

# TREE CARE INDUSTRY

M A G A Z I N E

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## The Fundamentals & Fine Points of Footlocking

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# The Fundamentals & Fine Points of Footlocking

By Daniel Murphy

**F**ootlocking is an incredibly fast and efficient way to ascend into a tree. With its speed and efficiency, it has replaced the sluggishly difficult body thrusting as the main method of ascension for many progressive arborists. By relying primarily on the strength of the leg muscles, it uses energy efficiently – especially when done with good form.

This article will discuss how to footlock, expound on the dos and don'ts, and examine associated techniques and equipment. My intent is to give novices enough information to learn the basic technique, use it safely, and help others improve their performance.

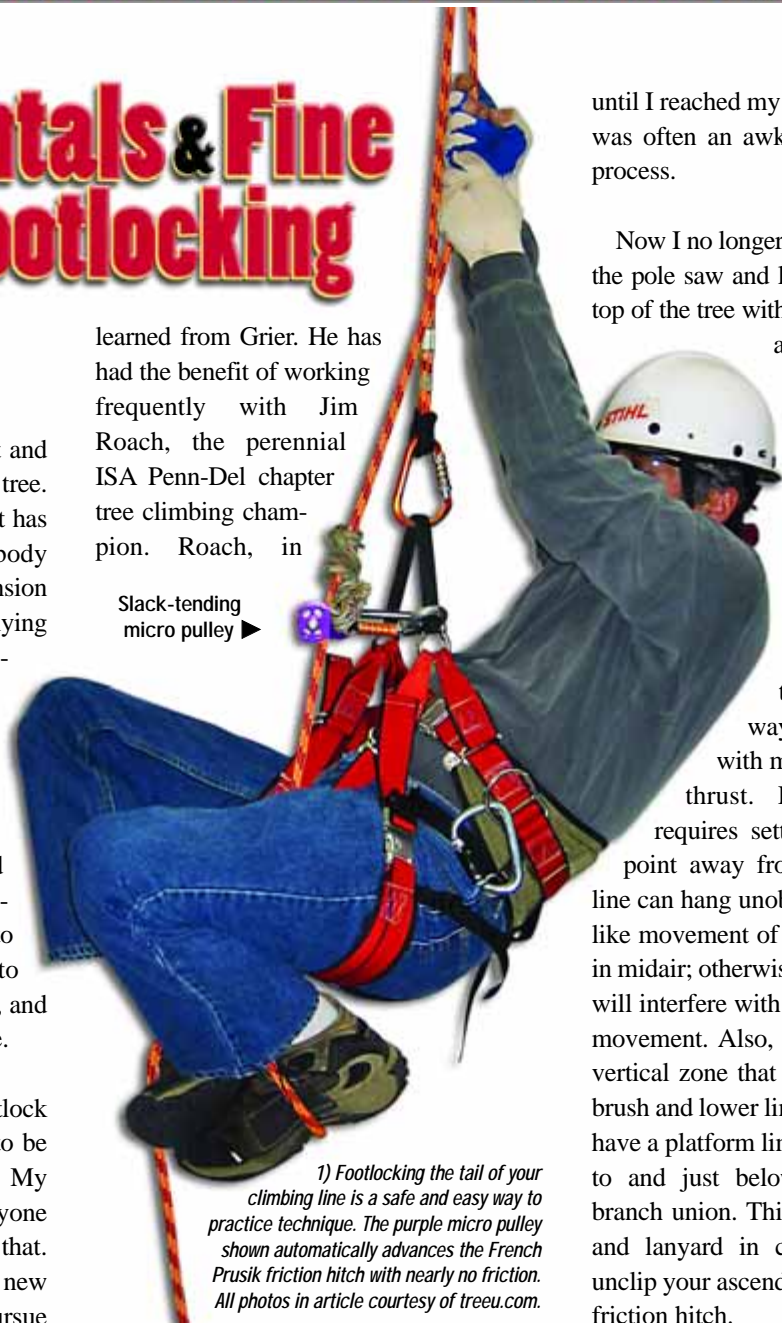
The first person I ever watched footlock was Mark Chisholm, who happened to be the world record holder at that time. My jaw dropped. I had never seen anyone move up into and around a tree like that. That revelation opened up a whole new world of potential, and I vowed to pursue the latest and greatest in progressive climbing techniques and equipment.

The vast majority of climbers today have yet to adopt footlocking. You have to see someone footlock to really understand what a marvelous technique it is. The world record for the 15 meter (approximately 49 feet) is under 14 seconds. I doubt I could run 50 feet up a set of stairs in less than 14 seconds. I have seen my climbing mentor, John Grier, set a throw line, footlock up and be tied into a big oak at 85 feet in less than five minutes from the time the truck door shut.

Most of what I know about footlocking I

learned from Grier. He has had the benefit of working frequently with Jim Roach, the perennial ISA Penn-Del chapter tree climbing champion. Roach, in

Slack-tending micro pulley ▶



1) Footlocking the tail of your climbing line is a safe and easy way to practice technique. The purple micro pulley shown automatically advances the French Prusik friction hitch with nearly no friction. All photos in article courtesy of treeu.com.

turn, has credited Chisholm, a two-time international tree climbing champion, with helping him refine his technique. So I am standing on the shoulders of some giants here in order to bring you this information.

Footlocking is primarily used for initial ascent into a tree on pruning and other non-removal jobs. Footlocking is not possible or necessary when wearing spikes on removals. In my early climbing days to access a tree, I would tie in with a lanyard at the top of a ladder, use a pole saw to set my line over a reachable branch union (crotch), and then body thrust up and slowly advance my line to higher branch unions

until I reached my desired tie-in point. This was often an awkward, slow and tedious process.

Now I no longer need to fool around with the pole saw and ladder. I set a rope at the top of the tree with a throw line, clip on my ascenders, and footlock up to the top of the tree.

## A detailed look

When body thrusting, I like to have my climbing line set in a tie-in point that draws my body toward the trunk of the tree. That way I can push off the trunk with my legs to assist the body thrust. Footlocking, however, requires setting the line in a tie-in point away from the trunk where the line can hang unobstructed. The inchworm like movement of footlocking is best done in midair; otherwise, banging into the trunk will interfere with the necessary fluidity of movement. Also, the line is best set in a vertical zone that is as free as possible of brush and lower limbs. Finally, it is good to have a platform limb or branch union close to and just below the ascending line's branch union. This offers a place to stand and lanyard in comfortably before you unclip your ascenders and get tied in with a friction hitch.

So footlocking is greatly facilitated by having the ability to accurately set an ascending line in a desirable branch union. Good throw line technique is somewhat of a pre-requisite for footlocking. Throw line technique is a subject for another article, and hopefully it will suffice to say for now that I can accurately set a throw line up to 90 feet, using the Big Shot sling shot, a 12-ounce throw bag and the 1.75 mm Zing-it throw line.

Once a throw line is set in a good branch union, you have the option to footlock up either a single line or double(d) line. There are pros and cons to each. If the throw line



2) Two ascender rigs with single line back ups.

There is less of a tendency for the line to slip.

Most experienced climbers prefer to use a single line. A doubled line is twice as heavy, which means a lot more effort, especially on long ascents where you might be tailing 50 to 75 feet of rope. That extra weight makes a big difference because the climber must use abdominals and legs to lift the weight of the rope with every bite.

There is also no need to isolate the line when using a single line. One end of the ascent line can simply be tied off to the base of the tree with some form of choked hitch, often a running bowline. Also, in high branch unions where both ends of the rope won't reach the ground, it's easy to tie a running bowline in the tail of the ascent line, going around the throw line, as the ascent line is being pulled into the tree. Then, simply run the knot up to the branch union leaving a single line tied off at the branch union



3) When the branch union is too high for both ends of the rope to reach the ground, tie a running bowline around the throw line and run the knot up to the branch union for single line ascent.

is isolated, you can pull up an ascent line and clip in double ascenders, back them up on both lines and footlock the doubled line. Footlocking a double line tends to be easier for novices because the two lines give more friction at the boot. This provides a better grip and

Once you have chosen single or double(d) line, you need to use either handled ascenders with a tether clipped to your saddle or a Prusik cord to secure yourself to the line in case of a slip. Handled ascenders are mechanical one-way rope grabbing devices that can be advanced easily or moved up a rope with negligible friction. As their name implies they have a handle for gripping. They are attached to the climber's saddle using a tether strap or cord that must be rated for life support. A backup system is needed! More on that later ...

A Prusik cord is a loop of soft lay cordage with a slightly smaller diameter than the host line. The loop is usually made by tying both ends of a length of cord together with a double fisherman's knot, also called a double-barrel knot. This cord is then used to tether the climber to the ascent line with either a three-wrap Prusik, a Klemheist or another suitable friction hitch. Prusik cords can be used when footlocking with either single or double(d) line.

Although the Prusik cord is still used, in my opinion it is inferior to ascenders for several reasons. It takes a little longer to tie and untie the knots. The Prusik cord is designed as a fail-safe mechanism that is only there to keep you from falling should you lose your grip on the rope. The knots tend to lock up when loaded, therefore you must always support your own weight to prevent the knot from seizing. This makes it more difficult to use your hands to move around or through brush or lower limbs, as well as precluding the opportunity to sit back for a break. The handles also give a better grip than the rope, which makes a big difference.

Safety must be paramount when incorporating the footlock technique into your climbing system. Industry safety guidelines, called the ANSI Z133.1 standard, contain specifications for all life support equipment used in tree care, including the Prusik cords, tether straps, ascenders and carabineers used in footlocking techniques. ANSI Z133 has been developed to protect us in all phases of tree work and especially as we incorporate new climbing gear and techniques. These guidelines should give comfort to those whom may be reluctant to try new climbing gear and related techniques because of safety concerns.

Conversely, it would be foolish to begin using new gear, friction hitches, or cordage without fully understanding and implementing industry safety standards.

One very important safety concern when footlocking with a Prusik cord is to keep your hands under the Prusik knot or Klemheist. Never place either hand above the knot while gripping the rope. If your hand is above the knot and slips down the rope, you'll grab the knot, which could cause an uncontrolled descent. Also when using a Prusik on a double(d) line, don't advance the knot too close to the limb where the line is hung. If you get too close, the spread of the rope can loosen the knot. The rule of thumb is to keep the friction hitch below the limb a minimum distance of five times the diameter of the limb.

The length of the Prusik cord or the tether on handled ascenders is very important. A Prusik loop should be long enough so that it allows for a full stretch with just a little slack remaining. Remember this is only a fail safe. Never sit in it unless you need to. However, when using ascenders, you must be able to reach the ascenders easily when hanging from the ascent line, so the tether must be long enough to allow a nearly full range of motion. To reduce joint strain, keep the tether just short enough so that when you reach up in a stretch you still have a very slight bend at the elbow (image 4). When you are standing on the ground under the



4) Practicing low and slow with ascenders.





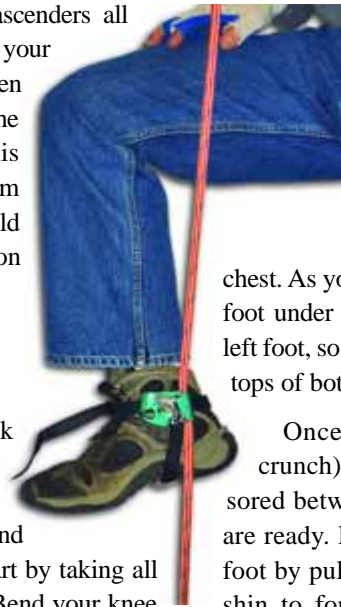
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ascend line, holding the ascenders all the way up, the bottom of your hands should be about even with or slightly above the top of your head. This should keep your arms from overextending, which could cause a repetitive motion injury.



**Starting the ascent**

Whether using a Prusik cord or ascenders, or going single or double line, the basic motion and technique is the same. Start by taking all the slack out of the line. Bend your knee to lift your left foot to about knee height. Cock your left knee slightly out to the left, to let the line(s) hang down on the inside of the left knee and the outside of the left ankle. Then transfer all your weight to your arms as you do a leg up motion into a tuck, where you lift both knees up into your

5) The Petzl pantin is a foot ascender that can be used to footlock the tail of the climbing line for those who have not yet learned footlocking. The pantin also reduces repetitive motion joint strain.

chest. As you lift both legs, keep your right foot under and slightly to the left of your left foot, so that the rope hangs between the tops of both feet.

Once you are in the tuck (or crunch) position with the line scissored between the tops of both feet, you are ready. Hook the rope with your right foot by pulling your toes up toward your shin to form a hook. And then in one motion bring your right foot under, around and then on top of your left foot. At this point the rope should be going over the top and side of the left foot, near the ankle, be looped under the left foot at the arch, then come up past the right sole at the arch and be draped over the top of

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6 & 7) Close up of the bite. Editor's note: A "bight" is an open loop in a rope. A "bite," as used in this article, refers to the grip on the rope with the feet. In footlocking, you create a bight in the rope with every bite. For clarity, we've used bite.

the right foot (Images 6 & 7).

The final motion is very simple. Just step down hard on the rope with the arch of your right foot onto the side and top of your left foot and stand up on the rope quickly. This should clamp the rope tightly between your two feet with enough friction

so that it will not slip when weighted. As a matter of fact the more weight you put on your feet while standing the tighter the rope is held in place.

If the rope is slipping between your feet, it's probably due to one or more of the following mistakes. You might:

- ▶ have a bad bite with your feet
- ▶ be wearing improper footwear
- ▶ be using your arms to help lift as you stand up, which takes weight off your feet. You need friction at the boot to keep the rope from slipping.

When using a double(d) line, each leg of the line has to support only half the load, so there is much less friction needed on each of the two lines than is required on a single line. This makes it easier to learn the basic movement on double(d) line as there will be less slipping. However once the bite and standing motion have been perfected, most climbers prefer to use a single line.

When you stand up, bring your legs directly beneath you, pulling the knees together, and stand straight up into a full stretch, pushing the ascenders up as high as possible. Repeat the motion. Transfer your weight to your arms as you let the line go with your feet, then lift your legs, get another bite, and stand up again. Keep the



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(8-13) Practice taking a bite from a chair on a loose single line. Clockwise, from top left:  
 Rope falls inside of knee and outside of ankle.  
 Lift legs up into crunch position with right foot under left and in position to hook rope.  
 Bring right foot around left hooking rope.  
 Right foot steps down on top of left clamping rope firmly.  
 Pull up hard on rope to check the bite.  
 Put your feet down on floor and stand up and then sit back down and repeat.

line in constant contact with the outside of your left ankle as you lift your legs. This way it will always be in the right place for you to hook it with your right foot. And as you lift your legs bring your right foot back under your left foot so the rope is again scissored between the tops of your feet. Your feet will be positioned perfectly to take another bite.

Proper form is crucial. Focus on three things when you are first learning.

1. Keep your feet in proper position around the rope as you lift your legs.



2. Get a good bite between your feet as you step down on the line.

3. When you stand, keep your legs directly underneath you and keep your full weight on your feet, making sure not to lift with your arms.

Once you have those basics down, work on developing a smooth rhythm – the key to speed and energy efficiency. When I first started, I would rock my whole torso back away from the rope in order to reach up higher with my feet, get a bite, then rock forward to get my legs underneath me and stand up. This rocking motion is good for novices because it is easier to get a good bite with the feet, but it also wastes time and energy.

When done well, the torso is always kept nearly parallel to the rope throughout the motion. It has to be fast and smooth, less than one second to lift the legs and get a bite and less than another second to stand

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up. The arms and legs should be moving as one, so when you finish one cycle by standing up into a stretch, you move right into the next cycle by lifting with your arms. When you get the rhythm and timing just right, the bounce of the rope helps you stand into the stretch. If you miss a bite with your feet you'll lose the rhythm.

Footlocking demands a good deal of athletic ability. The repeated leg lifting requires abdominal and core strength. The standing motion requires core, hip and leg strength. If you are having trouble with the basic motion, it might be a sign that you need to get into better physical condition. And, those interested in becoming really fast will need arm strength as well to do chin-up type movements. The key is to lift the body with the arms before you take a bite with your feet.

Those are the fundamentals of footlocking. And, as with so many other aspects of arboriculture, the fine points and details of this technique are critical to safe and efficient operations. Let's start by looking at some safety issues.

### Ascending systems

All ascenders, carabineers, screw links, and shackles must be rated at a minimum of 5,000 pounds and meet other ANSI guidelines. All ropes, tethers, and Prusik cords must be rated at a minimum of 5,400 pounds. You need to know and understand all guidelines for each piece in your system. Although it should go without saying, inspect your equipment before use every day and always follow manufacturer's recommendations for equipment use. Read, understand and keep the instructions. If you have a question, call or write the manufacturer. They are usually happy to answer questions. This is especially true for ascenders. You need to know exactly how to – and how not to – use them.

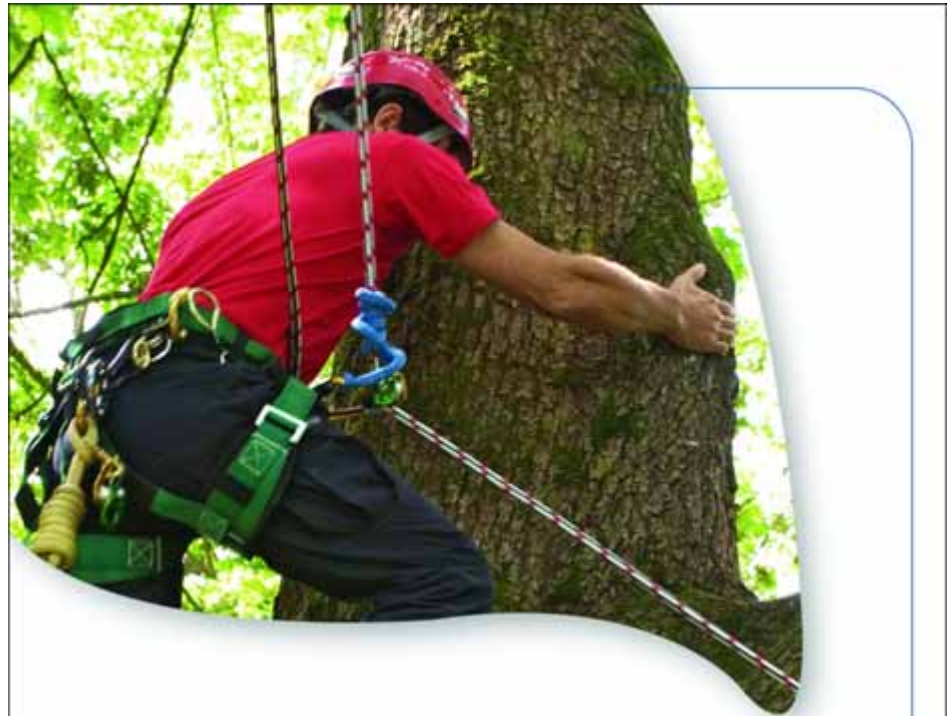
Handled ascenders must be backed up for safety. When using a single line, that means two ascenders attached in line, or an ascender with a Prusik cord above it. Should one unit fail the other is there to save your life. Keep them free of leaves,

bark and twigs, since these could cause the gate to open accidentally or interfere with the locking mechanism or friction on the rope. Maneuvering through thick trees is problematic. That is why you must always back up your ascenders!

Backing up a doubled line is twice as complicated, because each of the lines must be backed up. It could be backed up

using a single three-wrap Prusik over both lines, or a second mechanical ascender on each leg. Most advanced climbers prefer to back up mechanically because the knots take more time to tie and untie.

One way to avoid the need to back up each leg on a doubled line is to use a true double line instead. When a rope goes over a branch union and back to the ground it is



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one line that has been doubled. Should an ascender fail on either leg, the whole system fails, which is why you need to back up both legs. To make a true double-line system, do the following:

Use a throw ball to pull your first ascending line up into the tree. Once the ascending line makes it through the branch union, pull several more feet of line through, just enough to tie it off to the base of the tree. Then tie a second line midline to line 1. As you continue to pull line 1, it will take line 2 up with it. When you tie off the standing end of line 1 to the base of the

tree, line 2 will be tied midline to line 1, up close to the branch union. The working ends of these lines will not move, so there is no need to back either one up. They are effectively backing each other up, so just clip in one ascender on each line and you're ready to go.

It is important to inspect every tree for overhead hazards and potential dangers before ascending. This is especially true when footlocking. The ascending systems are designed for one way travel going up. Should you need to head down in a hurry, you can't just hit your climbing knot. You

need to switch to a descending system, which can take up to a minute. That would be dangerous during a hornet attack, which could cause panic. So remember to take a careful look at those trees before you go.

When you first learn how to footlock, you need to learn and become familiar with switching to the descending system during mid-line ascent, since you may not make it to your intended tie-in point or platform limb. This is done as follows:

Hang from your ascenders or Prusik cord and set a figure-8 descender or an HMS carabiner with a Munter hitch in line below the ascenders. Take the slack out between the 8/Munter and your ascenders. Then take a bite with your feet, stand up and hold it. Keep yourself balanced with one hand holding the rope while you unclip the ascenders or loosen the Prusik. Then sit back down into your saddle, making sure to keep a good grip on the rope below the 8/Munter with your hands, and descend. It is good to have a back-up belay man on the ground once the 8/Munter is set.

The Munter or the figure 8 can be used with either single or double(d) lines. The Munter is generally preferred because it

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14) This shows Kong double-handled ascenders set on a single line. All ascenders must be backed up, as here, with a micro-ascender.



gives excellent control during descent, while causing less hocking (kinking) in the rope. And the Munter requires only the use of an HMS carabineer, which has multiple uses in climbing. The 8 requires a carabineer and the figure 8, so using the Munter makes for one less piece of equipment taking up room on your saddle.

There may be situations where you want to make a few cuts with your handsaw on the way up; that's fine, but keep a few things in mind. Always avoid slack in the line, as a slip could end up shock loading the ascenders. The ascending hardware is not designed to take shock loads. It doesn't take much of a drop to cause a toothed ascender to shred a line. Also having a chain saw flopping around on the side of your saddle is not conducive to good footlocking technique. Leave it behind. And though you may be tempted to start working from the ascenders, don't do it. There are approved methods for working single-line technique, but they are beyond the

scope of this article. Learn to footlock for initial ascents and become completely familiar with the proper use of ascenders before even thinking about switching to single-line technique.

### Don't learn aloft

When learning and incorporating new gear and techniques into your climbing, always start low and slow. Throw a line over a 10-foot limb in the backyard and take a bite or two and then walk your hands back down the rope. Or start practicing by footlocking the tail of your climbing line. In order to do that you'll need to have a slack-tending micro pulley set below your friction hitch.



15) When footlocking on a Prusik cord, don't sit on the knot between bites. Hold your weight up with your hands.

It is easy to learn to footlock on the tail of your climbing line because the system's approximate 2:1 mechanical advantage puts about half the load on the tail. You only need about half the friction with your feet and half the strength to stand up. It is much slower, since you only advance half the distance with each cycle, but it is still easier and faster than body thrusting.

Another way to learn is to practice in a chair. Throw a rope over a limb or rafter and sit right under it. Try single line at first. Sit back in the chair and get a bite with your feet. Then grab the rope and pull up hard to make sure you have a good grip with your feet. Keep the bite and put your feet down on the floor and stand up into a full stretch, reaching up high on the rope with your hands. Then pull the rope down as you sit back in the chair. Drop the bite with your feet, lift your legs up for another bite and repeat. Focus on keeping your feet in a good position relative to the rope throughout the movement.

Once you are confident that you are getting a good grip with your feet, switch to a doubled line. And this time when you get a bite, come out of the chair so your full weight is now hanging on the rope and then stand up. Now you're footlocking. Next practice with your saddle and ascenders and practice switching to a Munter and descending. Once you have mastered taking that first bite and switching to a Munter, you're ready to take it into the tree.

### Other gear

Proper footwear is crucial to getting a good grip on the rope. If your form looks good, but you still find the rope slipping through your feet, you probably need to change your boots. Good boots are expensive and well worth the investment to any serious tree climber. Quality lightweight hiking or mountaineering boots are ideal. The key friction in footlocking is at the arch of the right boot, as it presses the rope down on top of the left foot. The tall heel in

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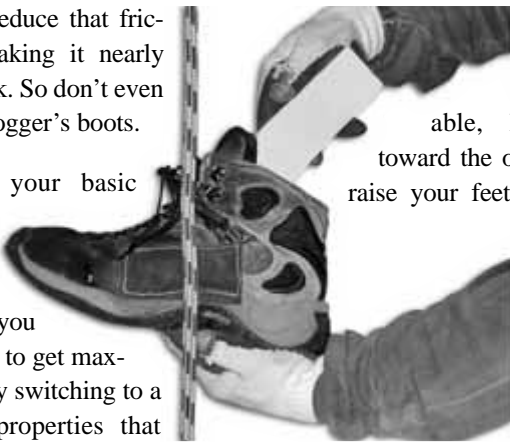


logger's boots will reduce that friction at the arch, making it nearly impossible to footlock. So don't even try to footlock with logger's boots.

Once you have your basic movement and ascending hardware perfected and are using a good boot, you can tweak the system to get maximum performance by switching to a quality rope. The properties that make a good rope for footlocking are low stretch, light weight, and the appropriate gripping ability of the cover. The amount of stretch in a rope will make a big difference in footlocking, especially on long ascents. Every time you stand up onto the rope, you put additional force on it which will cause it to stretch. The more elasticity in the rope (dynamic), the more of your energy goes into the stretch before you get any lift. So a low stretch or semi-static rope is best for footlocking.

A dynamic rope with a lot of stretch reduces the effective forces in shock loading, which is why it is generally preferable to use a dynamic rope in rigging. Climbing lines are designed to be slightly dynamic as well to reduce the force on the climber should he fall with slack in his line. Unlike rock climbers and other high angle disciplines, tree climbers rarely climb with much slack in their lines, so we really don't need to climb on dynamic ropes. Semi-static lines have enough stretch to protect the climber in case of a fall, yet have far less stretch than many older climbing lines.

New England Ropes makes the Fly, which is a low stretch (semi-static) climbing line with great resistance to abrasion and wear. Samson's Velocity is another preferred climbing line that is slightly lighter. And Yale makes a great handling line called Blaze. For particularly long ascents you might consider going with a true static line, such as New England's KMIII. You would use the static line for ascent only and then set a lanyard and switch to a semi-static climbing line when you reached your tie-in point.



16) I have sewn a stiff rubber patch on the outside of my left boot and use a piece of hard foam rubber inside of the boot to prevent rope pressure from bruising the outside of my foot.

When footlocking near the trunk is unavoidable, keep your back toward the obstacle so you can raise your feet unobstructed, and proceed carefully. Tom Dunlap, safety trainer and arborist guru, recommends that the ascenders NEVER touch anything except rope. Leaves, twigs and branches should be pushed aside,

the ascenders should NOT be pushed through plant material. To do this you need to keep a hand free to push the branches aside as the other hand advances the ascenders. When the line is touching a large limb you can rock on the rope to pendulum

away from the limb as you advance the ascender past it.

When you have reached the top of your ascent, simply tie in with your lanyard before unclipping your ascenders. Then set your regular friction hitch, lower your ascenders to get them out of your way, and get to work.

Footlocking requires the right set of skill, equipment and physical ability. Good form takes time, effort and determination to perfect, and is richly rewarded in both productivity and a sense of personal achievement.

*Daniel Murphy is a working arborist, tree care company owner and founder of Tree University, which provides educational training materials, seminars and consulting services for professional arborists. For more information, visit [www.treeu.com](http://www.treeu.com).*





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