Chapter 29 - "Other Silviculture Work"

For many planters, tree planting is a short-term career which might be useful for a few years, or it's a summer job to help put you through college or university. In both examples, planting is only viewed as a temporary position until you find work in a different field. These situations probably apply to about eighty percent of the tree planters. Other planters have different needs, and are able to seek additional employment outside of the months of May through July. Some crusty coastal planters like to make fun of planters who work at the larger northern companies that do the majority of the planting in Western Canada, deriding those planters for accepting lower prices rather than working at coastal companies with high tree prices. These same planters overlook the fact that, above and beyond coastal ground being much slower and more challenging, coastal planting happens during the shoulder season when a large portion of the work force is in school (and downplay the fact that prices are irrelevant unless taken in context with the difficulty of the land). It is fortunate that the months when the majority of planting is needed (May/June/July) are also the months when the labour supply is most readily available.

For someone who is interested in forestry but not a full-time student, there are many career choices available that can keep you working just about year-round. There's work available in stand management, such as brushing, spacing, pruning, or girdling a growing stand. You can become an accredited silviculture surveyor. You can do fire-fighting or slashpile burning work. There are cone-picking projects to source seed for forest nurseries, and herbicide programs to eliminate vegetation and deciduous brush that grows in competition with the targeted coniferous species. And finally, for people who have done some forestry-related schooling, there is work relating to Geographic Information Systems, mapping, or timber cruising (the latter of which is sometimes available to people who simply have sufficient field experience in other silviculture activities).

You may still wonder why, in a book about tree planting, I devote so much space to other types of forestry work. The answer is simple: A great deal of this work is performed by former planters, or done at specific parts of the year when planting work isn't available. Many of these activities are very similar to planting: They involve working outdoors under difficult conditions similar to planting, they are often paid by piece rate, and they are frequently done by the same companies, for the same clients. It is useful to look at the entire forest management system to fully understand how the role of planting fits in with other related activities, both from a labour and from an environmental point of view.

Reforestation has a great deal in common with farming. The only significant difference is that farming generally deals with an annual crop cycle, whereas forestry deals with a 40-year to 80-year cycle between successive crops. Farmers devote a great deal of care to their crops during the growth cycle, rather than just walking away after the seeds have been planted. Similarly, once the trees have been planted, you shouldn't just walk away and ignore them for the next forty to sixty years. A few decades ago, the biggest problem in reforestation was ensuring the survival of plantations. Plantation mortality is a less significant issue today. In many areas, over 95% of the planted seedlings get through the initial shock of planting and survive for at least the first few years of growth toward maturity. Many foresters are now concentrating more on maximizing growth and minimizing time to harvest, which together serve to maximize long-term crop yields.

There are many approaches to maximizing long-term yields. First, foresters can prescribe the use of fertilizers. Generally, targeted fertilization (through the use of fertilizer tea-bags planted with the trees) is more successful than broad-scale fertilization applied to the entire block, because broad-scale fertilization also benefits plants that grow in competition with crop trees. Once seedlings have become established and start to enter the juvenile stage, it may become practical to eliminate some of the brush and vegetative competition through herbicide programs or manual brushing programs (using brush saws), to kill competing species and leave more nutrients for the crop trees. If the density of the crop trees is too high, perhaps due to significant amounts of natural generation, some of the same problems occur as through vegetation/brush competition. Juvenile spacing or thinning programs can remove some of the weaker trees in a plantation, so the trees that remain will be stronger and have less competition for natural resources. Pruning of lower limbs can ensure that a tree directs its nutrients towards maximizing height and stem volumes, rather than losing nutrients to heavy lower branches.

Explaining all these jobs in depth would be a complex undertaking, because many of them are as complex and nuanced as tree planting itself, but I'll try to give you some of the basics in this chapter. For a very brief overview, you can visit the Silviculture Canada website that I created at www.silviculturecanada.ca – but the information in this chapter goes into far more depth.

Brushing

Brushing refers to the elimination of brush and vegetative competition in a plantation. In a brushing program, it is unlikely that many crop trees will be targeted for elimination, although certainly if a stand is being cleaned up and the density of crop trees is too high, a few of those trees may be cut at the same time (especially those which are obviously diseased or unhealthy). However, the main target of a brushing program is plants and weeds (and young deciduous trees) such as fireweed, alder, aspen, willow, birch, grasses, cow parsnip, devil's club, and similar species.

Brushing is usually divided into two main categories: Establishment brushing, and conifer release. Establishment brush is sometimes done before planting, but more frequently after planting is

complete (usually within five years). The main point of establishment brushing is typically to eliminate herbaceous competition. It's called establishment brushing because it takes place while the stand is initially being established. Conifer release is the cutting of deciduous competition, and is usually done around the free-to-grow time.

One method of brushing is through the use of chemical herbicides, discussed separately. More commonly, one associates brushing with the use of brush saws such as the Stihl 560. Workers walk around the block and knock down or kill everything but the crop trees, which is why this type of work is sometimes also referred to as manual brushing (to distinguish it from herbicide work). Depending on the species which are competing with crop trees, it is also possible to do brushing work with machetes or even by hand (particularly when the only significant problem is fireweed).

A brush saw is very similar to a weed trimmer, although it is much more rugged and industrial, and the cutting tool is a serrated metal blade (similar to the blades used in skill saws), rather than plastic teeth or a plastic cord. A professional brush saw such as the 560 is quite easily capable of taking down trees with diameters of three to four inches or even greater, so it can definitely mow through thin vegetation with ease. Brush saws are significantly safer than chain saws, because the design of the saw (a blade mounted at the end of a long shaft) inherently keeps the cutting implement away from your body parts when worn properly. If you're using a brush saw, it's common to wear a harness system over the shoulders, and the saw hooks onto this harness which effectively transfers most of the weight of the saw onto your upper body. This leaves your hands free to guide the saw around, rather than devoting most of their energy to holding it up off the ground.

Figure 29.01
A Brush Saw.

This type of saw is not suited for cutting mature trees that a chain saw would be used for. However, it is very well suited to quickly cutting much smaller brush and saplings quickly and safely.

Figure 29.02
Fueling a Brush Saw.

A brush saw, like a chain saw, runs on "mixed" gas, which is mostly gasoline with a small amount of 2-cycle oil, mixed in a ratio of 50:1 gas to oil. The blue dye in the 2-stroke oil is what gives the mixed gas its slight bluish-green tint.

In a brushing program, one of the key challenges is to ensure that you don't accidentally cut any of the crop trees. Killing or even nicking a crop tree is assessed as a significant quality fault. Also, because there is no reasonable way to model compensation based upon the number of plants cut, all piece-rate compensation is based upon the area that a worker covers.

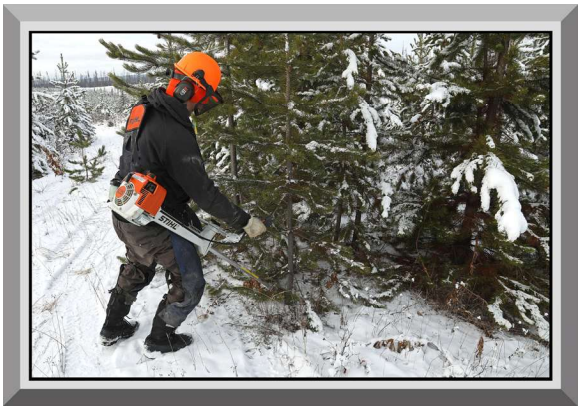

Figure 29.03
Brusher At Work.

The worker in this photo is thinning out some pine trees in a stand that is too thick.

A brushing contract with visible crop trees is a very easy way for a planter to start getting used to working with a brush saw.

Thinning

If you can imagine brushing as being a way to open space within a stand by targeting vegetation, then thinning is a way to open up space within a stand by targeting some of the crop trees. Thinning is a suitable type of treatment when there are too many crop trees, or when some of the crop trees are diseased, unhealthy, deformed, or poorly spaced. There are two categories of thinning: Pre-Commercial Thinning, and Commercial Thinning. Pre-Commercial Thinning (PCT) is also referred to as Juvenile Spacing.

It might seem odd that cutting trees is a good approach to encouraging reforestation. However, sometimes it becomes necessary. Sometimes, a planted block will end up having much more natural regen than expected, so there are many thousands of "extra" trees per hectare that the foresters didn't expect. In other cases, natural regeneration is just extremely dense, especially when considering pine stands that are regenerating after wildfire disturbance. For example, it's possible to see pine densities of over 100,000 stems per hectare in some stands. When you consider that target planting densities are typically between 1200 and 2400 stems/Ha, you can see why 100,000 stems/Ha might be considered somewhat inappropriate. In a stand such at this, many thousands of trees will be cut in order to allow a select few the room to grow that they need. This allows them to receive far more sunlight, rain, and nutrients than the would have otherwise.

Planters generally catch on to the concepts involved in thinning quite quickly, because they're already familiar with density concepts and inter-tree spacing. In fact, it is quite typical for target

spacing after a juvenile spacing program to be in the exact same sort of range as a planting program, say perhaps 1600 stems/Ha post-treatment. It's still a different mindset than planting because you are approaching your target density from the opposite direction (ie. reducing the number of stems down to the target, instead of adding seedlings until you get up to the target), but it doesn't take very long for planters to feel comfortable with that. Workers can still throw plots on themselves to increase their confidence that they're hitting the right numbers. The only difference is that a 5.64m plot cord is typically used rather than a 3.99m plot cord. This plot cord covers exactly double the surface area, so you're typically going to get approximately twice as many trees in a plot, and you multiply the number of trees in the plot by 100 rather than by 200 to figure out your stems/Ha. So in other words, if a section of the plot typically had 8's when measured with a planting plot cord, then you'd probably expect to be getting mostly 16's with a 5.64m plot cord, and you'd multiply that number by 100 to find out that you're spacing is roughly 1600 stems/Ha.

Since workers are generally targeting trees rather than brush and vegetation in a thinning program, it's important to recognize some of the possible faults. If you cut a stem at too much of an angle, that would be a fault (flat cuts are safer, and nobody wants pointed cuts all over a block in case a worker or an animal falls on one and impales themselves). If you cut the stump too high off the ground, it's a fault. If you cut the stem above a live branch (which could then grow up and turn into a new leader), it's a fault. Nicking or cutting a crop tree is a problem, especially if you create a "void," which basically means a small "hole" within the piece/plot. Planting is more forgiving than brush saw work in this respect. With planting, if you plant too few or too many trees, you can always add more or pull some. However, if you cut something accidentally, you can't "put it back."

The difference between pre-commercial thinning and regular commercial thinning relates to the size and treatment of the wood that is cut. Pre-commercial thinning (juvenile spacing) treatments target wood that is not yet mature and does not have an associated commercial value. For a PCT program, expect the slash to be left to decay where it falls onto the ground. The benefit of leaving the slash where it falls is that its eventual decomposition leads to an increase in organic nutrients on the block.

Commercial thinning programs generally don't take place until a stand has been growing for at least twenty years, and sometimes up to forty years. By this point, the crop trees are of a sufficient height and volume that they can be used to generate value. Perhaps they can be recovered and milled into small lumber, such as 2x2's or 2x4's, or used for veneer. Perhaps they can be chipped and used as biofuels. Or perhaps they can be processed for pulp fibre. By the time a stand reaches the age where it is a feasible candidate for a commercial thinning treatment, the stand has probably self-pruned somewhat and might only have a density of 1000-1500 stems per hectare. Even so, removing half of those trees in a dispersed pattern will again allow the remaining trees to gain height and/or volume more quickly as they grow towards maturity. If you are thinning the dominant or co-dominant trees and releasing the suppressed understory, then the trees would increase in height. If all the trees were planted at the same time (thus presuming equal amounts of sunlight and photosynthesis), then they would probably not allocate their resources to a growth in height, and would instead increase in diameter.

Although brushing saws are typically used in juvenile spacing programs for younger stands, it might be necessary to incorporate the use of chain saws for a more mature stand. Chains saws would unquestionably be required for a commercial thinning treatment.

Spacing work on the coast is quite different than in the Interior of BC, primarily due to the difficulty of working on steep terrain. The trees targeted in a coastal spacing program are generally much bigger, so chainsaws are used almost exclusively. Species selection and stem quality become much more important than the actual spacing.

Post-planting silviculture treatments seem to be chronically underfunded throughout Canada, so the volume of this type of work is much less than planting. However, the fact that spacing work can be performed for much of the year makes it an attractive option for experienced planters who wish to extend their seasons significantly.

Figure 29.04
Sharpening a Chain Saw.

Chain saws are occasionally used in thinning and juvenile spacing programs, especially on steeper ground.

For more information about juvenile spacing, google the following two documents: "BC FS208 Juvenile Spacing Information" and "BC FS251 Juvenile Spacing Quality Inspection."

Mistletoe Eradication

Dwarf mistletoes are parasitic seed plants affecting several coniferous tree species in forested ecosystems throughout North America. British Columbia is especially proactive in making efforts to control this parasite. Having said that, it's good to remember that dwarf mistletoes can have both beneficial and detrimental effects on the health, function, and productivity of forests.

Dwarf mistletoes grow in tree bark and wood, absorbing water and nutrients of the host tree that would otherwise be captured for tree growth. The parasite induces a localized swelling of the bark and wood. Nearby buds and branches are often stimulated to excessive growth, resulting in branch clumping (referred to as brooms or witches' brooms).

The four main dwarf mistletoes that are targeted in BC are the various species that target lodgepole pine, western hemlock, western larch, and Douglas fir. One of the best way to control them is to remove live host trees. Essentially, a spacing or brushing crew will be sent into a block that is heavily infected, and all the infected young trees will be cut down with brush saws. This kills the mistletoes, then the forester is able to plant the block a second time. It is possible to target individual trees with some types of dwarf mistletoes, but for the ones that attack lodgepole pine, the only effective solution is to completely eradicate the infected stand. Partial cuttings simply let more light into the stand, which causes the mistletoe to thrive.

For more information about mistletoe eradication work, search online for the "Dwarf Mistletoe Management Guidebook" that is published by the Province of British Columbia.

Pruning

Pruning refers to the removal of some of the branches from a tree. While most people think of residential property maintenance or gardening when they think about pruning, some juvenile plantations are also targeted for pruning programs. Pruning can divert nutrients from large lower branches with no value to the height and volume of the trunk. Pruning can remove dead, damaged and diseased lower limbs, which helps prevent insect and decay organisms from entering the tree. Pruning creates space which allows animals and humans to pass through a stand more easily, which creates additional habitat for certain animals, and it allows for more sunlight to enter into the stand.

A pruning program typically targets a stand of trees which is at least 10-12 feet in height, and may be much taller. Lower branches are removed up to a certain target height (perhaps up to 2.0 meters above ground level). There will be guidelines giving the minimum and maximum distance from the trunk at which point the branch can be severed, preferably just outside the branch collar (this allows the tree to heal quickly).

When pruning diseased trees, it is important to have a form of sanitization to apply to the saw between cuts. This decreases the likelihood of the saw vectoring the disease to a new host.

Although power saws can be used in pruning programs, it is somewhat uncommon. Chain saws have a rougher cut than hand saws, thus are more likely to rip the bark at the cut than to sever the branch cleanly. A clean cut is desirable because it leaves less of a wound for insects or other biological pests to enter the tree. This is why urban arborists often apply paint to seal a branch stub, although that practice is of questionable value. Remember that it is not very safe to be using a chain saw above chest level. If powered saws must be used, a pole saw may be a much better choice than a chain saw. If a chain saw must be used, it may be better to use an arborist's saw than a typical production saw, since the arborist saw is much lighter, can be used safely with one hand, and has a chain that performs a cleaner cut.

Here are a few definitions specific to the pruning industry:

- **Included Bark:** Bark that is found within the notch of a mature tree, when the tree has co-dominant branching.
- **Branch Bark Ridge**: A line of rough bark running from the branch/trunk crotch into the trunk bark.
- **Branch Bark Collar:** Contains critical wound defense and wound response organisms. Good pruning always leaves the branch bark collar intact, in order to take advantage of the tree's natural defense systems.
- **Lion's Tail:** A tree whose form has the foliage concentrated solely at the tips of the branches rather than also being found close to the core of the tree. This type of form can be caused by incorrect pruning. Lion's tailed trees often fail during wind events.
- **Three Cut Method:** A technique used in urban tree pruning. The first cut will be an undercut, usually about thirty to fifty centimeters away from the base of the branch. The second cut will be above that undercut and distal to the trunk (a few centimeters further out along the branch). The second cut severs and drops the branch, removing tension/compression that was due to the weight of the branch. The third cut is a final cleanup cut that removes the stub. Make sure that you leave the branch bark collar intact.

Girdling

If the bi-directional flow of nutrients between the roots and the top of the tree is hindered, the tree will suffer. Cut the flow off completely, and the tree will eventually die. To girdle a tree means to remove the bark in a circle around the entire trunk, which prevents the sap from flowing up or down the tree. The gap left when a tree is girdled does not have to be very large. A gap of two centimeters will be adequate to eventually kill the tree, provided of course that the girdle completely encircles the tree. A properly girdled tree will die in a matter of a few weeks, and then generally topple over (with the break occurring at the girdle) after one to three years.

Many people wonder why someone would girdle a tree rather than cut it. There are several valid reasons. Hand girdling avoids the use of chain saws and brush saws, therefore it is safer (although girdling is usually slower and thus costlier than using saws). The targeted trees are not left laying all over the block as slash, which makes it easier for animals and humans to walk around the block (this is useful if additional work needs to be done). And finally, girdling works quite effectively to prevent a biological process called suckering. Suckering means that after the trunk of a tree is cut off, new trees will grow out of the edges of the stump. Some of the species which are most frequently targeted for girdling (such as aspen) are very good at suckering. Some species which are typically targeted for girdling programs include birch, balsam poplar, trembling aspen, and cottonwood.

In some girdling programs, it's common to ignore very large trees (greater than 20cm). These are called ghost trees. They may be left standing intentionally because their mass would damage newly planted seedlings if they fell over. Or they may be large enough to be beneficial to wildlife. Smaller

trees are not girdled either. If their diameter is only 2-3cm, these whips may either be cut off completely, or given the "snap & hinge" treatment. If you snap the tree, it obviously can't grow any higher. The hinge prevents the tree from suckering. Trees under half a meter in height can also be ignored, as they are generally considered to be too small to pose a significant competitive threat to the crop trees.

To girdle a tree, a worker typically uses what's called a girdling tool. This is a piece of 2" wooden dowel, which has a piece of sharp metal attached in the middle. The metal of the tool is pressed firmly against the bark of the tree, then the worker grinds the tool around the tree in a circle. As the tool rotates, a layer of bark gets peeled off. These girdling tools are quite easy to make for just a few dollars in parts and half an hour in labour, if you have access to a woodworking and metal shop. Alternatively, you can google "The Ringer Girdling Tool" on the IRL website and see a specialty metal-handled tool that sells for about $220. That seems quite expensive. You're probably better off making your own.

It's also possible to make your own alternative tool by modifying a putty knife. Start by purchasing a Richards putty knife from Canadian Tire with a 2" blade. These knives have a nice yellow/black moulded handle, and the blade is fairly strong. Sharpen the blade on the front and also along one side, using a grinder or file, until the blade has a razor-sharp edge. After the blade has been sharpened, heat it with a propane torch and slowly curve the blade with a vise until the blade has a curved angle of about 45 degrees (but don't curve the outermost centimeter of the blade). This curvature gives the knife the ability to circle around the trunk more easily. To make the girdle is a two-step process. The first step is to make a slice vertically down the bark of the tree, using the sharp curved side of the blade. Then, once a slit has been created through the bark, the front of the blade can be inserted under the bark, and as the blade is pushed in a circle around the stem, it peels the bark away from the inner wood.

Most girdling contracts should be scheduled for between the middle of spring and when the sap hardens off around mid-August. When the bark is quite moist, the putty knife is the most efficient tool. Once the sap has hardened, the girdling tool is stronger and more effective.

Girdling compensation is usually based on piece-rates, and subject to the same sort of quality assessment rules as planting. A forester will throw a number of plots on the block after the girdling crew has finished, and this determines the pay rate for the company. Common girdling faults include: Girdle too high, tree completely severed, girdle not wide enough, incomplete girdle, damage to crop tree, covering a crop tree (with hinged trees), slash too high (hinges more than 1m above ground level), and of course, missed trees.

Cone Picking

Cone picking contracts typically take place during the winter. Cones are picked from various conifer species, brought to a central field processing area, measured by volume or weight (typically volume), and then shipped to a nursery. Once they're at the nursery, they are dried and tumbled, which releases the seeds within the cones, then those seeds are collected and used to sow the seedlings that the nursery produces for planting projects. Some cone picking projects occur on a regular annual basis, while others are sporadic and only take place once every several years. Dry seed can be frozen in bags in conventional deep freezes, and stored for many years or even decades before it is used, yet still remains quite viable. Some of the trees that you plant may have been grown from seed collected in the early 2000's.

A lot of cone picking takes place in winter, so you need to be prepared to bundle up. Sometimes, you'll be working in the field, working through blocks that have recently been harvested. In those cases, you'll go to trees that have recently been logged, and you'll pull the cones off, filling buckets that you take back to your cache (you often get paid by the bucket). In other cases, you'll sit in a central camp location with the rest of the crew, and the tree tops will be brought to you. On these jobs, it might be a piece of heavy machinery that brings you the trees and cones. At other times, a helicopter with a pruning rig might be brought in to assist with the project. The helicopter can fly out to a location with some prime trees, lower the pruning rig over the top of the tree, remote cut off the top (creating something similar to a Christmas tree), then bring the tree back to the field processing staging area where the pickers remove the cone. This type of operation is more communal, because everyone works in close proximity. It can also be colder, since you don't have the advantage of moving around to keep warm.

The resin and sap from the trees gets on your gloves, and slows you down. Sometimes, oils or similar lubricants can be used to keep your gloves greasy, so you can pick more quickly. Since you're trying to source seed, you'll want to use food-based oils, probably either Mazola oil or margarine.

Figure 29.05
Worker with a Bag of Cones.

This one bag of cones will contain enough seed to grow thousands of new seedlings.

Herbicide Work

Herbicide application involves spraying chemicals onto plantations in order to thin out vegetative competition for crop trees. Currently there are five herbicide active ingredients registered for use in Canadian forestry, however, glyphosate is allegedly the active ingredient used in over 96% of herbicide applications. You've probably heard of glyphosate before, as it is the active ingredient in RoundUp.

Glyphosate is used because it has a good record for controlling most species that compete with conifers. It is non-persistent in soils, vegetation, and water. It does not accumulate in animals, and has a low innate toxicity to humans and wildlife. Glyphosate does not easily kill conifers (when sprayed in the proper concentrations), particularly after they've had a chance to fully develop a waxy cuticle on their needles, which usually happens in mid to late August. This cuticle wax typically protects the needles from disease and late-summer dehydration, but has a side benefit of protecting the conifer from glyphosate. It's also important for the buds to have hardened off (gone into dormancy). Although the glyphosate does not typically kill the conifers at this point, it causes significant mortality in undesired grass and broadleaf vegetation that surrounds the conifers.

Glyphosate is often marketed under brand names such as Vantage and VisionMax. Although RoundUp is used very heavily in many parts of the world, its use has become increasingly contentious in the past few years. As a preventative measure, glyphosate was banned for cosmetic purposes (lawns, gardens and parks) in Ontario in 2018, although it is still permitted for forestry applications. There is a risk that it may be completely banned in Canada at some point in the future, which would mean that all future herbicide work would probably have to be replaced by manual brushing. In the meantime, it would be smart for workers to wear suitable protective clothing, including long sleeves, long pants, good boots, a hat (for the sun as much as for herbicide protection), and a reliable double layer glove system with inner nitrile gloves and an outer work glove. Some especially cautious workers also wear disposable coveralls over their clothing, and face masks.

The majority of herbicide application is done either through aerial spray programs, or manually by backpack sprayers. In both cases, very dilute solutions of glyphosate are mixed with large quantities of water, and that solution is sprayed on blocks where vegetative competition is significant. To avoid having significant amounts of herbicide escape into the local aquatic system before it has had time to break down (which takes a couple of days), blocks are usually laid out first with the intention that sprayers (regardless of whether it is aerial or backpack) don't spray within 10m of streams or block edges.

Figure 29.06
Backpack Sprayer at Work.

This worker is carrying a pack of mixed herbicide chemicals and water, and walks a careful pattern through the block, spraying the herbicide as he walks.

Herbicide programs usually start at some point in August, depending upon the latitude and recent weather conditions. A typical program lasts for approximately 2-4 weeks, and is highly dependent upon weather conditions during this period. Spraying cannot take place outside of certain temperature ranges, when the humidity becomes too high, when there is active precipitation, or when the wind speed starts to pick up. All of these conditions are fairly restrictive, so there is a lot of downtime for the sprayers while they wait for the spray window to open, so they can go to work. As winds and temperatures are most favorable in the morning and evening, a typical day for a sprayer involves getting up in the very early morning, getting out to the blocks by the time the sun starts to rise (before 6am), and if the herbicide monitors approve spraying activity, working as quickly as possible until the window closes. Depending on location, the crew might then return to town for several hours and then try again in the evening, if conditions look favorable. At other times, it makes sense for the crew to laze about at the blocks, reading, sleeping, or watching movies for several hours, while hoping that they can start work again. On the very rare days that conditions are favorable for the entire day, a sprayer might want to put in a seventeen-hour day, spraying from dawn until dusk. Sprayers are typically paid per pack, with no compensation for downtime.

Spraying crews are generally fairly small. Logistics dictate that it is effective to use two trucks (which usually each have a trailer) to move equipment and a water reservoir. A typical crew consists of a crew leader, a mixer, and four to eight sprayers. The crew leader organizes mapping and production, and ensures that the sprayers don't do a trespass and spray outside permitted boundaries. The mixer generally stays at the truck and deals with mixing the herbicide sprays all day long, ensuring that the proper ratio of herbicide to water is being used, refilling backpacks, and related tasks. The sprayers usually put on a significant amount of protective clothing, then move through the blocks as a group in a wave pattern back and forth, under the direction of the crew leader.

Figure 29.07
Mixing Tub.

This tub is used as a protection measure in case any of the herbicide is accidentally spilled, so it doesn't end up on the ground.

Figure 29.08
Water Reservoir.

A spraying crew needs to have lots of clean water available to mix with the concentrated herbicide chemicals.

There are usually staff on hand also to act as herbicide monitors, to make sure that the sprayers aren't working during restricted weather conditions. The monitor will use a device called a Kestrel to measure all of the weather characteristics. For more information about the best recommended weather conditions for herbicide application, google "Pesticide Spraying With Kestrel Meters." If there are no additional monitor staff on site, it is the responsibility of the crew leader or mixer to take readings every 15-30 minutes.

Figure 29.09
Kestrel Device.

This device can measure outside air temperature, wind speed, relative humidity, and much more.

It is also important to have one or two people working ahead of the crew to lay out blocks, do stream assessments, flag 10m buffers, and look for wet areas. These people need to stay well ahead of the crew, because if the crew gets several days with good window, they need to be able to keep working.

This work is typically the client's responsibility, however, crew leaders and sprayers should use common sense when working on a block in case something was missed or laid out incorrectly.

When a herbicide program has both aerial and backpack components, the helicopters will usually do the bulk of the work (sometimes spraying thousands of hectares in a few short weeks), and the backpack sprayers will do a lot of smaller blocks and cleanup work that can not be done efficiently with the helicopters. For the aerial work, a spray boom is attached to the bottom of the helicopter.

Figure 29.10
Aerial Spraying with Helicopter.

This photo shows a spray boom that is attached to the bottom of the helicopter, and there is also a herbicide reservoir attached to the bottom of the machine. The helicopter flies a careful grid pattern over the block being sprayed.

Depending on the type of ground (and other conditions), different amounts of spray may be necessary. For example, one particular licensee might ask for total spray of 3.0 litres per hectare for ground that has already been planted, 3.5 litres per hectare for ground that will be planted the following year, and 4.0 litres per hectare for site prepped ground. Depending on local conditions, a pack may be mixed to a simple concentration such as one litre of herbicide per backpack of mixed solution. In a case such as that, if you know that you need to be spraying 4.0 litres per hectare, you should be spraying four packs per hectare. Incidentally, if spraying a block that has already been planted, spruce trees can usually be sprayed the same season as planting, while pine trees should not be sprayed for at least twelve months after planting (to ensure there is no conifer mortality).

Weather restrictions vary depending on the client and the location, but a typical spray program might have the following rules in place:

- Winds must be less than or equal to 8 km/hr.
- Temperature must be less than or equal to 25 degrees Celsius.
- Relative humidity must be less than or equal to 30%.
- Not allowed to spray when there is any frost.
- Not allowed to spray when there is dripping dew, although droplets on plants are Ok (can test by running your hand through the grass – if it drips, conditions are too wet).
- Can start as soon as you can see in the morning.
- Must cease evening operations 30 minutes after official sunset.

Some typical guidelines for what blocks are chosen to be targeted might include, "Target any block with 30% or more green aspen coverage, target any block with 55% or more green grass coverage,

and target any raspberry patches." This is just one possible example, and can vary widely from client to client.

Spraying is tough work, and since it usually runs into early September, it's not suitable work for most summer planters who attend college or university in the fall. It's a job that is most suited for people who have no other immediate plans, and who are content to sit and read a lot of books whenever there is no spray window. The earnings for sprayers can range from terrible (if there are a couple weeks of rain during the program) to stellar (if conditions align and a lot of long days can be logged).

Public tolerance for herbicide use is diminishing. There is a growing movement across Canada and around the world to limit the use of glyphosate and related chemicals. It would not surprise me if the use of glyphosate was completely banned within the forest sector of most Canadian provinces within the next five years. Thinking ahead, manual brushing is likely going to be the preferred stand treatment approach in the future.

Wildfire Fighting

Wildfire suppression work is highly variable in availability, and the characteristics of the work vary highly from province to province. The majority of the fire-fighting work in many provinces is done by full-time seasonal, professionally trained workers. However, in many provinces, if there's a bad fire season, there are opportunities for additional temporary workers to be hired for a few weeks or months in the summer and even into the early fall.

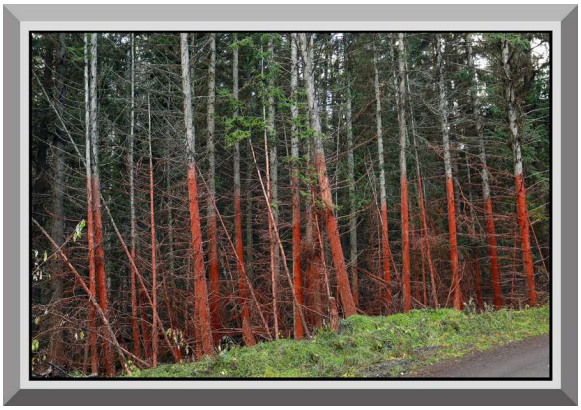

Figure 29.11
Fire Retardant on Roadside Woodline.

Here we can see a significant amount of fire retardant that has been applied to trees along a road, in hopes of using the road as a guard to prevent further spread of the wildfire.

Within BC, the majority of the spring/summer planting season is usually over by the time temporary firefighting work may become available. This works out well to ensure that a workforce is available should the need arise to suddenly recruit a significant number of people for wildfire suppression. In 2017 and 2018, the province had two back-to-back record-breaking wildfire years, with more than a million hectares burning each year. In both of those years, a significant number of planters took firefighting work in August and even into September. In other years with much lower fire activity, there has not been as much opportunity to secure that kind of employment. Unfortunately, in light of

a massive body of scientific evidence that (not surprisingly) confirms that climate change is not a hoax, the odds of more bad fire years in the future appear significant.

If you're interested in getting fire suppression work after your planting season and you work in BC, you can increase your chance of securing a job by ensuring that you have a few basic qualifications and some training under your belt before the season starts. Here are some things that will help your resume:

- Be physically fit, and ready to work at a moment's notice.
- Have first aid training. An Intermediate First Aid certificate is good. An Advanced First Aid certificate is great.
- Have taken BC's two common wildfire training courses, the S-100 and the S-185.
- If you have experience driving pickups on bush roads, along with a valid driver's license and a relatively clean driver's abstract, that's an additional asset.

Regulations surrounding fire fighting work vary significantly from province to province, as already mentioned. Depending on what province you work in, you may have to do some research on your own. You might be able to call a local fire office or ministry of forests office to get information about which companies you can talk to about potential employment opportunities.

Safety protocols are highly emphasized in wildfire suppression, due to the inherent danger of the work. You'll be trained in fire behaviour, and taught acronyms like LACES (Lookouts, Anchor Points, Communications, Escape Routes, and Safety Zones) to codify best safety practices on any worksite.

Burning

Burning refers to the burning of slashpiles. Everyone wants to unleash their inner pyromania, so this is considered by most people to be one of the best jobs in silviculture. Unfortunately, it's not a very significant one, employing very few people for a very short time frame each fall.

There is a lot of public resistance to wide-scale burning, which is why broadcast burning (a site prep treatment approach that was common in the 1980's and 1990's) is extremely rare at the present time. This public resistance comes partly from concerns about the carbon release contributing to global warming, but more significantly due to nearby residents being unhappy with all the smoke in the air when piles are being burned in the area.

Figure 29.12
Slashpiles Burning in the Fall.

Once the risk of a fire escaping into the nearby woods is deemed to be acceptably low, a burning program will commence, to get rid of all the slash piles on a series of blocks.

Burning usually starts as early as the start of October, or as late as mid-November, but the exact dates depend on factors such as the local weather, elevation, and location of blocks. In particular, the air temperatures, the wind/venting conditions, and the moisture content of the ground and vegetation surrounding the piles are especially important. The ideal conditions occur when there is very little chance that a burning pile can "escape" into the surrounding block or, much worse, into any mature timber adjoining the block.

Piles burn best when they contain significant amounts of "fines," the smallest particles left over after logging (small stick, twigs, and especially coniferous needles). Green wood (most easily evidenced by green needles) does not light up as easily as drier wood. If the needles in the pile are red or have dropped, then the pile has probably been sitting for at least three months to a year, and it shouldn't have as much moisture content as a green pile. Piles that contain mostly log fragments are usually hard to light, as a fire enjoys a high ratio of surface area to volume (this allows more oxygen to be present at the fuel or site of combustion). Deciduous (aspen) piles are usually harder to light up than coniferous piles. Tall piles are often easier to light up than short piles. Recent rains may only have coated the surface of the wood, but so long as the inner parts of the pile and wood are dry, that shouldn't matter. Snow is often less of a problem than rain, as it doesn't increase the moisture content of the pile (because most of the snow sits on top of the slash instead of being fully absorbed into the slash), but does have the drawback of dripping down onto a fire that you're trying to light as the heat from the growing fire melts the snow above it.

To light a pile, typically one of two pieces of equipment is used, either a drip-torch (most common) or a terra-torch (similar to a large tiger-torch). The drip torch typically holds about five litres of fuel, and is typically fueled with a mix of about one third gasoline and two thirds diesel. Higher ratios of gasoline can be used, and help create a more intense initial flame, although the fuel is spent more quickly. Diesel burns more slowly, and can thus ensure that a piece of wood starts to combust before the burning fuel exhausts itself. I'd recommend that you never mix a higher gas-to-diesel ratio than a 50/50 mix.

Figure 29.13
A Drip Torch, Not Ready For Use.

The spout on this drip torch is upside down, inside the fuel canister. Also, the two vent holes are currently closed by the screw-knobs.

Figure 29.14
Drip Torch Equipment & Fuel Supply.

Red jerry cans contain gasoline, and yellow contain diesel. The two types of fuel are mixed together to create the proper fuel mix for the drip-torches.

The drip torch has a special design that ensures that it is impossible for the flame at the end of the torch to go backwards up into the torch itself, thus preventing an explosion. There are two small vents on a drip-torch, to ensure that there is enough air flow to prevent a complete vacuum and thus allow a fine stream of fuel to be poured out of the torch. Never try mixing gas and diesel in any sort of a bucket or device other than a professional driptorch, and using it to light fires. That would be extremely dangerous.

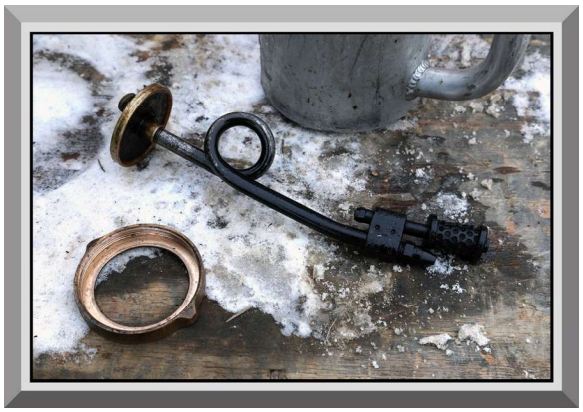

Figure 29.15
Disassembled Drip-Torch Spout.

This is what the spout of the drip torch looks like.

A terra torch is basically a convenient propane-powered flamethrower on a wand. A harness worn by the user supports a small propane tank that is carried on the back, and attached to the burning wand. As the propane burns so quickly, this device does not actually deposit any burning fuel into the slashpile that you're attempting to light on fire. However, the flame coming out of the terra torch

is quite intense, and can get dry wood burning very quickly. The primary advantage of a terra-torch over a drip torch is that a user doesn't have to crawl so far into a slash pile to start the fire.

With a drip torch, the easiest way to light a fire is to crawl slightly into the pile, pouring burning fuel into the pile in a spot where there are lots of fines accumulated, and preferably where there is additional wood located directly above the spot being ignited. This way, the heat from the initial fire will ignite the wood higher up in the pile. If there is any wind, it's best to be on the side of the pile that the wind is hitting. If you're pouring fuel into the center of the pile, it's important that there is some air flow to the base of the fire so it gets the oxygen that it needs. Other than that, you just pour some burning fuel onto the pile, and watch it go up in smoke. It's not rocket science. Really dry piles with lots of fines can sometimes be ignited in as little as five to ten seconds (which is why many foresters are so adamant that planters only smoke on bare roads). However, if you have a wet pile with green wood, it may be that no amount of fuel will get it going. Also, although heavy snow does not make it impossible to start the piles burning, the snow can cause significant access problems. Trucks may not be able to get to the blocks, which might require the use of snowmobiles in extreme cases. And walking from pile to pile can be quite difficult on a block with even a moderate slash load that has been covered in snow.

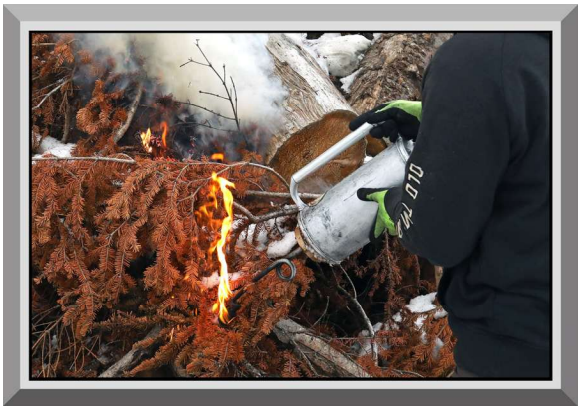

Figure 29.16
Lighting a Pile.

If the pile has lots of dry fines, which appears to be the case with the red needles in this pile, it should light up fairly easily within 15-30 seconds.

Figure 29.17
Stand Back and Let Chemistry Do Its Work.

Very few things are quite as exciting as large-scale rapid oxidation.

Always pay attention to the wind direction. As with planting, it's smart to pre-plan your path through the block, in order to minimize walking and maximize efficiency. However, wind direction plays a significant role in these decisions. Although you would normally start burning at the back of the block, you also need to ensure that smoke from your early piles is not blowing towards piles that

you'll be burning twenty minutes later, or you'll get smoked out. It's also important not to park the truck anywhere that airborne burning embers or sparks could drop onto your truck and/or fuel supply.

You will probably not be allowed to burn on days when the atmospheric venting conditions are not favorable. Good venting conditions mean that the smoke from your burning piles will rise quickly and stay well above ground level, so there are minimal impacts on nearby residents. You don't want to light up a block and have all the smoke stay at ground level and blow a few kilometers downwind into an area where people live. You can check for appropriate venting conditions every morning on an ArcGIS map provided by the BC government. Visit www.replant.ca/venting to look at that map, or if that link dies, do a google search for "BC ventilation index interactive map."

Finally, don't wear plastic clothing. Different types of fabric that are resistant to melting are important, in case you spill some burning fuel onto yourself. Also, don't wear your best outdoor gear, as there is a high chance that it will eventually become covered in pinhole burns. Weather-appropriate clothing, covered with an outer layer of disposable Value Village throwaways, is the best approach. Make sure you have a pocket that has extra lighters in a zip-lock, in case your working lighter gets wet.

Figure 29.18
Burning Mop-Up Work.

When weather conditions are challenging, you'll probably have to revisit a block the following day to do the mop-up work, and burn any piles that didn't continue burning the previous day.

Pile burning work is not all that it's cracked up to be. Some people learn about pile burning work, and want to unleash their inner arsonist. However, aside from the thrill of lighting large piles of scrap wood on fire, pile burning generally isn't lucrative work. A company might only be able to work 8-10 days over a 3-4 week time span, due to venting restrictions and other weather problems. Day rate pay is generally very low. Access is dicey, as you may be driving on very icy roads or through thick snow to get to the blocks (you may even need to use snowmobiles in rare cases). Finally, planting companies frequently don't get involved in this type of work (for reasons listed above), so in a lot of cases, the piles are burned by full-time mill staff.

Silviculture Surveys

There are so many different types of silviculture surveys that it's impossible to list them all. I'll just give a few examples. For starters, the list can include regen surveys, free growing surveys, stocking surveys, quality surveys, density surveys, mortality surveys, and pest assessment surveys. Essentially, doing a survey is similar to taking a series of plots in most cases, although the size/shape of each plot may be different than a planting plot, and the information collected may be more complex.

When picking the survey plot locations, the plots are usually based on somewhat random locations, although usually ordered in some sort of grid pattern. For example, in a survey program that requires one plot per hectare, the surveyor will typically pick and mark an arbitrary starting plot at a POC (point of commencement), and will then do a full grid of the block with plots spaced in a rectangular pattern, 100m apart. For one plot per every two hectares, the distance changes to 141m spacing. The plot locations are usually marked with winter weight flagger in such a way that they can be easily found again for the next year or two. For a more long-term plot, such as a "permanent sample plot" (PSP) that surveyors will return to for many years in the future, more permanent markers such as steel pins may be used. For some types of plots, the sizes can be the same as planting plots (ie. 3.99m radius, or 50 square meters in area). Other plots may be double the area, ie. 5.64m radius or 100 square meters in area. And some special types of plots can be very large, ie. have a radius of up to 15 meters or more.

Some surveys only assess the populations of commercial species in the plot, which is often synonymous with a limited group of preferred and accepted conifer species. Depending on the type of survey, the plot data may only measure the number of good crop trees, or it might also include the heights and DBH (stem thickness) of each tree within the plot (even if there are hundreds of small saplings and germinants). Some surveys may include data about non-coniferous trees and vegetation found within the plot. Other surveys may focus upon pest populations or disease indications.

Different provinces refer to various forestry surveys by different names. For example, if you're working as a silviculture forester or technicians in Alberta, you'll be expected to know the difference between performance surveys and establishment surveys. To learn about these, you could find the "Reforestation Standards of Alberta" (RSA) guidelines which are online, but this information isn't important to people who only work as seasonal tree planters. It is, however, quite important if you end up doing other silviculture field work in Alberta.

Many people who have planted for one or two seasons are quite capable of performing various basic types of surveys with minimal additional training. For surveys that need a comprehensive competency in species identification (ie. being able to look at a twelve-inch high deciduous germinant with no leaves and determine accurately exactly what type of species it is), you may need to complete some sort of silviculture surveyor training. Within BC, for example, your best bet is to look into the "Comprehensive Silviculture Survey Training course, parts 1 and 2" (a two-week program costing

approximately $1500) which is offered by John Wallis of Wallis Environmental in Sorrento. John is without question the top expert in the field within BC, and a great instructor.

If you enjoy field work, and can afford the time and cost to take the Silviculture Survey training course (or any useful equivalent training in other provinces), then surveying can be a really rewarding job. You'll get lots of exercise, get to spend a lot of time outdoors, and make a reasonable daily wage. As an added bonus, once you have a bit of experience and some connections, you'll find that you can probably work at least nine months per year doing surveying work. Surveys can be done right up to the point when the snow flies, and in some cases, it's even possible to keep doing certain types of surveys with some snow on the ground.

Timber Cruising

Timber cruising refers to the process of measuring the volume of all standing and fallen timber on a block before that block is harvested. Timber cruising staff generally need some sort of formal education in a forestry or related program, although occasionally an experienced planter can get a job and learn the role effectively within a forestry consulting firm. When cruising, workers generally have to walk a block, throwing surveys and measuring the estimated volumes of wood by sampling the DBH and estimated heights of individual trees within plots.

A related activity is layout, where workers go into areas to mark block boundaries, planned roads, etc. If you enjoy working in the woods, going to school for a forest tech diploma or degree can easily set you up for work like this. Nobody wants to be stuck in an office job for the rest of their lives. Well, I don't.

Beetle Work

The significance of the mountain pine beetle (MPB) infestation in western Canada for the past two decades has opened up an entire new industry in trying to deal with the damage. Alberta paid attention to the damage that the MPB did to British Columbia, and reacted accordingly. Pine beetle mitigation essentially involves two components: Surveying, plus the more physically demanding Fall & Burn work.

Beetle surveys are intended to discover the early warning signs of beetle infestation. Surveyors then go into those areas on foot and do proper assessments to determine if any trees are infested. If so, the infested or potentially infested trees are marked for destruction. This survey work is typically carried out starting in the late fall, and can continue into winter while the crews are cutting.

Figure 29.19
MPB Pitch Tubes on Lodgepole Pine.

It's easy to see all the pitch tubes in the base of this pine tree, where pine beetles burrowed into the tree and threw piles of sawdust out around the base of the tree.
Photo Credit: Gillian Stewart.

Once the snows hit, the Fall & Burn crews go to work. The faller is someone who is certified and qualified for dropping trees with a chain saw. The piler's role tends more towards manual labour. When there is a third person, that person works as a bucker (cutting up the trees that the senior faller drops). Fallers drop the trees, then pilers consolidate and burn them. This destroys the beetles in the infested trees before they can migrate to a new host. Fall & burn work therefore slows the initial spread of the beetle quite significantly.

Although the amount of fall & burn work may have peaked in the past few years, there's still a significant amount of work available, especially in northern and central Alberta. The work is generally lucrative, but it's much more difficult than planting. In order to get a job as a faller, you need your proper chain saw training, plus all of the appropriate equipment. In order to get a job as a piler, you need to be strong and ready to work yourself to the bone. The work is done in the winter, so you need to be prepared to work in extremely cold conditions.

An experienced worker (Liam Carroll, who runs Malachite Forestry) shared some extensive information about the work related to beetle control. I'm going to include his essay here because it provides great insights into the beetle control sector:

"Forestry management areas in Alberta that are determined to be at risk for mountain pine beetle infestation are first subjected to an aerial survey. During this aerial survey, a helicopter flies a grid over the FMA. A surveyor looks out the window for pine trees that have turned red, obviously indicating a tree death. When a red tree is found, the helicopter hovers over it as closely as possible, and the GPS coordinates are recorded. These GPS coordinates are then given to the on-ground surveyors. They make their way to the GPS coordinates by use of truck, snowmobile, snow-shoes, by foot, and on occasion by helicopter. I've had sites that required as far a walk as 5km, one-way.

The red tree is located by the surveyor, then assessed to confirm that it was a mortality caused by mountain pine beetle (MPB). This is done by examining the tree for pitch tubes (resin that seeps from the beetle's bore holes as part of the tree's natural defense system. The assessor also scrapes the bark away to reveal the beetle's pattern of burrowing, referred to as the "gallery." Mountain pine beetles have a distinct 'J' shaped gallery.

If the tree is MPB-positive, then a survey must be completed in a circle of 100m diameter, with the red tree at its very center. The standard procedure for this survey involves cutting up the survey site into four pie-shaped quadrants. The surveyor flags the tree at the center and writes some identifying information on the flagging tape. The surveyor then uses a string box and a compass to establish points at 25m and 50m in each cardinal direction from the red tree at plot center. The reason for making these 25m and 50m points is that, according to standard procedure, if a MPB tree is found beyond 25m from the plot center, then, according to long-term statistical observations of beetle infestation patterns, there is a high likelihood that MPB trees will exist beyond 50m of the red tree at the plot center. As such, finding a MPB tree beyond 25m triggers a "mini sweep," where the plot is additionally surveyed from 50m to 60m in all cardinal directions.

Depending on the specs of the contract, if three trees are found beyond 50m, then an additional plot is triggered, and the surveyor will construct another 100m survey area in the direction they determine most likely to have beetles. This is usually (but not always) desirable for the surveyor as it means that they are able to get paid for two surveys while only having to make the commute for one.

As each quadrant is surveyed, any tree determined to have a sufficient MPB attack to warrant destruction is then flagged with pink flagging tape, and recorded in a small book called the "MPB Blue Book." Not all trees qualify, as a tree with only a small amount of MPB attack is left alone, under the assumption that the tree can beat the beetle. Generally, a tree needs to have forty pitch tubes or greater to be considered to be one that needs to be destroyed. The Blue Book is essentially a rule book for how to conduct the MPB survey. There are, of course, a number of rules and exceptions that can make surveying quite complicated. The Blue Book also has blank pages at the back, to notate any findings during the surveys.

The location of each tree is marked on a diagram of the survey plot, then transcribed into a more detailed drawing later in the evening. That detailed diagram is submitted to the Client and eventually also goes to the Fall & Burn team (F&B). The diagram is basically a small map to allow the F&B team to successfully locate every tree that needs to be controlled.

Before I delve into that side of things, I'll mention that a recurring workplace dynamic that exists in MPB work is the tension between the surveyors and the QI (Quality Inspection) personnel. MPB often has a 97% quality requirement for full payment, so you need to be on it. I've noticed that planters will often struggle with MPB because they try to "find the line." Well, there is no line with MPB. It is basically 100% or nothing. If you can't immediately demonstrate that you can hit 100% every single time, then your employment is usually terminated. It is cutthroat, and one of the reasons why I think that it's the craziest subsector of the silviculture industry that I've encountered. More on that later. The other thing about the QI people is that they are all seasoned MPB surveyors themselves, so they have a really high standard. You don't get the luxury of having an oblivious co-op forestry student doing the checks. Instead, you hear stories about people getting points docked for not double-knotting their flagging ribbon. It can get ridiculous.

Let's zoom out for a bit, and look at the bigger picture. The funding for this work comes from the government of Alberta. This can be a problem, because the government works on government time. Contracts are sometimes awarded as early as the first week of November, but other times, not until December. This is a massive PITA regardless of whether you're a contractor or an employee, because you just sit around in the fall for weeks on end, wondering what is going to happen. You know that you're either going to have a very lucrative season of [very challenging] winter work, or you won't. This has a huge impact on the life of a full-time bush worker. Another interesting characteristic of the contracts is that they are massive, and only the beefiest of companies have pockets that are deep enough to bid safely. Companies such as Spectrum (aka. Spectrum Resource Group, or SRG). However, these companies don't have the necessary standby personnel to actually complete the contracts, so a lot of their workload gets subcontracted out.

I'm not 100% confident about the accuracy of this next dynamic, but my understanding is that the primary contractor subs out a number of sites, but not necessarily the specific locations of those sites. In other words, the primary contractors "reserve the right" to put the subcontractors where they want, and to switch that up throughout the season if they feel like it. If they can, the primary contractors will take the cream (which is usually the sites with the best access). Naturally, the less creamy sites end up being allocated to the subcontractors. The interesting thing about this system is that it incentivises the subcontractors to cream themselves out. For examples, let's assume that the subcontractor is assigned an area with a hundred sites. Some are creamy, and some aren't. Any good tree planter would work the area as efficiently as possible, even if this often means getting the tough sites out of the way first. However, with MPB work, the possibility exists that if you do all of the worst sites first, the primary contractor might then suddenly switch you to a different location without warning, and you don't get to finish up the cream.

Another annoying characteristic of this system is that it means that subcontractors will start their season hard, aggressively pursuing the cream and the highest volume of sites, making workers more pone to injury, burnout, and errors before they're properly warmed up. Then, as the season is wrapping up, the crews are left with a diaspora of sites with the worst access, which slows production tremendously (sometimes the crew can only knock out one site per day). Remember too that there are only a limited number of sites to be completed, so if you don't get to them, someone else will. Beetle work still has that glorious but problematic "wild west" flavour that is gradually disappearing from the rest of the silviculture industry. It isn't uncommon for "motivated" (money-hungry) surveyors to almost never take days off. On a positive note, surveying is not as hard on the body as most other jobs, but it's not uncommon to start with an 8-and-1 shift, and follow that up with a 21-and-1.

On the Fall and Burn (F&B) or "Control" side of the sector, most of the work is done in pairs. Each pair is a certified faller (CAGC Level 3) and a "piler." Fall and Burn is, hands-down and without a doubt, the most brutal bush job in the entire forestry industry. And the hardest job that I've ever done in my life. I remember being a rookie planter, sitting around the fire on a chilly night off in

May, and hearing a crusty veteran crew leader describing the horrors, warning every listener to never, ever do Fall & Burn work. Why didn't I listen?

The F&B team is given the site maps create by the surveyors, then the two of them head to the site. The faller falls the trees, then gets to work limbing and bucking. The piler gets to work flipping the bucked logs into a pile and then lighting that pile on fire. A pulp hook helps with this task. Be aware that even though beetle probing (surveying) is paid "per site," F&B is paid per tree. The rate is generally around $50/tree. This rate is generally split 60/40, with the larger portion being paid out to the fall to aid in covering their chainsaw expenses.

Flipping logs, how hard can that be? Well, it depends on your luck. A decade ago, there were apparently a lot of infected trees that had a small DBH (diameter at breast height). As such, F&B crews could bang through trees all day long and make great money. Sure, there was often a mix of trees with large and small DBH, but one good parcel of survey sites with small trees and several days of great earnings could help make the rest of the Control season worth it.

Unfortunately, nowadays it seems that most of the MPB trees being found seem to have an especially large DBH. Despite this, you're still being paid the same as for a tree for a smaller DBH. Let's say that you have a tree with a DBH of 40cm. Do the math on the tree, volumetrically, and it ends up weighing about 3600kg, or almost four metric tonnes. Therefore, if you're a piler, you're moving four tonnes of heavy timber into a pile in order to earn twenty dollars. Furthermore, you're not picking each section up once and setting it back down. Instead, you flip each section with the bulk hook, over and over again, until you bring it to the pile in the center of your work area. Start with the closest pieces, but remember that each successive section lays progressively further and further away as you get further and further away from the pile. The only minor consolation is that each piece gets progressively lighter as the tree tapers (assume that the butts are closest to the pile, and that the faller is dropping trees away from the piler). Think about this situation. If you're getting paid $20 to relocate four tons of wood in the snow, does it seem worth it? And take into consideration the fact that it may be -40^{o}C outside, or that you may be working in four feet of snow, which of course cuts down significantly on your piling speed. Oh yeah, and these trees are not dried and cured. They're usually wet, green, and frozen solid. Your pulp hook may not even penetrate as you attempt to stab it into the timber. Sounds bleak, right? We haven't even gotten to the hard part yet. Remember that your job isn't just to pile the trees. You also need to somehow start a sustained burn in a heap of thousands of pounds of green wood.

Pouring a 60/40 mix of diesel/gasoline onto the pile is usually nowhere near enough to get it lit, especially with the thicker trees, so your faller will probably need to take time to cut some dead and [hopefully] dry snags for you, to use as tinder. And of course, this means that you're piling additional trees, which you don't get paid for.

Your responsibility as a piler is to ensure that absolutely every morsel of bark is reduced to nothing but fine ash. Quality is still important on this job. This means tending to your fires during the day,

doing kick-in's (consolidating the fire to burn everything), and then returning the following day to make sure that everything burned completely. If your fire didn't burn completely, or if you weren't able to get the fire going, you're completely screwed. Remember that we're working in northern Alberta in the middle of winter, so the hours of daylight are short too. Every part of nature is working against you. Nowadays, it's almost impossible to make good money at $20/pile. Sometimes, it's even difficult to make minimum wage. I guess you could try working in the dark? No. You can see how this job can get really miserable, really fast.

Let's look at what the faller has to do. Piling is unquestionably a harder job than falling. However, being the faller isn't exactly a walk on easy street either. First, you need to buy a saw. Maybe a Stihl 462 for around $1500. Better yet, buy two saws, because redundancy is everything in the bush. On top of that, you need to have invested the time and expense of taking the CAGC training courses, which amounts to north of four thousand dollars. Most importantly, falling exposes you to the many risks associated with worksite injuries. It's no secret that falling is one of the most dangerous jobs in Canada. That said, the main benefit to falling is that it provides the opportunity of a higher ceiling for earnings. As a piler, your job is almost entirely grunt work. Figuring out a good technique for flipping is important, as is your skill at lighting fires, but the lion's share of your capacity for production comes down to one thing – just how much you can lift and move in a day.

As a faller, technique is everything. The better you get at reading trees and where they'll fall easily, the more confident you get in your cuts, and the more trees you'll be able to fall in a day. However, the discrepancy between the potential earnings of fallers versus pilers is yet another problematic aspect of the industry. What I've seen is that motivated and skilled fallers can out-perform the pilers by a significant factor. Furthermore, the job is much easier on the body than piling, so the fallers are able to put in longer hours than the pilers. The fallers also get paid per tree, so the money is fair. But what happens to the pilers when they're faced with such enormous quantities of timber to pile? Some of the most legendary fallers treat their pilers quite roughly, often going through three pilers in a short season, each of whom ends up quitting. I've heard frequent stories of fourteen-hour days, and living day-to-day on gas station food. That's not healthy.

Each faller/piler partnership is different. The structure that I've just described is somewhat void of any real sense of teamwork, although it allows the faller to make fair wages. In other faller/piler relationships, the faller helps the piler catch up somewhat, any time that they get fairly far ahead. This is a more equitable distribution of wealth, but it involves the faller sacrificing the opportunity costs associated with their falling skills."

Don't expect this synopsis of the industry to remain accurate for too many more years. It may not be long before Alberta beetle control work starts to disappear. Perhaps spruce and fir beetle work (especially in BC) will eventually provide an alternative opportunity for the experienced workforce of the beetle control sector.

Reclamation Work

Reclamation work is performed by hundreds of companies across Canada. In some cases, a small amount of tree planting work is done. However, there is much more to reclamation work. Typically, reclamation work is done for reasons such as returning an area to its original state after a natural disaster or man-made activities. For example, if a mining operation exhausts its ore body and shuts down, it's typical for the government to require that the mining company erase all evidence that there was a mine there. Part of that obligation can involve landscaping, watercourse improvements, and restoration of grasses and vegetative cover.

A typical reclamation project can start with surveys, stream assessments, topography studies, seismic studies, and environmental inventories. After an understanding is developed of what the long-term goals are, the project may move on to earth-moving, seeding, and planting of a wide variety of grasses and other plants. Ultimately, the hope is that in a few decades, visitors to the side won't know that there had ever been a natural disaster or human activity.

Figure 29.20
Cutting Willow Clippings.

These two workers are harvesting willow clipping to be used in a stream-bed reclamation project.

Figure 29.21
Willow Clippings.

Willow (salix sp.) is an interesting plant because a clipping from a willow stem can be planted in a moist area, and it usually takes root and grows into a new plant. So long as the inner wood is healthy and alive, willow trees and shrubs are very easy to reproduce.

GIS Work

Geographic Information Systems (GIS) are designed to capture, store, manipulate, and analyze spatial or geographic data. This is a broad definition, but GIS work can encompass mapping,

analysis of survey results, inventory work, and much more. Typically, this type of work is most suited for people who have some basic educational background in a forest tech program. There are quite a few schools across Canada which have forestry or forest tech programs. A short list would include UBC, TRU, UNBC, NAIT, the University of Alberta, Lakehead, U of T, and UNBC, but of course there are quite a few more. A fair number of planters end up becoming interested in forestry, and go on to study forestry professionally. And some people who start studying forestry decide to become planters to help pay for their education.

Figure 29.22
Working on Maps.

Although field work is usually healthy and enjoyable, a great deal of computer work needs to be done behind-the-scenes, no matter what type of project is in progress.

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