Product Selection

There are multitudes of product options available for eye protection. Proper product selection is mandatory and must consider the physical demands of the job. If proper products are not available for the job, this must be considered as a limitation or additional risk factor associated with the use of eye protection in the workplace.

- Anti-fog glasses must be used due to the condition of the workplace and demands of tree planting in a wet environment, where workers produce significant body heat.
- Fogging problems can be mitigated by choosing glasses that are big enough to allow a significant amount of airflow behind the lens. A snug-fitting pair is much more likely to fog than one that fits correctly. In addition to finding the right size, adjustable nose pads are an important anti-fog feature because they allow you to position your eyewear the appropriate distance from your face. Generic glasses without proper customization options are likely to cause fogging problems and interfere with workers’ ability to see.
- Most anti-fog technology is based on a treatment or chemical coating applied to the lenses. This coating varies in durability and may not remain effective when subjected to the conditions of the tree planting work environment.
- Hi-quality optics are required in order to protect workers from eye strain, and to ensure clear vision. Given the similarity of tree planting with extreme sports based on physical performance, product selection should consider requirements for optical quality and clarity. The highest possible grade of eye protection should be selected in order to minimize any distortion of worker vision. This includes ensuring that sufficient

peripheral field is maintained so that a worker can remain aware of their surroundings. Generic safety-glasses can be purchased for as little \$5 per unit, but such glasses may be entirely unsuitable for tree planting. Meanwhile, glasses for athletic applications may cost in excess of \$100 but may lack necessary standards (CSA and ANSI) identified by regulation.

- Protective hard-bodies cases with non-scratching flocked liners should be provided so that workers can store their eye protection without risk of it being crushed or scratched. Bright colored cases with carabiner attachments can be selected to reduce risk of losing eyewear in the worksite.
- Anti-scratch coatings should be preferred due to the demanding physical conditions of tree planting. However, the anti-scratch coating should not detract from optical quality.
- A full range of sizes must be provided to ensure that all workers have access to eye protection that fits properly.
- Workers should be provided with both cleaning cloths and cleaning solution. Using clothing, tissues, or improper solutions to clean glasses can result in scratched lenses and decreased anti—fog efficiency.
- Replacement glasses should be kept available for all workers, as the extreme physical demands of the job are likely to result in decreased product longevity, and premature deterioration of anti-fog treatment coatings.
- Photochromic lenses that adjust light transmission based on the lighting conditions (shade vs open sunlight) may be suitable for the job, due to the constant transition of worker’s gaze between the ground and horizon. However, the photochromic lenses generally take between 30 seconds and several minutes to adjust to changing light, thus making them impractical for the tree planting worksite. Furthermore, higher quality photochromic lenses cost in excess of several hundred dollars.
- Glasses must be able to fit properly in combination with head protection. Tree planters generally wear alpine mountaineering helmets rather than standard construction style hard hats. Standard hard hats are impractical for tree planting, as they tend to fall off whenever workers bend forward to plant a tree and provide little to no protection in a fall. The use of mountaineering helmets by tree planters is only required when overhead hazards are identified or when falls in steep ground are likely, and Section 8.11(1) of the OSHR Guidelines identified alpine helmets as acceptable for silviculture (tree planting) workers.

Product Testing

In order to test the utility of eye protection, the Forestry Safety Advocate conducted a field test in coastal planting conditions with five different types of eye protection. The test was conducted on April 6th, on moderately steep and moderately slash-covered terrain, with variable conditions that ranged from direct sunlight to wind and rain. The job specifications included planting of a single species of trees with the application of a fertilizer teabag with each planted tree, which is typical for many coastal operations. The Advocate possesses 15 years of planting experiences, with extensive experience as a highly-efficient worker in coastal terrain. The Advocate planted 360 trees, or approximately 90 trees with each type of eyewear, with one type of eye wear (#3) proving to be unusable in this application. The different glasses are numbered and shown below, with a picture of the test-subject.



Product #1: Manufacturer: 3M. Antifog, anti-scratch. Flexible side arms. No tint.

These glasses did not work effectively with helmet straps, as they constantly shifted on the wearer's face as he moved around in the act of planting trees. The highly flexible arms would not remain in place, causing the glasses to contact his face, become smeared with sweat, and occasionally fog up due to the inability to maintain an optimal distance from the wearer's face. The optical quality was poor, resulting in distorted vision and discomfort for the wearer. Notably, these glasses were the most comfortable when tried on in the store, yet performed among the worst in the field.

Product #2: Manufacturer: Bolle. Antifog, anti scratch. Low tint.

These glasses had been worn for approximately 5 days and kept in a proper eyeglass bag and hard-case. Despite the handling of the glasses, the anti-fog and anti-scratch coatings of the glasses were visibly worn, and resulted in decreased optical clarity, and decreased anti-fog performance. Optical quality hampered the wearer's ability to see when peering down at the ground while planting in shaded areas, and reduced detail for distance sight. They required frequent clearing and cleaning. The glasses became unusable when some tree sap got on a lens during removal for cleaning.

Product #3: Manufacturer: Uvex. Supra anti-fog . No tint.

These glasses were not compatible with head protection due to the top rim contacting the rim of the helmet, and the wide rigid arms not fitting around the head straps. The rigid frame of the glasses pressed into the bridge of the wearer's face. These glasses are simply not suitable at all for the application.

Product #4: Manufacturer: Uvex. Antifog. No tint.

These glasses performed well initially. However, they would fog temporarily when the wearer was breathing heavily, resulting in vision being temporarily obscured. This occasionally happened mid-step. When rain began falling part-way through the test, the glasses quickly became a serious impediment as the droplets on the glasses refracted light and interfered with clear vision (see picture of test-subject).

Product #5: Manufacturer: Unknown. Mesh lenses.

These glasses incorporated a mesh lens similar to what some costumes and sports helmets use inside their eye-pieces. The mesh lens was superior for distinguishing colors and seeing up-close detail when planting trees. However, the lens became blocked with random particular and sweat drops caught in the mesh, resulting in a "pixelated" view-scape, similar to a LCD television with numerous dead emitters. Secondly, the bottom rim of the glasses severely hampered peripheral vision, with the wearer unable to clearly see his own feet at all times while walking.

Product Test: General Findings

The test was conducted in relatively favorable conditions, given that it only remained intermittently, there was minimal mud, and the wearer was working at a slower pace than many workers and thus producing less body heat and sweat than a typical worker. It is noted that none of the products were specifically designed for this type of work but represented a selection of best available products.

All of the glasses exhibited significant flaws with three of the five models proving to be nearly unusable (#1, #3, #5). Products #2 and #4 performed well, when standing still or moving at a slow pace in normal conditions. However, they did not perform well when subjected to actual planting conditions.

Sweat-droplets were a major problem, as even in moderate conditions the wearer produced significant heat and sweat. The process of planting requires extensive head movement throughout the planting of each tree. This begins with turning the head to the side and downwards to locate and select A) a seedling, B) a fertilizer teabag, and C) a piece of colored ribbon for marking the tree. This movement occurs in addition to the swiveling of the head to navigate technical terrain, and bending over to plant the tree. While each test began easily, the contamination of the glasses by sweat became a constant problem once the wearer began exerting himself.

Fogging occurred on a variable basis. All of the glasses (except #5) had anti-fog treatments. However, the glasses still fogged, albeit temporarily. This simply meant that the duration of vision impairment was reduced, not eliminated. Moreover, when the fogging became more significant it did at one point progress to beading of liquid inside the lens. It was clear also, that the anti-fog treatment coatings on the glasses that had actually been used for several days had lost much of their effectiveness, along with overall optical quality. Cleaning of the glasses was made difficult by the dirt stuck to the wearer's hands. Regardless of wearing gloves, it was impossible to maintain perfectly clean hands and a pristine cleaning cloth when thrusting hands and fingers into the dirt on a repeated basis.

During the test-period and in the week leading up to the test, the Advocate also consulted with 20 different contractors and workers who had been attempting to work with the glasses. All respondents reported similar findings, and expressed concerns that the requirement to wear glasses was interfering with their ability to navigate difficult terrain, and to generally complete their job according to specifications. The problems identified demonstrate the difficulty of finding suitable products, and the negligible likelihood of finding any single product that is suitable for all conditions or all users. All products should be tested carefully before being

considered for use in tree planting applications, and it may be necessary to permit workers to select their own products and obtain remuneration.

It is noted that glasses do provide some level of protection. However, clearly none of the glasses tested (or thus far seen) are designed for this purpose and may indeed offer negligible protection to the kinds of eye injuries that a tree planter may suffer. Given that trips and falls comprise the most common mechanisms of injury, it is questionable that glasses would stay in place to deflect any larger sharp debris that may contact an eye from a random angle during a fall. Indeed, glasses provide excellent protection against high-velocity projectiles emitted directly in front of the wearer. However, there are few hazards of this nature to be found when in the process of planting trees. Jagged or broken branches may pose a hazard, and these may be identified as part of the site assessment process.

Other experiences with PPE in the Planting Sector

In past years, tree planters have also encountered demands to wear hard hats as part of blanket policies from licensees. It was quickly determined that standard hard-hats are unsuitable for planting as they; A) often fall off whenever a worker bends over to plant a tree; B) cause neck strain due to the additional weight placed on the head of the constantly bending worker; C) reduce workers' ability to effectively temperature-regulate when working in warm conditions under intense physical demands; D) interfered with workers' ability to maintain optimal balance and awareness by limiting sight lines; and E) were not necessary in the majority of planting worksites where no overhead obstacles are present. As a result, revisions were made to WSBC guidelines to recognize alpine mountaineering helmets as acceptable for tree planting operations where head protection is deemed necessary due to risk of overhead hazards. In many operating areas, the requirement for head protection has been dropped entirely for tree planters, and head injuries are not listed among the most common body part involved injury claims due to the limited incidence of such injuries. Instead, head protection is only required in steeper (largely coastal) areas where steep ground includes risk of falling objects, and sites where overhead hazards are present.

In summary, it was determined when evaluating hard hats that the PPE appropriate for other forestry jobs (falling trees and working around heavy equipment) is not necessarily appropriate for tree planting. Specialized equipment is appropriate in certain conditions, but blanket assignment of generic PPE has been found to be a poor fit for the demands of the job and the risks it entails. Any application of PPE should be based on a fully detailed risk analysis, that not only proceeds from the injury statistics for the job, but also is informed by the demands of the job and the impact that the PPE may have on the ability of the workers to perform their jobs safely and manage the other hazards they encounter on a daily basis.

Summary

The use of eye protection in tree planting may have some practical applications, particularly those conditions identified earlier in this report. However, consideration of eye protection for tree planters should only proceed based on a proper risk analysis at each worksite. This analysis should evaluate:

- Actual incidence of eye injuries while planting trees.
- Physical demands of the job.
- Environmental conditions of the job.
- Impact of physical demands and environmental condition on usability and proper maintenance of eye protection.
- Impacts of eye protection on workers' ability to work safely and effectively
- Availability of suitable products.
- Customization of products to ensure proper fit and function.
- Impact of work setting (weather and terrain) on practical use of eye protection.

If it is determined that the risks created by the use of eye protection are greater than the risks they mitigate, other means of control (i.e. training and education) should be sought as a means to reduce risk of eye injuries.

Additionally, demands from Licensees to use eye protection should not take precedent over regulatory requirements, including the need to consult Joint OH&S Committees prior as part of a fully detailed hazard assessment process.